PROJECT MANUAL

REBID OF
Install Nature Park
Missouri School for the Blind
St. Louis, Missouri

DESIGNED BY: Oates Associates, Inc.
720 Olive, Ste. 700
St. Louis, MO 63101

DATE ISSUED: 3/11/2020

PROJECT NO.: E1703-01

FOR: State of Missouri
Office of Administration
Division of Facilities Management, Design and Construction
1.1 DESIGN PROFESSIONALS OF RECORD

A. Civil Engineer:
   1. John Travis Helmkamp
   2. 2013004339
   3. Responsible for Divisions 01-49 Sections except where indicated as prepared by other design professionals of record.

B. Architect:
   1. Michael Ratliff
   2. 6855
   3. Responsible for 040120.63, 061053, 072413, 075423, 077100, 078413, 081213, 081416, 083323, 084113, 084226, 087100, 088000, 092216, 092300, 099123, 099600, 101423, 123661.19

C. Landscape Architect:
   1. Michael Ratliff
   2. 6855
   3. Responsible for 044313.13, 061063, 116800, 116801, 321316, 321816.13, 323300, 329113.19, 329300
D. Structural Engineer:
1. Haley J. Coons
2. 2014016938
3. Responsible for 024116, 033000, 042200, 051200, 053100

E. Plumbing Engineer:
1. Mike Hoff
2. PE201300576
3. Responsible for Division 22.

F. Electrical Engineer:
1. Carl Hauk
2. E-16688
G.  Telecommunications Engineer:

1. Carl Hauk
2. E-16688
3. Responsible for Division 27 and 28.

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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. REBID OF Install Nature Park
      Missouri School for the Blind
      St. Louis, Missouri
      Project No.: E1703-01

3.0 BIDS WILL BE RECEIVED:
   A. Until: 1:30 PM, Tuesday, May 12, 2020
   B. Only electronic bids on MissouriBUYS shall be accepted: https://missouribuys.mo.gov. Bidder must be registered to

4.0 bid. DESCRIPTION:
   A. Scope: The project includes improvements in the east and west courtyards as well as improvements along Magnolia Avenue in front of the School. Additionally, improvements include construction in the main lobby of the school, the 2nd Floor Health Center, as well as the 2nd Floor Southeast Administration Offices.
   B. Estimate: $1,600,000 to $2,200,000
   C. MBE/WBE/SDVE Goals: MBE 10.00%, WBE 10.00%, & SDVE 3.00%. NOTE: Only MBE/WBE firms certified by a State of Missouri public entity as of the date of bid opening, or SDVE(s) meeting the requirements of Section 34.074, RSMo and 1 CSR 30-5.010, can be used to satisfy the MBE/WBE/SDVE participation goals for this project.
   D. **NOTE: Bidders are provided new Good Faith Effort (GFE) forms on MissouriBUYS.

5.0 PRE-BID MEETING:
   A. Place/Time: 10:00 AM; Monday, April 27, 2020; JOIN BY PHONE, Dial # 1-650-479-3207; Enter Access Code: 286 577 335
   B. Anytime between 1-3 pm, bidders may come to MSB for an on-site review. Our intent is to limit the number of people on site at one time. We ask all attendees to adhere to the current CDC guidelines throughout the project and site walk-through.

6.0 HOW TO GET PLANS & SPECIFICATIONS:
   A. View Only Electronic bid sets are available at no cost or paper bid sets for a deposit of $100 from American Document Solutions (ADS). MAKE CHECKS PAYABLE TO: American Document Solutions. Mail to: American Document Solutions, 1400 Forum Blvd., Suite 7A, Columbia, Missouri 65203. Phone 573-446-7768, Fax 573-355-5433, https://www.adsplanroom.net. NOTE: Prime contractors will be allowed a maximum of two bid sets at the deposit rate shown above. Other requesters will be allowed only one bid set at this rate.
   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:
   B. Project Manager: Sandra Walther, phone # 573-751-2283, fax # 573-751-7277

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

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

B. Once registered, log in.
2. Under “Filter by Agency” select “OA-FMDC-Contracts Chapter 8.”
4. Above the dark blue bar, select “Other Active Opportunities.”
5. To see the Solicitation Summary, single click the Opp. No. (Project Number) and the summary will open. Single quick click each blue bar to open detailed information.

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

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

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

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

SPECIFICATION CHANGES:

A. SECTION 002113 – INSTRUCTIONS TO BIDDERS: Article 14.0, Section B.1. (bottom of page 6 of 8): Delete: “an MBE or WBE must be certified by the State of Missouri, Office of Equal Opportunity and”.

To allow MBE, WBE, or MBE/WBE contractors, subcontractors, and suppliers to have ample time to register with the Office of Equal Opportunity, this requirement will not take effect until July 1, 2020. Until then, we will continue to accept certifications from the Office of Equal Opportunity and other Missouri certifying agencies.
1.0 - SPECIAL NOTICE TO BIDDERS
   A. If awarded a contract, the Bidder’s employees, and the employees of all subcontractors, who perform the work on the project, will be required to undergo a fingerprint background check and obtain a State of Missouri identification badge prior to beginning work on site. The Bidder should review the information regarding this requirement in Section 013513 – Site Security and Health Requirements prior to submitting a bid.
   B. The Bidder’s prices shall include all city, state, and federal sales, excise, and similar taxes that may lawfully be assessed in connection with the performance of work, and the purchased of materials to be incorporated in the work. THIS PROJECT IS NOT TAX EXEMPT.

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

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

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

5.0 - BIDS AND BIDDING PROCEDURE
   A. Bidders shall submit all submission forms and accompanying documents listed in SECTION 004113 – BID FORM, Article 5.0, ATTACHMENTS TO BID by the stated time or their bid will be rejected for being non-responsive.
Depending on the specific project requirements, the following is a GENERIC list of all possible bid forms that may be due with bid submittals and times when they may be due. Please check for specific project requirements on the proposal form (Section 004113). Not all of the following bid forms may be required to be submitted.

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

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

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

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

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

**6.0 - SIGNING OF BIDS**

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

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

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

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

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

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

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

B. Bids must be submitted through the MissouriBUYS statewide eProcurement system ([https://www.missouribuys.mo.gov/](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/](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:

13.0 - AMERICAN AND MISSOURI - MADE PRODUCTS AND FIRMS

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

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

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

14.0 - MBE/WBE/SDVE INSTRUCTIONS

A. Definitions:

1. “MBE” means a Minority Business Enterprise.

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

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


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


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.

A. 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.

B. Certification of MBE/WBE/SDVE Subcontractors:

1. In order to be counted towards the goals, an MBE or WBE must be certified by the State of Missouri, Office of Equal Opportunity and an SDVE must be certified by the State of Missouri, Office of Administration, Division of Purchasing and Material Management or by the Department of Veterans Affairs.
2. The Bidder may determine the certification status of a proposed MBE or WBE subcontractor or supplier by referring to the Office of Equal Opportunity (OEO)’s online MBE/WBE directory (https://apps1.mo.gov/oeo/). The Bidder may determine the eligibility of a SDVE subcontractor or supplier by referring to the Division of Purchasing and Materials Management’s online SDVE directory (http://oa.mo.gov/purchasing/vendor-information/missouri-service-disabled-veteran-business-enterprise-sdve-information) or the Department of Veterans Affairs’ directory (https://www.vip.vetbiz.gov/).

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

C. 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.

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

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

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

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

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

https://www.vip.vetbiz.va.gov
THIS AGREEMENT, made (DATE) by and between:

Contractor Name and Address
hereinafter called the "Contractor,"

and the State of Missouri, hereinafter called the "Owner", represented by the Office of Administration, Division of Facilities Management, Design and Construction, on behalf of the Department of Elementary & 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: REBID OF Install Nature Park Missouri School for the Blind St. Louis, Missouri

Project Number: E1703-01

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

ARTICLE 2. TIME OF COMPLETION
The contract performance time is 160 working days from the transmittal date of this agreement. The contract completion date is MONTH, DAY, YEAR. This time includes ten (10) working days for the Contractor to receive, sign and return the contract form along with required bonding and insurance certificates. Failure of the Contractor to provide correct bonding and insurance within the ten (10) working days shall not be grounds for a time extension. Receipt of proper bonding and insurance is a condition precedent to the formation of the contract and if not timely received, may result in forfeiture of the Contractor's bid security. Work may not commence until the Owner issues a written Notice to Proceed and must commence within seven (7) working days thereafter.

ARTICLE 3. LIQUIDATED DAMAGES
Whenever time is mentioned in this contract, time shall be and is of the essence of this contract. The Owner would suffer a loss should the Contractor fail to have the work embraced in this contract fully completed on or before the time above specified. THEREFORE, the parties hereto realize in order to adjust satisfactorily the damages on account of such failure that it might be impossible to compute accurately or estimate the amount of such loss or damages which the Owner would sustain by reason of failure to complete fully said work within the time required by this contract. The Contractor hereby covenants and agrees to pay the Owner, as and for liquidated damages, the sum of $1,000 per day for each and every day, Sunday and legal holidays excepted, during which the work remains incomplete and unfinished. Any sum which may be due the Owner for such damages shall be deducted and retained by the Owner from any balance which may be due the Contractor when said work shall have been finished and accepted. But such provisions shall not release the Bond of the Contractor from liability according to its terms. In case of failure to complete, the Owner will be under no obligation to show or prove any actual or specific loss or damage.
ARTICLE 4. CONTRACT SUM

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

Base Bid: $ 

The Owner accepts the following Alternate Bids:

Alternate 1: $ 
Alternate 2: $ 
Alternate 3: $ 
Alternate 4: $ 

TOTAL CONTRACT AMOUNT: ($CONTRACT AMOUNT)

UNIT PRICES: The Owner accepts the following Unit Prices: NOT APPLICABLE

ARTICLE 5. PREVAILING WAGE RATE

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

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

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

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

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

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

Total $ 

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

The Director of the Division of Facilities Management, Design and Construction or his Designee shall be the final authority to resolve disputes and disagreements between the Contractor and the MBE/WBE/SDVE firms listed above when such disputes impact the subcontract amounts shown above.
ARTICLE 7. CONTRACT DOCUMENTS

Contract documents shall consist of the following component parts:

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

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

APPROVED:

Mark Hill, P.E., Director
Division of Facilities Management,
Design and Construction

Contractor’s Authorized Signature

DELETE IF PRIVATE OR PARTNERSHIP

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

Corporate Secretary
First being duly sworn on oath states: that

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

NAME

☐ 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

SUBSCRIBED AND SWORN BEFORE ME, THIS

DAY OF

YEAR

NOTARY PUBLIC SIGNATURE

MY COMMISSION EXPIRES

NOTARY PUBLIC NAME (TYPED OR PRINTED)

STATE OF

COUNTY (OR CITY OF ST. LOUIS)

USE RUBBER STAMP IN CLEAR AREA BELOW
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**

<table>
<thead>
<tr>
<th>CHECK APPROPRIATE BOX</th>
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<tbody>
<tr>
<td>☐ SUBSTITUTION PRIOR TO BID OPENING</td>
<td>(Minimum of (5) working days prior to receipt of Bids as per Article 4 – Instructions to Bidders)</td>
</tr>
<tr>
<td>☐ SUBSTITUTION FOLLOWING AWARD</td>
<td>(Maximum of (20) working days from Notice to Proceed as per Article 3 – General Conditions)</td>
</tr>
</tbody>
</table>

**FROM:**  
BIDDER/CONTRACTOR (PRINT COMPANY NAME)

**TO:**  
ARCHITECT/ENGINEER (PRINT COMPANY NAME)

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

**SPECIFIED PRODUCT OR SYSTEM**

**SPECIFICATION SECTION NO.**

**SUPPORTING DATA**

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

**QUALITY COMPARISON**

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

<table>
<thead>
<tr>
<th>PROJECT</th>
<th>ARCHITECT/ENGINEER</th>
<th>LOCATION</th>
<th>DATE INSTALLED</th>
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**SIGNIFICANT VARIATIONS FROM SPECIFIED PRODUCT**

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**REASON FOR SUBSTITUTION**

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

**DOES PROPOSED SUBSTITUTION AFFECT OTHER PARTS OF WORK?**

☐ YES  ☐ NO

IF YES, EXPLAIN __________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

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

☐ YES  ☐ NO

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

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

**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.

**SECTION 006325 – SUBSTITUTION REQUEST**

07/16  Page 2 of 2
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.

3. 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
### MBE/WBE/SDVE Progress Report

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

**MBE/WBE/SDVE Progress Report**
Submit with ALL INVOICES. (PLEASE CHECK APPROPRIATE BOX BELOW)

<table>
<thead>
<tr>
<th>CONSULTANT</th>
<th>CONSTRUCTION</th>
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**INVOICE NO.**

**PROJECT NUMBER**

**CHECK IF FINAL**

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</table>

**DATE**

**PROJECT TITLE**

**PROJECT LOCATION**

**FIRM**

**TOTAL CONTRACT AMOUNT**

$ 

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

% and $ .

<table>
<thead>
<tr>
<th>CHECK</th>
<th>MBE</th>
<th>WBE</th>
<th>SDVE</th>
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<tr>
<td>ITEM OF WORK</td>
<td>TOTAL AMOUNT OF SUBCONTRACT</td>
<td>$ AMOUNT &amp; % COMPLETE (PAID-TO-DATE)</td>
<td>CONSULTANT/ SUBCONSULTANT OR CONTRACTOR/ SUBCONTRACTOR/ SUPPLIER NAME, ADDRESS, CONTACT, AND PHONE NUMBER</td>
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**ORIGINAL:** Attach to ALL Progress and Final Payments
STATE OF MISSOURI
OFFICE OF ADMINISTRATION
DIVISION OF FACILITIES MANAGEMENT, DESIGN AND CONSTRUCTION
AFFIDAVIT – COMPLIANCE WITH PREVAILING WAGE LAW

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)
GENERAL CONDITIONS

INDEX

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

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

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

5. Construction and Completion
   5.1. Construction Commencement
   5.2. Project Construction
   5.3. Project Completion
   5.4. Payments

6. Bond and Insurance
   6.1. Bond
   6.2. Insurance

7. Termination or Suspension of Contract
   7.1. For Site Conditions
   7.2. For Cause
   7.3. For Convenience
SECTION 007213 - GENERAL CONDITIONS

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

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

ARTICLE 1 – GENERAL PROVISIONS

ARTICLE 1.1 - DEFINITIONS

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

1. "COMMISSIONER": The Commissioner of the Office of Administration.

2. “CONSTRUCTION DOCUMENTS”: The “Construction Documents” shall consist of the Project Manual, Drawings and Addenda.

3. "CONSTRUCTION REPRESENTATIVE:" Whenever the term “Construction Representative” is used, it shall mean the Owner’s Representative at the work site.

4. "CONTRACTOR": Party or parties who have entered into a contract with the Owner to furnish work under these specifications and drawings.

5. "DESIGNER": When the term "Designer" is used herein, it shall refer to the Architect, Engineer, or Consultant of Record specified and defined in Paragraph 2.0 of the Supplemental Conditions, or his duly authorized representative. The Designer may be either a consultant or state employee.

6. "DIRECTOR": Whenever the term "Director" is used, it shall mean the Director of the Division of Facilities Management, Design and Construction or his Designee, representing the Office of Administration, State of Missouri. The Director is the agent of the Owner.


8. “INCIDENTAL JOB BURDENS”: Shall mean those expenses relating to the cost of work, incurred either in the home office or on the job-site, which are necessary in the course of doing business but are incidental to the job. Such costs include office supplies and equipment, postage, courier services, telephone expenses including long distance, water and ice and other similar expenses.

9. "JOINT VENTURE": An association of two (2) or more businesses to carry out a single business enterprise for profit for which purpose they combine their property, capital, efforts, skills and knowledge.

10. "OWNER": Whenever the term “Owner” is used, it shall mean the State of Missouri.

11. "PROJECT": Wherever the term “Project” is used, it shall mean the work required to be completed by the construction contract.


13. "SUBCONTRACTOR": Party or parties who contract under, or for the performance of part or this entire Contract between the Owner and Contractor. The subcontract may or may not be direct with the Contractor.

14. "WORK": Labor, material, supplies, plant and equipment required to perform and complete the service agreed to by the Contractor in a safe, expeditious, orderly and workmanlike manner so that the project shall be complete and finished in the best manner known to each respective trade.


ARTICLE 1.2 DRAWINGS AND SPECIFICATIONS

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

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

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

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

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

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

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

ARTICLE 1.6 - PATENTS AND ROYALTIES

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

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

ARTICLE 1.7 - PREFERENCE FOR AMERICAN AND MISSOURI PRODUCTS AND SERVICES

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

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

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

ARTICLE 1.8 - COMMUNICATIONS

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

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

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

ARTICLE 1.9 - SEPARATE CONTRACTS AND COOPERATION

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

B. The Contractor shall consult the drawings for all other contractors in connection with this work. Any work conflicting with the above shall be brought to the attention of the Owner’s Representative before the work is performed. If the Contractor fails to do this, and constructs any work which interferes with the work of another contractor, the Contractor shall remove any part so conflicting and rebuild same, as directed by the Owner’s Representative.

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

D. Should the Contractor or project associated subcontractors refuse to cooperate with the instructions and reasonable requests of other Contractors or other subcontractors in the overall
coordinating of the work, the Owner may take such appropriate action and issue directions, as required, to avoid unnecessary and unwarranted delays.

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

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

ARTICLE 1.10 - ASSIGNMENT OF CONTRACT
A. No assignment by Contractor of any amount or any part of this contract or of the funds to be received there under will be recognized unless such assignment has had the written approval of the Director and the surety has been given due notice of such assignment and has furnished written consent thereto. In addition to the usual recitals in assignment contracts, the following language must be set forth: "It is agreed that the funds to be paid to the assignee under this assignment are subject to the 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 the performance by the Contractor of this contract and to claims or liens for services rendered or materials supplied for the performance of the work called for in said contract in favor of all persons, firms or corporations rendering such services or supplying such materials."

ARTICLE 1.11 - INDEMNIFICATION
A. Contractor agrees to indemnify and save harmless Owner and its respective commissioners, officers, officials, agents, consultants and employees and Designer, their agents, servants and employees, from and against any and all liability for damage arising from injuries to persons or damage to property occasioned by any acts or omissions of Contractor, any subcontractors, agents, servants or employees, including any and all expense, legal or otherwise, which may be incurred by Owner or Designer, its agents, servants or employees, in defense of any claim, action or suit.

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

ARTICLE 1.12 - DISPUTES AND DISAGreements
A. It is hereby expressly agreed and understood that in case any controversy or difference of opinion arises during construction, best efforts will be given to resolution at the field level. Should those efforts be unsuccessful, the Contractor has the right to appeal in writing, the decision of the Director’s Designee to the Director at Room 730 Truman Building, P.O. Box 809, Jefferson City, Missouri 65102. The decision of the Director shall be final and binding on all parties.

ARTICLE 2 - OWNER/DESIGNER RESPONSIBILITIES
A. The Owner shall give all orders and directions contemplated under this contract relative to the execution of the work. During progress of work the Owner will be represented at the project site by the Construction Representative and/or Designer, whose responsibilities are to see that this contract is properly fulfilled.

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

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

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

E. Failure or neglect on the part of Owner to observe faulty work, or work done which is not in accordance with the drawings and specifications shall not relieve the Contractor from responsibility...
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 purchasing, testing, delivery, other submittals, and related activities that require sequential activity.

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 without compensation may be made when:

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

2. Labor strikes or acts of God occur, OR

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

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

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

ARTICLE 5 - CONSTRUCTION AND COMPLETION

ARTICLE 5.1 – CONSTRUCTION COMMENCEMENT

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

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

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

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

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

ARTICLE 5.2 -- PROJECT CONSTRUCTION

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

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

ARTICLE 5.3 -- PROJECT COMPLETION

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

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

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

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

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

ARTICLE 5.4 -- PAYMENT TO CONTRACTOR

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

ARTICLE 6 -- INSURANCE AND BONDS

ARTICLE 6.1 -- BOND

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

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

ARTICLE 6.2 -- INSURANCE

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

B. Minimum Scope and Extent of Coverage
1. General Liability

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

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

2. Automobile Liability

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

3. Workers' Compensation and Employer's Liability

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

4. Builder's Risk or Installation Floater Insurance

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

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

C. Minimum Limits of Insurance

1. General Liability

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

2. Automobile Liability

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

3. Workers' Compensation and Employers Liability

   Workers' Compensation limits as required by applicable State Statutes (generally unlimited) and minimum of $1,000,000 limit per accident for Employer's Liability.
   General Liability and Automobile Liability insurance may be arranged under individual policies for the full limits required or by a combination of underlying policies with the balance provided by a form-following Excess or Umbrella Liability policy.

D. Deductibles and Self-Insured Retentions

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

E. Other Insurance Provisions and Requirements

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

1. General Liability

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

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

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

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

3. Workers’ Compensation/Employer’s Liability

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

4. All Coverages

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

F. Insurer Qualifications and Acceptability

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

G. Verification of Insurance Coverage

Prior to Owner issuing a Notice to Proceed, the Contractor shall furnish the Owner with Certificate(s) of Insurance and with any applicable original endorsements evidencing the required insurance coverage. The insurance certificates and endorsements are to be signed by a person authorized by that insurer to bind coverage on its behalf. All certificates and endorsements received by the Owner are subject to review and approval by the Owner. The Owner reserves the right to require certified copies of all required policies at any time. If the scope of this contract will exceed one (1) year - or, if any of Contractor’s applicable insurance coverage expires prior to completion of the work or services required under this contract - the Contractor will provide a renewal or replacement certificate before continuing work or services hereunder. If the Contractor fails to provide documentation of required insurance coverage, the Owner may issue a stop work order and no additional contract completion time and/or compensation shall be granted as a result thereof.
ARTICLE 7 – SUSPENSION OR TERMINATION OF CONTRACT

ARTICLE 7.1 - FOR SITE CONDITIONS
A. When conditions at the site of the proposed work are considered by the Owner to be unsatisfactory for prosecution of the work, the Contractor may be ordered in writing to suspend the work or any part thereof until reasonable conditions exist. When such suspension is not due to fault or negligence of the Contractor, time allowed for completion of such suspended work will be extended by a period of time equal to that lost due to delay occasioned by ordered suspension. This will be a no cost time extension.

ARTICLE 7.2 - FOR CAUSE
A. Termination or Suspension for Cause:
   1. If the Contractor shall file for bankruptcy, or should make a general assignment for the benefit of the creditors, or if a receiver should be appointed on account of insolvency, or if the contractor should persistently or repeatedly refuse or fail to supply enough properly skilled workers or proper materials, or if the contractor should fail to make prompt payment to subcontractors or for material or labor, or persistently disregard laws, ordinances or the instructions of the Owner, or otherwise be guilty of a substantial violation of any provision of this contract, then the Owner may serve notice on the Contractor and the surety setting forth the violations and demanding compliance with this contract. Unless within ten (10) consecutive calendar days after serving such notice, such violations shall cease and satisfactory arrangements for correction be made, the Owner may suspend the Contractor's right to proceed with the work or terminate this contract.
   2. In the event the Owner suspends Contractor's right to proceed with the work or terminates the contract, the Owner may demand that the Contractor's surety take over and complete the work on this contract, after the surety submits a written proposal to the Owner and receives written approval and upon the surety's failure or refusal to do so within ten (10) consecutive calendar days after demand therefore, the Owner may take over the work and prosecute the same to completion by bid or negotiated contract, or the Owner may elect to take possession of and utilize in completing the work such materials, supplies, appliances and plant as may be on the site of the work, and all subcontractors, if the Owner elects, shall be bound to perform their contracts.
   B. The Contractor and its surety shall be and remain liable to the Owner for any excess cost or damages occasioned to the Owner as a result of the actions above set forth.
   C. The Contractor in the event of such suspension or termination shall not be entitled to receive any further payments under this contract until the work is wholly finished. Then if the unpaid balance under this contract shall exceed all expenses of the Owner as certified by the Director, such excess shall be paid to the Contractor; but, if such expenses shall exceed the unpaid balance as certified by the Director, the Contractor and their surety shall be liable for and shall pay the difference and any damages to the Owner.
   D. In exercising Owner's right to secure completion of the work under any of the provisions hereof, the Director shall have the right to exercise Owner's sole discretion as to the manner, methods and reasonableness of costs of completing the work.
   E. The rights of the Owner to suspend or terminate as herein provided shall be cumulative and not exclusive and shall be in addition to any other remedy provided by law.
   F. The Contractor in the event of such suspension or termination may be declared ineligible for Owner contracts for a minimal period of twelve (12) months. Further, no contract will be awarded to any Contractor who lists in their bid form any subcontractor whose prior performance has contributed, as determined by the Owner, to a breach of a contract. In order to be considered for state-awarded contracts after this period, the Contractor/subcontractor will be required to forward acceptance reports to the Owner regarding successful completion of non-state projects during the intervening twelve (12) months from the date of default. No contracts will be awarded to a subcontractor/Contractor until the ability to perform responsibly in the private sector has been proven to the Owner.

ARTICLE 7.3 -- FOR CONVENIENCE
A. The Owner may terminate or suspend the Contract or any portion of the Work without cause at any time, and at the Owner's convenience. Notification of a termination or suspension shall be in writing and shall be given to the Contractor and their surety. If the Contract is suspended, the notice will contain the anticipated duration of the suspension or the conditions under which work will be permitted to resume. If appropriate, the Contractor will be requested to demobilize and re-mobilize and will be reimbursed time and costs associated with the suspension.
   B. Upon receipt of notification, the Contractor shall:
1. Cease operations when directed.

2. Take actions to protect the work and any stored materials.

3. Place no further subcontracts or orders for material, supplies, services or facilities except as may be necessary to complete the portion of the Contract that has not been terminated. No claim for payment of materials or supplies ordered after the termination date shall be considered.

4. Terminate all existing subcontracts, rentals, material, and equipment orders.

5. Settle all outstanding liabilities arising from termination with subcontractors and suppliers.

6. Transfer title and deliver to the Owner, work in progress, completed work, supplies and other material produced or acquire for the work terminated, and completed or partially completed plans, drawings information and other property that, if the Contract had been completed, would be required to be furnished to the Owner.

C. For termination without cause and at the Owner's convenience, in addition to payment for work completed prior to date of termination, the Contractor may be entitled to payment of other documented costs directly associated with the early termination of the contract. Payment for anticipated profit and unapplied overhead will not be allowed.
SECTION 007300 - SUPPLEMENTARY CONDITIONS

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

2.0 CONTACTS:
   Designer: Travis Helmkamp
   Oates Associates, Inc.
   720 Olive, Ste. 700, St. Louis, MO 63101
   Telephone: 314-588-8381; Fax: 314-588-9605
   Email: travis.helmkamp@oatesassociates.com

   Construction Representative: Mike Howard
   Division of Facilities Management, Design and Construction
   OA/FMDC, 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 65102
   Telephone: 573-751-2283; Email: Sandra.Walther@oa.mo.gov

   Contract Specialist: Kelly Copeland
   Division of Facilities Management, Design and Construction
   301 West High Street, Room 730, Jefferson City, Missouri 65102
   Telephone: 573-522-2283; Email: Kelly.Copeland@oa.mo.gov

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

4.0 FURNISHING CONSTRUCTION DOCUMENTS:
   A. The Owner will furnish the Contractor with approximately 10 complete sets of drawings and specifications at no charge.
   B. The Owner will furnish the Contractor with approximately 10 sets of explanatory or change drawings at no charge.
   C. The Contractor may make copies of the documents as needed with no additional cost to the Owner.

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

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

7.0 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.
In accordance with Section 290.262 RSMo 2000, within thirty (30) days after a certified copy of this Annual Wage Order has been filed with the Secretary of State as indicated below, any person who may be affected by this Annual Wage Order may object by filing an objection in triplicate with the Labor and Industrial Relations Commission, P.O. Box 599, Jefferson City, MO 65102-0599. Such objections must set forth in writing the specific grounds of objection. Each objection shall certify that a copy has been furnished to the Division of Labor Standards, P.O. Box 449, Jefferson City, MO 65102-0449 pursuant to 8 CSR 20-5.010(1). A certified copy of the Annual Wage Order has been filed with the Secretary of State of Missouri.

Original Signed by
Taylor Burks, Director
Division of Labor Standards

Filed With Secretary of State: ____________________________ March 8, 2019

Last Date Objections May Be Filed: April 8, 2019

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

**CITY OF ST. LOUIS CITY**

<table>
<thead>
<tr>
<th>OCCUPATIONAL TITLE</th>
<th>** Date of Increase</th>
<th>Basic Hourly Rates</th>
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<tbody>
<tr>
<td>Carpenter</td>
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<td>Groundman</td>
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<td>Group IV</td>
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</tbody>
</table>

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

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

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

*The Division of Labor Standards received less than 1,000 reportable hours as required by RSMo 290.257.4(b). Public works contracting minimum wage is established for this occupational title using data provided by Missouri Economic Research and Information Center, in accordance with RSMo 290.257.2.
OVERTIME

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

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

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

HOLIDAYS

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

If any holiday falls on a Sunday, the following Monday shall be considered a holiday.
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 63110).

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 March 11th, 2020 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 east and west courtyards as well as improvements along Magnolia Avenue in front of the School. Additionally, improvements include construction in the main lobby of the school, the 2nd Floor Health Center, as well as the 2nd Floor Southeast Administration Offices.

1. The Work includes construction operations throughout the campus of the Missouri School for the Blind. The work includes:

a. 2nd Floor Health Center: Selectively remove existing walls and construct new walls to extend the protected (rated) stair enclosure to meet applicable life safety codes and standards.

b. East Courtyard: Remove and replace existing concrete sidewalks in courtyard. Remove existing catwalk. Install new poured safety surface in the northern half of the east courtyard and install new high ropes course and playground equipment and structures. Install new concrete patio, synthetic turf and sensory maze on the southern half of the east courtyard. Install new rolled-up door in north wall of the existing Science Building. Selectively remove existing retaining wall and install new entrance to east courtyard. Install new security fence and gate. Remove and replace existing concrete sidewalk between Magnolia Avenue and the eastern pedestrian entrance to the School.

d. Magnolia Avenue / Front Entry to School: Remove and replace existing concrete sidewalk along Magnolia Avenue in front of the Missouri School for the Blind including a 2-foot stamped concrete sidewalk directly behind the existing curb line. Install rapid rectangular flashing beacons on the north and south side of Magnolia Avenue. Install new curb ramp at the eastern pedestrian entrance to Missouri School of the Blind. Strip new paring spaces to delineate bus parking.

e. Perimeter Security: Install new security fencing along the south side of the Missouri School for the Blind Campus in front of the existing track facility. Install new pedestrian and vehicular gates at various locations throughout the campus.

f. Main Lobby: Relocate existing security station to existing office located on the west side of the main hallway. Construct new security doors as well as the installation of a 3-D art piece and graphics.

g. Southeast Administration Egress: Selectively remove existing walls and construct new walls to modify existing office space to meet applicable life safety codes and standards.

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

1.3 DESIGNER’S ESTIMATE OF CONSTRUCTION COSTS

A. The project designer has prepared this cost estimate. The State of Missouri makes no guarantee regarding the accuracy of the values contained herein nor does the State of Missouri intend to imply that the values associated are accurate or in any way reflect actual costs required to perform the work represented by the specifications and drawings. The contractor should not rely on this estimate in any way while preparing a bid for this project or otherwise.

B. Project Cost Estimate Range: $1,600,000.00 - $2,200,000.00

1.4 FUTURE WORK

A. Separate Contract: The Owner may award a separate contract for performance of certain construction operations at the site. Those operations may be conducted simultaneously with work under this contract. That Contract includes the following:

1. Contract: A separate contract may be awarded for **E1908-01 Missouri School for the Blind – Replace Roofs**. The Work consists of replacement of the existing roof systems on multiple buildings at Missouri School for the Blind refereed to as New Administration Building (4,518 sf), the West Wing above Library Book Stacks (4,673 sf), the East Wing above K Dormitory (6,217 sf), the East Wing above the Little Theatre (2,668 sf), the Dining Hall above the Cafeteria (1,875 sf), the Dining Hall above the Teacher’s Lounge and Canteen (1,372 sf), the C & D Dormitory (4,775 sf), and the Multiple Handicapped and Disabled Annex Building (MHD Annex) (28,369 sf). The Work includes TPO membrane roofing, metal coping and flashings, and removal of HVAC roof top units.

B. Separate Contract: The Owner may award a separate contract for performance of certain construction operations at the site. Those operations may be conducted simultaneously with work under this contract. That Contract includes the following:
1. Contract: A separate contract may be awarded for **E2005-01 Missouri School for the Blind – Auditorium Renovation**. The Work consists of installation of a digital project booth, sound system with speakers, new auditorium seating, wall coverings, curtain and valance, and aisle lighting.

C. 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.

1.5 WORK SEQUENCE

A. The Work Sequence is broken into seven (7) phases. However these phases can occur simultaneously of any order of the Contractor’s choosing except as specified below.

1. Phase 1: Construct all improvements located in the 2nd Floor Health Center including the extension of the protected (rated) stair enclosure. Work of this phase shall be substantially complete, ready for occupancy within 2 weeks of commencement of construction.

2. Phase 2: Construct all improvements included in the East Courtyard including the removal of the existing catwalk in the east courtyard. Phase 2 construction improvements cannot begin until Phase 1 has been substantially completed. Substantial completion shall be defined as all construction items associated with extending the protected (rated) stair enclosure including 2-hour walls and the replacement of existing doors.

3. Phase 3: Construct all improvements included in the West Courtyard including the removal of the existing catwalk and the construction of a new greenhouse, Alternate #1, in the west courtyard. Phase 3 construction improvements cannot begin until Phase 1 has been substantially completed. Substantial completion shall be defined as all construction items associated with extending the protected (rated) stair enclosure including 2-hour walls and the replacement of existing doors. Phase 3 construction improvements can occur simultaneously with Phase 2 construction improvements.

4. Phase 4: Construct all improvements located along Magnolia Avenue / Front Entry to School including the removal and replacement of existing sidewalk along Magnolia Avenue. This Phase also includes the construction of new pedestrian entrances to the School including the construction of the canopy. A minimum of one assessible staff/visitor entry must be maintained, clearly marked and unobstructed always. Phase 4 construction improvements can be constructed at any time during construction operations.

5. Phase 5: Construct all improvements associated with Perimeter Security, including those identified in Alternate #4, including the construction of new fencing and gates around the campus. Phase 5 construction improvements can be constructed at any time during construction operations.

6. Phase 6: Construct all improvements included in the Main Lobby including the construction of security upgrades in the lobby as well as the installation of a 3-D art piece and wall graphics. Phase 6 construction improvements can be constructed at any time during construction operations. Work of this phase shall be substantially complete and ready for occupancy within 2 weeks of commencement of construction.
7. Phase 7: Construct all improvements including in the 2nd Floor Southeast Administration Rooms. Phase 7 construction improvements can be constructed at any time during construction operations. Work of this phase shall be substantially complete, ready for occupancy within 2 weeks of commencement of construction.

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.

1.6 CONTRACTOR USE OF PREMISES

A. General: During the construction period the Contractor shall have full use of the premises, within the project limits of the disturbed area(s), 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.

1.7 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.

1.8 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 012100 – ALLOWANCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

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

B. Types of allowances include the following:

1. Weather allowances.

C. Related Sections include the following:

1. Division 1 Section "Contract Modification Procedures" for procedures for submitting and handling Contract Changes for allowances.

1.3 WEATHER ALLOWANCE

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

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

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

D. There will be no modification to the time of contract performance due solely to the failure to deplete the “bad weather” day allowance.
E. Once this allowance is depleted, a no cost Contract Change time extension will be executed for “bad weather” days, as defined above, encountered during the remainder of the Project.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALLOWANCES

A. Weather Allowance: Included within the completion period for this Project fifteen (15) “bad weather” days.

END OF SECTION 012100
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 workdays 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 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

A. Alternate No. 1: West Courtyard.
   1. Base Bid: Remove the existing catwalks in the West Courtyard as indicated on Drawing SD-101. Remove and replace the existing concrete sidewalks, construct a new concrete ramp and reconstruct the existing stairs as indicated on the Civil drawings. Refer to the specifications for primary work requirements.
   2. Add Alternate: Perform all work as indicated in the Base Bid as well as construct new greenhouse including foundations, install new cedar fencing, planting beds, all plant materials, irrigation and drainage improvements as indicated on the Civil, Landscape and Structural drawings. Refer to the specifications for primary work requirements.

B. Alternate No. 2: Entrance Canopy: Add an entrance canopy as indicated in the plans and details as indicated on Drawing A-102, A-105, S-103, S-503 including below grade footings as indicated on Drawing S-101 and S-501. Refer to the specifications for primary work requirements.

C. Alternate No. 3: Self-Cleaning Roof for Greenhouse in West Courtyard: Install self-cleaning roof as part of the construction of the new greenhouse. Refer to the specifications for primary work requirements.

D. Alternate No. 4: Perimeter Security along Magnolia Avenue: Add perimeter security gates and remove and replace the existing perimeter security fence in front of the existing track on the east end of the Missouri School for the Blind campus along Magnolia Avenue as indicated in the plans and details as indicated on Drawing C-106, C-506 and C-507. Include key card pedestals as indicated on Drawing C-507. Include power as indicated in the plans on Drawing E-101 and E-102. Include technology as indicated in the plans on Drawing T-101, T-102 and according to the details indicated on Drawing T-201. 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 0, Section 007213, Article 3.1 "Acceptable Substitutions" for administrative procedures for handling Requests for Substitutions made after Contract award.
   4. Division 0, Section 007213, Article 4.0 "Changes in the Work" for 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 Contractor submits a RFI on a time sensitive activity on the current project schedule, the Contractor shall not be entitled to any time extension due to the time it takes the Designer to respond to the request provided that the Designer responds within the ten (10) working days set forth above.

C. Responses from the Designer will not change any requirement of the Contract Documents. In the event the Contractor believes that a response to a RFI will cause a change to the
requirements of the Contract Document, the Contractor shall give written notice to the Designer requesting a 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

1. 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 3 - EXECUTION

3.1 Referenced Forms

A. The following forms can be found on our website at https://oa.mo.gov/facilities/vendor-links/architectengineering-forms or https://oa.mo.gov/facilities/vendor-links/contractor-forms:

1. Request for Information
2. Designer's Supplemental Instructions
3. Request for Proposal
4. Contract Change
5. Contract Change Detailed Breakdown – SAMPLES
6. Contract Change Detailed Breakdown – General Contractor (GC)
7. Contract Change Detailed Breakdown – Subcontractor (SUB)

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.
   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. 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 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.

1.3 COORDINATION

A. Coordinate Contractor’s Construction Schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests, and other required schedules and reports.
   1. Secure time commitments for performing critical elements of the Work from entities involved.
   2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

1.4 CONTRACTOR’S CONSTRUCTION SCHEDULE, GENERAL

A. Time Frame: Extend schedule from date establish for the Notice to Proceed to date of Final Completion. The date of Final Completion shall be no later 120 Working Days from the Notice to Proceed.
   1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.

B. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule and show how the sequence of the Work is affected.
   1. Phasing: Arrange list of activities on schedule by phase.
      a. The project shall be phased in such a way that construction operations in the east courtyard will be significantly completed prior to beginning any work in the west courtyard.
      b. No catwalks in the west courtyard will be removed until the new catwalk to be constructed in the east courtyard is completed and open to pedestrian traffic.
      c. The easternmost pedestrian entrance to the School shall remain open during construction except for the removal and replacement of the existing sidewalk and the construction of the new canopy. The Contractor shall notify the School of the upcoming closure of the pedestrian entrance at least 7 Calendar days prior to closing the entrance.
d. Construction in the lobby can be completed at any time during the project. However, construction operations in the lobby shall be limited to 5 Calendar days following the start of construction activities in the lobby. The Contractor shall notify the School of the start of construction operations at least 7 Calendar days prior to starting construction in the lobby.

e. The Contractor shall coordinate with City of St. Louis, Board of Public Service to acquire all required permits prior to starting work on public right-of-way.

f. The Contractor shall submit a schedule of perimeter security gate construction to the School prior to starting construction operations. Construction shall be staged in such a manner that always maintains access to the large parking lot on the west side of the campus.

PART 2 - PRODUCTS – (Not Applicable)

PART 3 - EXECUTION

3.1 SUBMITTAL PROCEDURES

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

B. The Contractor shall submit an updated Schedule for presentation at each 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
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for submittals required for performance of the Work including the following:
   1. Shop Drawings
   2. Product Data
   3. Samples
   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 digital photographs. The Construction Administrator shall determine the quantity and naming convention at the preconstruction meeting.
2. The Contractor shall identify each photograph with project name, location, number, date, time, and orientation.

3. The Contractor shall submit progress photographs monthly unless specified otherwise. Photographs shall be taken one (1) week prior to submitting.

4. The Contractor shall take four (4) site photographs from differing directions and a minimum of five (5) interior photographs indicating the relative progress of the Work.

1.8 OPERATING AND MAINTENANCE MANUALS AND WARRANTIES

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

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 REQUIRED SUBMITTALS

A. Contractor shall submit the following information for materials and equipment to be provided under this contract. See individual Sections for additional information and for submittals not listed below.

<table>
<thead>
<tr>
<th>SECTION</th>
<th>DESCRIPTION</th>
<th>TYPE OF SUBMITTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>024116</td>
<td>Structure Demolition</td>
<td>Shop Drawings X</td>
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<td>Product Data X</td>
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<td>Sample X</td>
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<td>Certifications X</td>
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<td>Manufacturer’s Instructions X</td>
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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 Officer, 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 Immunoassey 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:

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<th>(GC/MS) Confirmation Test Cut-Off Level (ng/ml)</th>
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<td>Benzodiazepines</td>
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<tr>
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<tr>
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<td>.04%</td>
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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 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

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

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

F. Temporary Heating and Cooling: The normal heating and/or cooling system of the building shall be maintained in operation during the construction. Should the Contractor find it necessary to interrupt the normal HVAC service to spaces, which have not been vacated for construction, such interruptions shall be pre-scheduled with the Construction Representative.
G. Temporary Telephones: Provide temporary telephone service throughout the construction period for all personnel engaged in construction activities.
   1. Telephone Telephones: Contractor shall provide their own telephone communication.

H. 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.

I. 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.

J. 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).

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

3.3 SUPPORT FACILITIES INSTALLATION

A. General: Locate field offices, storage sheds, and other temporary construction and support facilities for easy access.
   1. Maintain support facilities until near Substantial Completion. Remove prior to Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to the Owner.

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

C. Storage Facilities: The Owner will provide storage onsite as designated by the Facility Representative or the Construction Representative. Areas for use by the Contractor for storage will be identified at the Pre-Bid Meeting. The Contractor shall provide his own security.
D. Temporary Paving: Construct and maintain temporary roads and paving to support the indicated loading adequately and to withstand exposure to traffic during the construction period. Locate temporary paving for roads, storage areas, and parking where the same permanent facilities will be located. Review proposed modifications to permanent paving with the Designer.
   1. Coordinate temporary paving development with subgrade grading, compaction, installation and stabilization of subbase, and installation of base and finish courses of permanent paving.
   2. Install temporary paving to minimize the need to rework the installations and to result in permanent roads and paved areas without damage or deterioration when occupied by the Owner.
   3. Delay installation of the final course of permanent asphalt concrete paving until immediately before Substantial Completion. Coordinate with weather conditions to avoid unsatisfactory results.
   4. Extend temporary paving in and around the construction area as necessary to accommodate delivery and storage of materials, equipment usage, administration, and supervision.

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

F. Dewatering Facilities and Drains: For temporary drainage and dewatering facilities and operations not directly associated with construction activities included under individual Sections, comply with dewatering requirements of applicable Division 2 Sections. Where feasible, utilize the same facilities. Maintain the site, excavations, and construction free of water.

G. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities.
   1. Where heat is needed and the permanent building enclosure is not complete, provide temporary enclosures where there is no other provision for containment of heat. Coordinate enclosure with ventilating and materials drying or curing requirements to avoid dangerous conditions and effects.
   2. Install tarpaulins securely with incombustible wood framing and other materials. Close openings of 25SqFt (2.3SqM) or less with plywood or similar materials.
   3. Close openings through floor or roof decks and horizontal surfaces with load-bearing, wood-framed construction.
   4. Where temporary wood or plywood enclosure exceeds 100SqFt (9.2SqM) in area, use UL-labeled, fire-retardant-treated material for framing and main sheathing.

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

I. Temporary Elevator Use: The Owner will allow use of elevators within the building. All construction personnel will be allowed access only to those specific elevators designated by the Construction Representative.
J. 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.

K. Temporary Exterior Lighting: Install exterior yard and sign lights so signs are visible when Work is being performed.

L. 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.

M. 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. Covered Walkway: Erect a structurally adequate, protective covered walkway for passage of persons along the adjacent public street. Coordinate with entrance gates, other facilities, and obstructions. Comply with regulations of authorities having jurisdiction.

1. Construct covered walkways using scaffold or shoring framing. Provide wood plank overhead decking, protective plywood enclosure walls, handrails, barricades, warning signs, lights, safe and well-drained walkways, and similar provisions for protection and safe passage. Extend the back wall beyond the structure to complete the enclosure fence. Paint and maintain in a manner acceptable to the Owner and the Designer.

F. 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.

G. 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 015639 - TEMPORARY PLANT PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes general protection and pruning of existing trees and plants that are affected by execution of the Work, whether temporary or permanent construction.

1.2 DEFINITIONS

A. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction and indicated on Drawings.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:
   1. Include plans and locations of protection-zone fencing and signage, showing relation of equipment-movement routes and material storage locations with protection zones.

C. Samples: For each type of the following:
   1. Organic Mulch: Sealed plastic bags labeled with composition of materials by percentage of weight and source of mulch.
   2. Protection-Zone Fencing: Assembled Samples.

1.5 INFORMATIONAL SUBMITTALS

A. Existing Conditions: Documentation of existing plantings indicated to remain, which establishes preconstruction conditions that might be misconstrued as damage caused by construction activities.

1.6 FIELD CONDITIONS

A. The following practices are prohibited within protection zones:
   1. Storage of construction materials, debris, or excavated material.
2. Moving or parking vehicles or equipment.
3. Foot traffic.
4. Erection of sheds or structures.
5. Impoundment of water.
6. Excavation or other digging unless otherwise indicated.
7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

B. Do not direct vehicle or equipment exhaust toward protection zones.

C. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones and organic mulch.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Backfill Soil: Planting soil of suitable moisture content and granular texture for placing around tree; free of stones, roots, plants, sod, clods, clay lumps, pockets of coarse sand, concrete slurry, concrete layers or chunks, cement, plaster, building debris, and other extraneous materials harmful to plant growth.

1. Planting Soil: Planting soil as specified in Section 329113 "Soil Preparation".

B. Protection-Zone Fencing: Fencing fixed in position and meeting one of the following requirements: Retain one or more of four fencing subparagraphs below for protection-zone fencing. Revise post and rail diameters to suit fence height and strength required.

1. Chain-Link Protection-Zone Fencing: Galvanized-steel fencing fabricated from minimum 2-inch opening, 0.148-inch diameter wire chain-link fabric; with pipe posts, minimum 2-3/8-inch OD line posts, and 2-7/8-inch OD corner and pull posts; with 1-5/8-inch OD top rails and 0.177-inch diameter bottom tension wire; with tie wires, hog ring ties, and other accessories for a complete fence system.

a. Height: 48 inches.

2. Plywood Protection-Zone Fencing: Plywood framed with four 2-by-4-inch rails, with 4-by-4-inch preservative-treated wood posts spaced not more than 96 inches apart.

a. Height: 48 inches.

3. Wood Protection-Zone Fencing: Constructed of two 2-by-4-inch horizontal rails, with 4-by-4-inch preservative-treated wood posts spaced not more than 96 inches apart, and lower rail set halfway between top rail and ground.

a. Height: 48 inches.

4. Plastic Protection-Zone Fencing: Plastic construction fencing constructed of high-density extruded and stretched polyethylene fabric with 2-inch (50-mm) maximum opening in
pattern and supported by tubular or T-shape galvanized-steel posts spaced not more than 96 inches (2400 mm) apart. High-visibility orange color.

a. Height: 48 inches.

5. Gates: Swing access gates matching material and appearance of fencing, to allow for maintenance activities within protection zones.

C. Protection-Zone Signage: Shop-fabricated, rigid plastic or metal sheet with attachment holes prepunched and reinforced; legibly printed with nonfading lettering.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Erosion and Sedimentation Control: Examine the site to verify that temporary erosion and sedimentation control measures are in place. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.

3.2 PREPARATION

A. Protect plant root systems from damage caused by runoff or spillage of noxious materials while mixing, placing, or storing construction materials. Protect root systems from ponding, eroding, or excessive wetting caused by dewatering operations.

3.3 PROTECTION ZONES

A. Protection-Zone Fencing: Install protection-zone fencing along edges of protection zones in a manner that will prevent people from easily entering protected areas except by entrance gates.

1. Chain-Link Fencing: Install to comply with ASTM F 567 and with manufacturer's written instructions.
2. Posts: Set or drive posts into ground one-third the total height of the fence without concrete footings. Where a post is located on existing paving or concrete to remain, provide appropriate means of post support.

B. Protection-Zone Signage: Install protection-zone signage in visibly prominent locations.

C. Maintain protection zones free of weeds and trash.

D. Maintain protection-zone fencing and signage in good condition and remove when construction operations are complete and equipment has been removed from the site.

3.4 EXCAVATION

A. General: Excavate at edge of protection zones and for trenches indicated within protection zones according to requirements in Section 312000 "Earth Moving" unless otherwise indicated.
B. Trenching within Protection Zones: Where utility trenches are required within protection zones, excavate under or around roots by hand or with air spade, or tunnel under the roots by drilling, auger boring, or pipe jacking. Do not cut main lateral tree roots or taproots; cut only smaller roots that interfere with installation of utilities. Cut roots as required for root pruning.

C. Do not allow exposed roots to dry out before placing permanent backfill.

3.5 REGRADING

A. Lowering Grade: Where new finish grade is indicated below existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.

B. Raising Grade: Where new finish grade is indicated above existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.

C. Minor Fill within Protection Zone: Where existing grade is 2 inches or less below elevation of finish grade, fill with backfill soil. Place backfill soil in a single uncompacted layer and hand grade to required finish elevations.

3.6 FIELD QUALITY CONTROL

A. Inspections: Engage a qualified arborist to direct plant-protection measures in the vicinity of shrubs and other vegetation indicated to remain and to prepare inspection reports.

3.7 REPAIR AND REPLACEMENT

A. General: Repair or replace shrubs, and other vegetation indicated to remain or to be relocated that are damaged by construction operations.

   1. Perform repairs of damaged trunks, branches, and roots within 24 hours according to arborist's written instructions.
   2. Replace trees and other plants that cannot be repaired and restored to full-growth status.

B. Excess Mulch: Rake mulched area within protection zones, being careful not to injure roots. Rake to loosen and remove mulch that exceeds a 2-inch uniform thickness to remain.

3.8 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove excess excavated material, displaced trees, trash, and debris and legally dispose of them off Owner's property.

END OF SECTION 015639
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.
MISSOURI SCHOOL FOR THE BLIND
(E1703-01) – Install Nature Park

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.

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 024116 - STRUCTURE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Demolition and removal of buildings and site improvements.
2. Abandoning in-place below-grade construction.
3. Disconnecting, capping or sealing and removing site utilities.
4. Salvaging items for reuse by Owner.

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 PREINSTALLATION MEETINGS

A. Predemolition Conference: Conduct conference at Project site.

1.4 INFORMATIONAL SUBMITTALS

B. 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.

1. Adjacent Buildings: Detail special measures proposed to protect adjacent buildings to remain including means of egress from those buildings.
C. Schedule of building demolition activities with starting and ending dates for each activity.
D. Predemolition photographs or video.
E. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician.
1.5 CLOSEOUT SUBMITTALS
   A. Inventory of items that have been removed and salvaged.

1.6 QUALITY ASSURANCE
   A. Refrigerant Recovery Technician Qualifications: Certified by EPA-approved certification program.

1.7 FIELD CONDITIONS
   A. Buildings to be demolished will be vacated and their use discontinued before start of the Work.
   B. Buildings immediately adjacent to demolition area will be occupied. Conduct building demolition so operations of occupied buildings will not be disrupted.
      1. Provide not less than 72 hours' notice of activities that will affect operations of adjacent occupied buildings.
      2. Maintain access to existing walkways, exits, and other facilities used by occupants of adjacent buildings.
         a. Do not close or obstruct walkways, exits, or other facilities used by occupants of adjacent buildings without written permission from authorities having jurisdiction.
   C. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
   D. Hazardous Materials: See the Hazardous Materials plans and specifications for requirements.
      1. If materials suspected of containing hazardous materials are encountered that are not included in the plans, do not disturb; immediately notify Architect and Owner.
   E. On-site storage or sale of removed items or materials is not permitted.
   F. Arrange demolition schedule so as not to interfere with Owner's on-site operations or operations of adjacent occupied buildings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS
   A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
   B. Standards: Comply with ASSE A10.6 and NFPA 241.
2.2 SOIL MATERIALS

A. Satisfactory Soils: Comply with requirements in Section 312000 "Earth Moving."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting demolition operations.

B. Inventory and record the condition of items to be removed and salvaged.

3.2 PREPARATION

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

B. Salvaged Items: Comply with the following:

1. Clean salvaged items of dirt and demolition debris.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to storage area designated by Owner.
5. Protect items from damage during transport and storage.

3.3 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Utilities to be Disconnected: Locate, identify, disconnect, and seal or cap off utilities serving buildings and structures to be demolished.

1. Owner will arrange to shut off utilities when requested by Contractor.
2. Arrange to shut off utilities with utility companies.
3. If removal, relocation, or abandonment of utility services will affect adjacent occupied buildings, then provide temporary utilities that bypass buildings and structures to be demolished and that maintain continuity of service to other buildings and structures.
4. Cut off pipe or conduit a minimum of 24 inches below grade. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing according to requirements of authorities having jurisdiction.
5. Do not start demolition work until utility disconnecting and sealing have been completed and verified in writing.

3.4 PROTECTION

A. Existing Facilities: Protect adjacent walkways, loading docks, building entries, and other building facilities during demolition operations. Maintain exits from existing buildings.
B. Temporary Shoring: Provide and maintain interior and exterior shoring, bracing, or structural support to preserve stability and prevent unexpected movement or collapse of construction being demolished.

C. Existing Utilities to Remain: Maintain utility services to remain and protect from damage during demolition operations. Do not interrupt existing utilities serving adjacent occupied or operating facilities unless authorized in writing by Owner and authorities having jurisdiction.

D. Temporary Protection: Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction and as indicated. Comply with requirements in Section 015000 "Temporary Facilities and Controls."

1. Protect adjacent buildings and facilities from damage due to demolition activities.
2. Protect existing site improvements, appurtenances, and landscaping to remain.
3. Erect a plainly visible fence around drip line of individual trees or around perimeter drip line of groups of trees to remain.
4. Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
5. Provide protection to ensure safe passage of people around building demolition area and to and from occupied portions of adjacent buildings and structures.
6. Protect walls, windows, roofs, and other adjacent exterior construction that are to remain and that are exposed to building demolition operations.
7. Erect and maintain dustproof partitions and temporary enclosures to limit dust, noise, and dirt migration to occupied portions of adjacent buildings.

E. Remove temporary barriers and protections where hazards no longer exist. Where open excavations or other hazardous conditions remain, leave temporary barriers and protections in place.

3.5 DEMOLITION

A. General: Demolish indicated buildings and site improvements completely. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Do not use cutting torches until work area is cleared of flammable materials. Maintain portable fire-suppression devices during flame-cutting operations.
2. Maintain fire watch during and for at least 4 hours after flame-cutting operations.
3. Maintain adequate ventilation when using cutting torches.
4. Locate building demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.

B. Site Access and Temporary Controls: Conduct building demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Do not close or obstruct streets, walks, walkways, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed trafficways if required by authorities having jurisdiction.
2. Use water mist and other suitable methods to limit spread of dust and dirt. Comply with governing environmental-protection regulations.

C. Explosives: Use of explosives is not permitted.

D. Proceed with demolition of structural framing members systematically, from higher to lower level. Complete building demolition operations above each floor or tier before disturbing supporting members on the next lower level.

E. Remove debris from elevated portions of the building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.

F. Salvage: Items to be removed and salvaged are indicated on Drawings.

G. Abandon foundation walls and other below-grade construction that are within footprint of new construction and extending 5 feet outside footprint indicated for new construction.

   1. Remove below-grade construction, including basements, foundation walls, and footings, to at least 12 inches below grade.

H. Existing Utilities: Demolish or Abandon existing utilities and below-grade utility structures that are within 5 feet outside footprint indicated for new construction. Abandon utilities outside this area.

I. Hydraulic Elevator Systems: Demolish and remove elevator system, including cylinder, plunger, well assembly, steel well casing and liner, oil supply lines, and tanks.

J. Below-Grade Areas: Completely fill below-grade areas and voids resulting from building demolition operations with satisfactory soil materials according to backfill requirements in Section 312000 "Earth Moving."

K. Site Grading: Uniformly rough grade area of demolished construction to a smooth surface, free from irregular surface changes. Provide a smooth transition between adjacent existing grades and new grades.

L. Promptly repair damage to adjacent buildings caused by demolition operations.

3.6 CLEANING

A. Remove demolition waste materials from Project site and recycle or dispose of them according to Section 017419 "Construction Waste Management and Disposal."

B. Do not burn demolished materials.

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

END OF SECTION 024116
SECTION 024119 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY
A. Section Includes:
   1. Demolition and removal of selected site elements.
B. See Section 024116 – Structural Demolition for demolition and removal of buildings, disconnecting, capping or sealing, site utilities and salvaging items for reuse by Owner.

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 PREINSTALLATION MEETINGS
A. Predemolition Conference: Conduct conference at the Project Site.

1.4 INFORMATIONAL SUBMITTALS
A. Schedule of selective demolition activities with starting and ending dates for each activity.

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 during the removal of selected site elements.
1. Hazardous materials will be removed by Owner before start of the Work.
2. 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.

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 ASSE A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 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.

3.2 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. Remove all existing concrete to the nearest concrete joint.
   2. Neatly sawcut at tie-ins the removal of all existing features.
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. 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.

3.3 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.

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
DIVISION 1

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 window glaze on the north exterior wall of the Science Building at 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: Sandra Walther, Office of Administration, FMDC

1.2 LIST OF MATERIALS CONTAINING ASBESTOS (TO BE ABATED)

<table>
<thead>
<tr>
<th>Material</th>
<th>Asbestos Content</th>
<th>Location &amp; Total Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Window Glaze In Science Building</td>
<td>&lt;1% to 1.6% Chrysotile</td>
<td>1 Window Unit</td>
</tr>
</tbody>
</table>

Note: Contractor is responsible for verifying all materials and quantities identified above prior to submitting their bid. The final quantity of window glaze to be abated will be based on the construction specifications.

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.


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 serpentine (chrysotile, antigorite), riebeckite (crocidolite), cummingtonite-grunerite (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 (1%) 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.

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), neither 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. NON-FRIABLE ACM. The window glaze within the scope of work is considered a non-friable Category II material. The Contractor is strongly encouraged to remove the window glaze using methods that will not render the material friable. 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. The entire window unit can be removed as part of the abatement process.
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. A courtesy abatement notification shall be submitted to the MDNR. Use EPA form “Notification of Demolition and Renovation and the MDNR 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. Department of Natural Resources
   Air Pollution Control Program (ASBESTOS)
   P. O. Box 176
   Jefferson City, MO 65102

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 not 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 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
   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. During abatement operations, at least two samples shall be collected outside the work area at upwind and downwind locations. 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 Owner’s Construction Representative and cause operations to cease and corrective measures be taken.
3. Provide Owner’s Construction Representative with daily abatement reports describing amount and type of work done, regulatory concerns, notable air monitoring reports, etc.
4. A visual inspection of the work area will be conducted at completion of abatement.
5. Confirm that the contractor’s procedures, methods, and practices were in full compliance with current federal or state regulations.

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 (if any) critical barriers and/or containment must remain in place until work area is cleared by TPAM and Owner’s Construction Representative 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 in an upwind and downwind location 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 Owner’s Construction Representative. 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.

D. All in-progress samples will be analyzed, at a minimum, by the PCM (NIOSH 7400) method, unless specifically stated elsewhere within this specification. Unless deemed unnecessary by the Air Sampling Professional at the time of sample collection, the upwind and downwind air samples (2) will act as project clearance samples. In addition to this, 1 field blank and 1 sealed blank will be analyzed. The abatement shall be considered complete when the result of each of upwind and downwind 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.

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.

E. Any work areas failing to meet the clearance requirements of this section shall be re-cleaned and retested 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 3.9. 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:

2. U. S. Environmental Protection Agency (EPA) including but not limited to:
   b. Asbestos Hazard Emergency Response Act (AHERA), Public Law (99-519) applicable only on schools.

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

4. State of Missouri
   a. H.B. 77, 85th General Assembly.
   b. Missouri Air Conservation Law, Chapter 643.
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 green/yellow ceramic block walls as a part of the upcoming renovation project and the white metal panels of the catwalks. The renovation project includes demolition of a portion of the north exterior wall of the Science Building in order to install an exterior door. The renovation project also includes the demolition of the catwalks. It has been determined that the paint within the green/yellow glazed block and the white exterior panels of the catwalks are lead-based paint and therefore 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.

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 demolition activities is to demolish the catwalks throughout the facility and a portion of the Science Building north exterior wall in order to install an exterior door. The painted walls, which has subsequently been identified as being lead-based, shall be demolished. 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 exterior white panels of the catwalks and the yellow/green glazed block in the Science Building which will be impacted during the installment of the new exterior door.
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.


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.

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.
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 Air Sampling Professional (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 or otherwise identified for future review by Barr Engineering. 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.
B. Related Requirements:
   1. Section 312000 "Earth Moving" for drainage fill under slabs-on-grade.
   2. Section 321313 "Concrete Paving" for concrete pavement and walks.
   3. Section 321316 "Decorative Concrete Paving" for decorative concrete pavement and walks.

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.
D. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
1. Location of construction joints is subject to approval of the Engineer.

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.
   7. Adhesives.
   8. Semirigid joint filler.

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:

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.

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.


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


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, Slabs-on-Grade and Slab-on-Metal Deck: Normal-weight concrete.

1. Minimum Compressive Strength: 4000 psi at 28 days.

2. Maximum W/C Ratio: 0.45.

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.
   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.

D. Footing Subgrade: Contractor will engage a qualified geotechnical engineering testing agency to perform at least one test of each soil stratum to verify design bearing capacities column footings. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Owner.
SECTION 040120.63 - BRICK MASONRY REPAIR

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. Repairing brick masonry.
   2. Removing abandoned anchors.
   3. Painting steel uncovered during the work.

1.3 DEFINITIONS

A. Low-Pressure Spray: 100 to 400 psi (690 to 2750 kPa); 4 to 6 gpm (0.25 to 0.4 L/s).

B. Rebuilding (Setting) Mortar: Mortar used to set and anchor masonry in a structure, distinct from pointing mortar installed after masonry is set in place.

C. Saturation Coefficient: Ratio of the weight of water absorbed during immersion in cold water to weight absorbed during immersion in boiling water; used as an indication of resistance of bricks to freezing and thawing.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
   1. Review methods and procedures related to brick masonry repair including, but not limited to, the following:
      a. Verify brick masonry repair specialist's personnel, equipment, and facilities needed to make progress and avoid delays.
      b. Materials, material application, sequencing, tolerances, and required clearances.
      c. Quality-control program.
      d. Coordination with building occupants.

1.5 SEQUENCING AND SCHEDULING

A. Order sand and gray portland cement for colored mortar immediately after approval of mockups. Take delivery of and store at Project site enough quantity to complete Project.
B. Work Sequence: Perform brick masonry repair work in the following sequence, which includes work specified in this and other Sections:

1. Remove plant growth.
2. Inspect masonry for open mortar joints and point them before cleaning to prevent the intrusion of water and other cleaning materials into the wall.
3. Remove paint.
4. Clean masonry.
5. Rake out mortar from joints surrounding masonry to be replaced and from joints adjacent to masonry repairs along joints.
6. Repair masonry, including replacing existing masonry with new masonry materials.
7. Rake out mortar from joints to be repointed.
8. Point mortar and sealant joints.
9. Install new windows / door frames / EFIS Infill.
10. After repairs and repointing have been completed and cured, perform a final cleaning to remove residues from this work.

1.6 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Include recommendations for product application and use.
3. Include test data substantiating that products comply with requirements.

B. Shop Drawings:

1. Include plans, elevations, sections, and locations of replacement bricks on the structure, showing relation of existing and new or relocated units.
2. Show provisions for expansion joints or other sealant joints.
3. Show provisions for flashing, lighting fixtures, conduits, and weep holes as required.
4. Show locations of scaffolding and points of scaffolding in contact with masonry. Include details of each point of contact or anchorage.

C. Samples for Initial Selection: For the following:

1. Colored Mortar: Submit sets of mortar that will be left exposed in the form of sample mortar strips, 6 inches (150 mm) long by typical width of existing mortar joints, set in aluminum or plastic channels.
   a. Have each set contain a close color range of at least three Samples of different mixes of colored sands and cements that produce a mortar matching existing, cleaned mortar when cured and dry.
   b. Submit with precise measurements on ingredients, proportions, gradations, and source of colored sands from which each Sample was made.
2. Sand Types Used for Mortar: Minimum 8 oz. (240 mL) of each in plastic screw-top jars.
3. Patching Compound: Submit sets of patching compound Samples in the form of plugs (patches in drilled holes) in sample units of masonry representative of the range of masonry colors on the building.
   a. Have each set contain a close color range of at least three Samples of different mixes of patching compound that matches the variations in existing masonry when cured and dry.

4. Include similar Samples of accessories involving color selection.

D. Samples for Verification: For the following:

1. Each type of brick unit to be used for replacing existing units. Include sets of Samples to show the full range of shape, color, and texture to be expected. For each brick type, provide straps or panels containing at least four bricks. Include multiple straps for brick with a wide range.

2. Accessories: Each type of accessory and miscellaneous support.

1.7 INFORMATIONAL SUBMITTALS

A. Qualification Data: For brick masonry repair specialist.

B. Preconstruction Test Reports: For existing bricks and mortar and replacement bricks.

C. Quality-control program.

1.8 QUALITY ASSURANCE

A. Brick Masonry Repair Specialist Qualifications: Engage an experienced brick masonry repair firm to perform work of this Section. Firm shall have completed work similar in material, design, and extent to that indicated for this Project with a record of successful in-service performance. Experience in only installing masonry is insufficient experience for masonry repair work.

1. Field Supervision: Brick masonry repair specialist firm shall maintain experienced full-time supervisors on Project site during times that brick masonry repair work is in progress.

B. Quality-Control Program: Prepare a written quality-control program for this Project to systematically demonstrate the ability of personnel to properly follow methods and use materials and tools without damaging masonry. Include provisions for supervising performance and preventing damage.

C. Mockups: Prepare mockups of brick masonry repair to demonstrate aesthetic effects and to set quality standards for materials and execution and for fabrication and installation.

1. Masonry Repair: Prepare sample areas for each type of masonry repair work performed. If not otherwise indicated, size each mockup not smaller than two adjacent whole units or approximately 48 inches (1200 mm) in least dimension. Construct sample areas in
locations in existing walls where directed by Architect unless otherwise indicated. Demonstrate quality of materials, workmanship, and blending with existing work. Include the following as a minimum:

a. Replacement: Four brick units replaced.
b. Patching: Three small holes at least 1 inch (25 mm) in diameter for each type of brick indicated to be patched.

2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

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

1.9 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on brick masonry as follows:

1. Provide test specimens as indicated and representative of proposed materials and existing construction.
2. Replacement Brick: Test each proposed type of replacement brick according to sampling and testing methods in ASTM C67 for compressive strength, 24-hour cold-water absorption, five-hour boil absorption, saturation coefficient, and initial rate of absorption (suction).
3. Existing Brick: Test each type of existing brick indicated for replacement according to testing methods in ASTM C67 for compressive strength, 24-hour cold-water absorption, five-hour boil absorption, saturation coefficient, and initial rate of absorption (suction). Carefully remove five existing units from locations designated by Architect. Take testing samples from these units.
4. Existing Mortar: Test according to ASTM C1324, modified as agreed by testing service and Architect for Project requirements, to determine proportional composition of original ingredients, sizes and colors of aggregates, and approximate strength.
5. Temporary Patch: As directed by Architect, provide temporary materials followed by permanent repairs at locations from which existing samples were taken.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver bricks to Project site strapped together in suitable packs or pallets or in heavy-duty cartons and protected against impact and chipping.

B. Deliver packaged materials to Project site in manufacturer's original and unopened containers, labeled with manufacturer's name and type of products.

C. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

D. Store hydrated lime in manufacturer's original and unopened containers. Discard lime if containers have been damaged or have been opened for more than two days.
E. Store sand where grading and other required characteristics can be maintained and contamination avoided.

F. Handle bricks to prevent overstressing, chipping, defacement, and other damage.

1.11 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit brick masonry repair work to be performed according to product manufacturers' written instructions and specified requirements.

B. Temperature Limits: Repair brick masonry only when air temperature is between 40 and 90 deg F (4 and 32 deg C) and is predicted to remain so for at least seven days after completion of the Work unless otherwise indicated.

C. Cold-Weather Requirements: Comply with the following procedures for masonry repair unless otherwise indicated:
   1. When air temperature is below 40 deg F (4 deg C), heat mortar ingredients, masonry repair materials, and existing masonry walls to produce temperatures between 40 and 120 deg F (4 and 49 deg C).
   2. When mean daily air temperature is below 40 deg F (4 deg C), provide enclosure and heat to maintain temperatures above 32 deg F (0 deg C) within the enclosure for seven days after repair.

D. Hot-Weather Requirements: Protect masonry repairs when temperature and humidity conditions produce excessive evaporation of water from mortar and repair materials. Provide artificial shade and wind breaks, and use cooled materials as required to minimize evaporation. Do not apply mortar to substrates with temperatures of 90 deg F (32 deg C) and above unless otherwise indicated.

E. For manufactured repair materials, perform work within the environmental limits set by each manufacturer.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Source Limitations: Obtain each type of material for repairing brick masonry (brick, cement, sand, etc.) from single source with resources to provide materials of consistent quality in appearance and physical properties.

2.2 MASONRY MATERIALS

A. Face Brick: As required to complete brick masonry repair work.
1. Brick Matching Existing: Units with colors, color variation within units, surface texture, size, and shape that match existing brickwork and with physical properties.
   a. For existing brickwork that exhibits a range of colors or color variation within units, provide brick that proportionally matches that range and variation rather than brick that matches an individual color within that range.

2. Tolerances as Fabricated: According to tolerance requirements in ASTM C216, Type FBS.

B. Building Brick: ASTM C62, of same vertical dimension as face brick, for masonry work concealed from view.
   1. Grade SW where in contact with earth.
   2. Grade SW or MW for concealed backup.

2.3 MORTAR MATERIALS

A. Portland Cement: ASTM C150/C150M, Type I or Type II, except Type III may be used for cold-weather construction; white or gray, or both where required for color matching of mortar.
   1. Provide cement containing not more than 0.60 percent total alkali when tested according to ASTM C114.

B. Hydrated Lime: ASTM C207, Type S.

C. Masonry Cement: ASTM C91/C91M.

D. Mortar Cement: ASTM C1329/C1329M.

E. Mortar Sand: ASTM C144.
   1. Exposed Mortar: Match size, texture, and gradation of existing mortar sand as closely as possible. Blend several sands if necessary to achieve suitable match.
   2. Colored Mortar: Natural sand or ground marble, granite, or other sound stone of color necessary to produce required mortar color.


G. Water: Potable.

2.4 MANUFACTURED REPAIR MATERIALS

A. Brick Patching Compound: Factory-mixed cementitious product that is custom manufactured for patching brick masonry.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Cathedral Stone Products, Inc.
b. Conproco Corporation.
c. Edison Coatings Inc.
d. Or Approved Equal

2. Use formulation that is vapor and water permeable (equal to or more than the brick), exhibits low shrinkage, has lower modulus of elasticity than bricks being repaired, and develops high bond strength to all types of masonry.

3. Use formulation having working qualities and retardation control to permit forming and sculpturing where necessary.

4. Formulate patching compound in colors and textures to match each brick being patched. Provide sufficient number of colors to enable matching of the color, texture, and variation of each unit.

2.5 ACCESSORY MATERIALS

A. Setting Buttons and Shims: Resilient plastic, nonstaining to masonry, sized to suit joint thicknesses and bed depths of bricks, less the required depth of pointing materials unless removed before pointing.

B. Masking Tape: Nonstaining, nonabsorbent material; compatible with mortar, joint primers, sealants, and surfaces adjacent to joints; and that easily comes off entirely, including adhesive.

C. Antirust Coating: Fast-curing, lead- and chromate-free, self-curing, universal modified-alkyd primer according to MPI #23 (surface-tolerant, anticorrosive metal primer).

1. Surface Preparation: Use coating requiring no better than SSPC-SP 3, "Power Tool Cleaning" surface preparation according to manufacturer's literature or certified statement.

2. VOC Limit: Use coating with a VOC content of 400 g/L (3.3 lb/gal.) or less.

D. Other Products: Select materials and methods of use based on the following, subject to approval of a mockup:

1. Previous effectiveness in performing the work involved.
2. Minimal possibility of damaging exposed surfaces.
3. Consistency of each application.
4. Uniformity of the resulting overall appearance.
5. Do not use products or tools that could leave residue on surfaces.

2.6 MORTAR MIXES

A. Measurement and Mixing: Measure cementitious materials and sand in a dry condition by volume or equivalent weight. Do not measure by shovel; use known measure. Mix materials in a clean, mechanical batch mixer.

B. Colored Mortar: Produce mortar of color required by using specified ingredients. Do not alter specified proportions without Architect's approval.
1. Mortar Pigments: Where mortar pigments are indicated, do not add pigment exceeding 10 percent by weight of the cementitious or binder materials, except for carbon black which is limited to 2 percent, unless otherwise demonstrated by a satisfactory history of performance.

C. Do not use admixtures in mortar unless otherwise indicated.

D. Mixes: Mix mortar materials in the following proportions:
   1. Rebuilding (Setting) Mortar by Type: ASTM C270, Proportion Specification, Type N unless otherwise indicated; with cementitious material limited to portland cement and lime, masonry cement, or mortar cement.
   2. Pigmented, Colored Mortar: Add mortar pigments to produce exposed, setting (rebuilding) mortar of colors required.

PART 3 - EXECUTION

3.1 PROTECTION

A. Prevent mortar from staining face of surrounding masonry and other surfaces.
   1. Cover sills, ledges, and other projecting items to protect them from mortar droppings.
   2. Keep wall area wet below rebuilding and repair work to discourage mortar from adhering.
   3. Immediately remove mortar splatters in contact with exposed masonry and other surfaces.

B. Remove gutters and downspouts and associated hardware adjacent to masonry and store during masonry repair. Reinstall when repairs are complete.
   1. Provide temporary rain drainage during work to direct water away from building.

3.2 MASONRY REPAIR, GENERAL

A. Appearance Standard: Repaired surfaces are to have a uniform appearance as viewed from 20 feet (6 m) away by Architect.

3.3 ABANDONED ANCHOR REMOVAL

A. Remove abandoned anchors, brackets, wood nailers, and other extraneous items no longer in use unless indicated to remain.
   1. Remove items carefully to avoid spalling or cracking masonry.
   2. Notify Architect before proceeding if an item cannot be removed without damaging surrounding masonry. Do the following where directed:
   3. Patch hole where each item was removed unless directed to remove and replace bricks.
3.4 BRICK REMOVAL AND REPLACEMENT

A. At locations indicated, remove bricks that are damaged, spalled, or deteriorated. Carefully remove entire units from joint to joint, without damaging surrounding masonry, in a manner that permits replacement with full-size units.

1. When removing single bricks, remove material from center of brick and work toward outside edges.

B. Support and protect remaining masonry that surrounds removal area.

C. Maintain flashing, reinforcement, lintels, and adjoining construction in an undamaged condition. Coordinate with new flashing, reinforcement, and lintels, which are specified in other Sections.

D. Notify Architect of unforeseen detrimental conditions including voids, cracks, bulges, and loose units in existing masonry backup, rotted wood, rusted metal, and other deteriorated items.

E. Remove in an undamaged condition as many whole bricks as possible.

1. Remove mortar, loose particles, and soil from brick by cleaning with hand chisels, brushes, and water.
2. Remove sealants by cutting close to brick with utility knife and cleaning with solvents.
3. Store brick for reuse. Store off ground, on skids, and protected from weather.
4. Deliver cleaned brick not required for reuse to Owner unless otherwise indicated.

F. Clean masonry surrounding removal areas by removing mortar, dust, and loose particles in preparation for brick replacement.

G. Replace removed damaged brick with other removed brick in good condition, where possible, or with new brick matching existing brick. Do not use broken units unless they can be cut to usable size.

H. Install replacement brick into bonding and coursing pattern of existing brick. If cutting is required, use a motor-driven saw designed to cut masonry with clean, sharp, unchipped edges.

1. Maintain joint width for replacement units to match existing joints.
2. Use setting buttons or shims to set units accurately spaced with uniform joints.

I. Lay replacement brick with rebuilding (setting) mortar and with completely filled bed, head, and collar joints. Butter ends with enough mortar to fill head joints and shove into place. Wet both replacement and surrounding bricks that have ASTM C67 initial rates of absorption (suction) of more than 30 g/30 sq. in. per min. (30 g/194 sq. cm per min.) Use wetting methods that ensure that units are nearly saturated but surface is dry when laid.

1. Tool exposed mortar joints in repaired areas to match joints of surrounding existing brickwork.
2. When mortar is hard enough to support units, remove shims and other devices interfering with pointing of joints.
J. Curing: Cure mortar by maintaining in thoroughly damp condition for at least 72 consecutive hours, including weekends and holidays.

1. Hairline cracking within the mortar or mortar separation at edge of a joint is unacceptable. Completely remove such mortar and repoint.

3.5 PAINTING STEEL UNCOVERED DURING THE WORK

A. Notify Architect if steel is exposed during masonry removal. Where Architect determines that steel is structural, or for other reasons cannot be totally removed, prepare and paint it as follows:

1. Surface Preparation: Remove paint, rust, and other contaminants according to SSPC-SP 3, "Power Tool Cleaning", as applicable to comply with paint manufacturer's recommended preparation.
2. Antirust Coating: Immediately paint exposed steel with two coats of antirust coating, following coating manufacturer's written instructions and without exceeding manufacturer's recommended rate of application (dry film thickness per coat).

B. If on inspection and rust removal, the thickness of a steel member is found to be reduced from rust by more than 1/16 inch (1.6 mm), notify Architect before proceeding.

3.6 BRICK MASONRY PATCHING

A. Patch the following bricks unless another type of repair or replacement is indicated:

1. Bricks indicated to be patched.
2. Bricks with holes.
3. Bricks with chipped edges or corners. Patch chipped edges or corners measuring more than 3/4 inch (19 mm) in least dimension.
4. Bricks with small areas of deep deterioration. Patch deep deteriorations measuring more than 3/4 inch (19 mm) in least dimension and more than 1/4 inch (6 mm) deep.

B. Remove and replace existing patches where loose or discolored.

C. Patching Bricks:

1. Remove loose material from masonry surface. Carefully remove additional material so patch does not have feathered edges but has square or slightly undercut edges on area to be patched and is at least 1/4 inch (6 mm) thick, but not less than recommended in writing by patching compound manufacturer.
2. Mask adjacent mortar joint or rake out for repointing if patch extends to edge of brick.
3. Mix patching compound in individual batches to match each unit being patched. Combine one or more colors of patching compound, as needed, to produce exact match.
4. Rinse surface to be patched and leave damp, but without standing water.
5. Brush-coat surfaces with slurry coat of patching compound according to manufacturer's written instructions.
6. Place patching compound in layers as recommended in writing by patching compound manufacturer, but not less than 1/4 inch (6 mm) or more than 2 inches (50 mm) thick. Roughen surface of each layer to provide a key for next layer.
7. Trowel, scrape, or carve surface of patch to match texture and surrounding surface plane or contour of brick. Shape and finish surface before or after curing, as determined by testing, to best match existing brick.
8. Keep each layer damp for 72 hours or until patching compound has set.
9. Remove and replace patches with hairline cracks or that show separation from brick at edges, and those that do not match adjoining brick in color or texture.

3.7 FINAL CLEANING
A. After mortar has fully hardened, thoroughly clean exposed masonry surfaces of excess mortar and foreign matter; use wood scrapers, stiff-nylon or -fiber brushes, and clean water applied by low-pressure spray.
   1. Do not use metal scrapers or brushes.
   2. Do not use acidic or alkaline cleaners.
B. Clean adjacent nonmasonry surfaces. Use detergent and soft brushes or cloths.
C. Clean mortar and debris from roof; remove debris from gutters and downspouts. Rinse off roof and flush gutters and downspouts.
D. Remove masking materials, leaving no residues that could trap dirt.

3.8 FIELD QUALITY CONTROL
A. Testing Agency: Contractor will engage a qualified testing agency to perform tests and inspections. Allow inspectors use of lift devices and scaffolding, as needed, to perform inspections.
B. Architect's Project Representatives: Architect will assign Project representatives to help carry out Architect's responsibilities at the site, including observing progress and quality of portion of the Work completed. Allow Architect's Project representatives use of lift devices and scaffolding, as needed, to observe progress and quality of portion of the Work completed.
C. Notify inspectors and Architect's Project representatives in advance of times when lift devices and scaffolding will be relocated. Do not relocate lift devices and scaffolding until inspectors and Architect's Project representatives have had reasonable opportunity to make inspections and observations of work areas at lift device or scaffold location.

3.9 MASONRY WASTE DISPOSAL
A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property.
B. Masonry Waste: Remove masonry waste and legally dispose of off Owner's property.

END OF SECTION 040120.63
SECTION 042200 - CONCRETE UNIT MASONRY

PART 1 - GENERAL

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

1.2 SUMMARY
A. Section Includes:
   1. Concrete masonry units.
   2. Brick masonry units.
   3. Cast stone units.
   4. Mortar and grout.
   5. Steel reinforcing bars.
   7. Embedded flashing.
   8. Miscellaneous masonry accessories.

B. Related Requirements:
   1. Section 033000 "Cast-in-Place Concrete" for installing dovetail slots for masonry anchors.
   2. Section 051200 "Structural Steel Framing" for installing anchor sections of adjustable masonry anchors for connecting to structural steel frame.

1.3 DEFINITIONS
A. CMU(s): Concrete masonry unit(s).
B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.
C. Cast Stone: Fabricated units for lintels and sills.

1.4 ACTION SUBMITTALS
A. Product Data: For each type of product.
B. Shop Drawings: For the following:
   1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
2. Reinforcing Steel: Detail bending, lap lengths, and placement of unit masonry reinforcing bars. Comply with ACI 315. Show elevations of reinforced walls.
3. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.

C. Samples for Initial Selection:
   1. Weep holes/vents.

D. Samples for Verification: For each type and color of the following:
   1. Exposed CMUs.
   2. Exposed Cast Stone.
   3. Exposed Mortar. Make Samples using same sand and mortar ingredients to be used on Project.

1.5 INFORMATIONAL SUBMITTALS

A. Material Certificates: For each type and size of the following:
   1. Masonry units.
      a. Include material test reports substantiating compliance with requirements.
      b. For masonry units used in structural masonry, include data and calculations establishing average net-area compressive strength of units.
   2. Cementitious materials. Include name of manufacturer, brand name, and type.
   3. Mortar admixtures.
   4. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
   5. Grout mixes. Include description of type and proportions of ingredients.
   6. Reinforcing bars.
   7. Joint reinforcement.
   8. Anchors, ties, and metal accessories.

B. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
   1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91/C 91M for air content.
   2. Include test reports, according to ASTM C 1019, for grout mixes required to comply with compressive strength requirement.

C. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to TMS 602/ACI 530.1/ASCE 6.

D. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.
1.6 QUALITY ASSURANCE

A. Sample Panels: Build sample panels to verify selections made under Sample submittals and to demonstrate aesthetic effects. Comply with requirements in Section 014000 "Quality Requirements" for mockups.

1. Build sample panels for each type of exposed unit masonry construction in sizes approximately 36 inches long by 36 inches high by full thickness.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. Deliver preblended, dry mortar mix in moisture-resistant containers. Store preblended, dry mortar mix in delivery containers on elevated platforms in a dry location or in covered weatherproof dispensing silos.

E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.8 FIELD CONDITIONS

A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

1. Extend cover a minimum of 24 inches down both sides of walls, and hold cover securely in place.

B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.

C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.

D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.
1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.


PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

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

2.2 PERFORMANCE REQUIREMENTS

A. Provide structural unit masonry that develops indicated net-area compressive strengths at 28 days.

   1. Determine net-area compressive strength of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to TMS 602/ACI 530.1/ASCE 6.

   2. Determine net-area compressive strength of masonry by testing masonry prisms according to ASTM C 1314.

2.3 UNIT MASONRY, GENERAL

A. Masonry Standard: Comply with TMS 602/ACI 530.1/ASCE 6 except as modified by requirements in the Contract Documents.

B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects are exposed in the completed Work and will be within 20 feet vertically and horizontally of a walking surface.

C. Fire-Resistance Ratings: Comply with requirements for fire-resistance-rated assembly designs indicated.

   1. Where fire-resistance-rated construction is indicated, units shall be listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction.
2.4 CONCRETE MASONRY UNITS

A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.
   1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
   2. Provide square-edged units for outside corners unless otherwise indicated.

B. Integral Water Repellant: Provide units made with integral water repellant for exposed units.

C. CMUs: ASTM C 90.
   1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 1500 psi.
   2. Density Classification: Normal weight.
   4. Exposed Faces: Provide color and texture matching the range represented by Architect's sample.

2.5 BRICK

A. General: Provide shapes as indicated and as follows, with exposed surfaces matching finish and color of exposed faces of adjacent units:
   1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.
   2. Provide special shapes for applications where stretcher units cannot accommodate special conditions, including those at corners, movement joints, bond beams, sashes, and lintels.

B. Clay Face Brick: Facing brick complying with ASTM C 216
   1. Brick: Colonial red brick, wire cut, smooth face
   2. Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced."
   3. Size: 2 ¼”x 8”x 3 5/8”

2.6 CAST STONE

A. General: Provide shapes as indicated and as follows, with exposed surfaces matching finish and color of exposed faces of adjacent units:

B. Cast Stone: Fabricated cast stone sills for top of CMU/brick veneer, complying with ASTM C1364.
   1. Sills: White, Buff color; fine grain texture

C. Compressive Strength: comply with ASTM C1194: 6,500 psi minimum for products at 28 days.

D. Absorption: comply with ASTM C1195, 6.0% maximum by cold water method.
2.7 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C 150/C 150M, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

B. Hydrated Lime: ASTM C 207, Type S.

C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.
   1. Type N: Brick, above grade.
   2. Type S: Brick, below grade.

D. Aggregate for Mortar: ASTM C 144.
   1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
   2. For joints less than 1/4-inch-thick, use aggregate graded with 100 percent passing the No. 16 sieve.
   3. White-Mortar Aggregates: Natural white sand or crushed white stone.
   4. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.

E. Aggregate for Grout: ASTM C 404.

F. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.

G. Additives:
   1. Integral Water Repellant: All mortar for CMU shall contain proper amount of admixture.

H. Water: Potable.

2.8 REINFORCEMENT

A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60.

B. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and to hold reinforcing bars in center of cells. Units are formed from 0.148-inch steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.

C. Masonry-Joint Reinforcement, General: Ladder or truss type with single pair of side rods complying with ASTM A 951/A 951M.
   1. Interior Walls: Hot-dip galvanized carbon steel.
   2. Exterior Walls: Hot-dip galvanized carbon steel.
5. Spacing of Cross Rods: Not more than 16 inches o.c.
6. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units.

2.9 TIES AND ANCHORS

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

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

5. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

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

1. Anchor Section for Welding to Steel Frame: Crimped 1/4-inch-diameter, hot-dip galvanized steel wire. Mill-galvanized wire may be used at interior walls unless otherwise indicated.
2. Tie Section: Triangular-shaped wire tie made from 0.25-inch-diameter, hot-dip galvanized steel wire. Mill-galvanized wire may be used at interior walls unless otherwise indicated.

2.10 EMBEDDED FLASHING MATERIALS

A. Flexible flashing and cavity drainage material: Provide flashing and accessories for veneer.

2.11 MISCELLANEOUS MASONRY ACCESSORIES

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

B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 or [PVC, complying with ASTM D 2287, Type PVC-65406 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

C. Bond-Breaker Strips: Asphalt-saturated felt complying with ASTM D 226/D 226M, Type I (No. 15 asphalt felt).
D. Weep/Cavity Vent Products: Use the following unless otherwise indicated:
   1. Cellular Plastic Weep/Vent: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, full height and width of head joint and depth 1/8 inch less than depth of outer wythe, in color selected from manufacturer’s list.

2.12 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.
   1. Do not use calcium chloride in mortar or grout.
   2. Use portland cement-lime mortar unless otherwise indicated.
   3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Mortar for Unit Masonry: Comply with ASTM C 270, Property Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.
   1. For masonry below grade or in contact with earth, use Type M.
   2. For reinforced masonry, use Type S.

D. Grout for Unit Masonry: Comply with ASTM C 476.
   1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with TMS 602/ACI 530.1/ASCE 6 for dimensions of grout spaces and pour height.
   2. Proportion grout in accordance with ASTM C 476, paragraph 4.2.2 for specified 28-day compressive strength indicated, but not less than 2000 psi.
   3. Provide grout with a slump of 8 to 11 as measured according to ASTM C 143/C 143M.

PART 3 - EXECUTION

3.1 EXAMINATION

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

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

3.2 INSTALLATION, GENERAL

A. Build chases and recesses to accommodate items specified in this and other Sections.

B. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match construction immediately adjacent to opening.

C. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

3.3 TOLERANCES

A. Dimensions and Locations of Elements:

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

B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 feet, or 1/2-inch maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2-inch maximum.
3. For vertical lines and surfaces do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2-inch maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2-inch maximum.
5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2-inch maximum.

C. Joints:

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

3.4 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.

C. Stopping and Resuming Work: Stop work by stepping back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.

D. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

E. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

F. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below, and rod mortar or grout into core.

G. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

3.5 MORTAR BEDDING AND JOINTING

A. Lay hollow CMUs as follows:

1. Bed face shells in mortar and make head joints of depth equal to bed joints.
2. Bed webs in mortar in all courses of piers, columns, and pilasters.
3. Bed webs in mortar in grouted masonry, including starting course on footings.
4. Fully bed entire units, including areas under cells, at starting course on footings where cells are not grouted.

B. Lay solid CMUs with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

D. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.
E. Cut joints flush where indicated to receive waterproofing unless otherwise indicated.

3.6 MASONRY-JOINT REINFORCEMENT

A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.

1. Space reinforcement not more than 16 inches o.c.
2. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings in addition to continuous reinforcement.

B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.

C. Provide continuity at wall intersections by using prefabricated T-shaped units.

D. Provide continuity at corners by using prefabricated L-shaped units.

3.7 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE

A. Anchor masonry to structural steel and concrete, where masonry abuts or faces structural steel or concrete, to comply with the following:

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

3.8 CONTROL AND EXPANSION JOINTS

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

B. Form control joints in concrete masonry as follows:

1. Fit bond-breaker strips into hollow contour in ends of CMUs on one side of control joint. Fill resultant core with grout and rake out joints in exposed faces for application of sealant.
2. Install preformed control-joint gaskets designed to fit standard sash block.
3. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar or rake out joint for application of sealant.
4. Install temporary foam-plastic filler in head joints and remove filler when unit masonry is complete for application of sealant.
3.9        FLASHING, WEEP HOLES, AND CAVITY VENTS

A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.

B. Install flashing as follows unless otherwise indicated:

1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
2. At lintels and shelf angles, extend flashing a minimum of 6 inches into masonry at each end. At heads and sills, extend flashing 6 inches at ends and turn up not less than 2 inches to form end dams.
3. Extend flexible flashing to outside face of wall.

C. Install weep holes in exterior wythes and veneers in head joints of first course of masonry immediately above embedded flashing.

   1. Use specified weep/cavity vent products to form weep holes.
   2. Space weep holes 24 inches o.c. unless otherwise indicated.

3.10        REINFORCED UNIT MASONRY INSTALLATION

A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.

   1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
   2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other loads that may be placed on them during construction.

B. Placing Reinforcement: Comply with requirements in TMS 602/ACI 530.1/ASCE 6.

C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.

   1. Comply with requirements in TMS 602/ACI 530.1/ASCE 6 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
   2. Limit height of vertical grout pours to not more than specified in Table 7 in the Specifications for Masonry Structures.
3.11 FIELD QUALITY CONTROL

A. Testing and Inspecting: Contractor will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.

B. Inspections: Special inspections according to Level B in TMS 402/ACI 530/ASCE 5.
   1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
   2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
   3. Place grout only after inspectors have verified proportions of site-prepared grout.

C. Testing Prior to Construction: One set of tests.

D. Testing Frequency: One set of tests for each 5000 sq. ft. of wall area or portion thereof.

E. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C 140 for compressive strength.

F. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C 780.

G. Mortar Test (Property Specification): For each mix provided, according to ASTM C 780. Test mortar for mortar air content and compressive strength.

H. Grout Test (Compressive Strength): For each mix provided, according to ASTM C 1019.

3.12 REPAIRING, POINTING, AND CLEANING

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

B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.

C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
   1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
   2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
3. Protect adjacent stone and non-masonry surfaces from contact with cleaner by covering
them with liquid strippable masking agent or polyethylene film and waterproof masking
tape.
4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by
rinsing surfaces thoroughly with clear water.
5. Clean concrete masonry by applicable cleaning methods indicated in NCMA TEK 8-4A.

3.13 MASONRY WASTE DISPOSAL

A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's
property. At completion of unit masonry work, remove from Project site.

B. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-
contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill
material as fill is placed.

1. Crush masonry waste to less than 4 inches (in each dimension.
2. Mix masonry waste with at least two parts of specified fill material for each part of
masonry waste. Fill material is specified in Section 312000 "Earth Moving."
3. Do not dispose of masonry waste as fill within 18 inches of finished grade.

C. Masonry Waste Recycling: Return broken CMUs not used as fill to manufacturer for recycling.

D. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as
described above or recycled, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 042200
SECTION 044313.13 - ANCHORED STONE MASONRY VENEER

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. Stone masonry anchored to concrete backup.
   2. Cast stone masonry anchored to concrete backup.

B. Related Requirements:
   1. Section 033000 "Cast-In-Place Concrete"

1.3 ACTION SUBMITTALS

A. Product Data: For each variety of stone, cast stone, stone accessory, and manufactured product.

B. Samples for Initial Selection: For mortar.

C. Shop Drawings: Approval submittal shall include shop drawings of the seat wall and fire pit, illustrating the vertical faces of the seat wall with stone veneer, cast stone insert panel with lettering, and horizontal coping.

D. Samples for Verification:
   1. For each stone type indicated. Include at least two Samples in each set and show the full range of color and other visual characteristics in completed Work.
   2. For each cast stone type indicated. Include at least two Samples in each set and show the full range of color and other visual characteristics in completed Work.
   3. For each mortar required.

1.4 INFORMATIONAL SUBMITTALS

A. Material Test Reports:
   1. Stone Test Reports: For each stone variety proposed for use on Project, by a qualified testing agency.
1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs experienced stonemasons and stone fitters.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

B. Store aggregates where grading and other required characteristics can be maintained, and contamination avoided.

C. Deliver preblended, dry mortar mix in moisture-resistant containers designed for use with dispensing silos. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, in a dry location, or in covered weatherproof dispensing silos.

D. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.7 FIELD CONDITIONS

A. Protection of Stone Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day’s work. Cover partially completed stone masonry when construction is not in progress.

1. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.

B. Stain Prevention: Immediately remove mortar and soil to prevent them from staining stone masonry face.

1. Protect base of walls from rain-splashed mud and mortar splatter using coverings spread on the ground and over the wall surface.

2. Protect sills, ledges, and projections from mortar droppings.

C. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace stone masonry damaged by frost or freezing conditions. Comply with cold-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and above and will remain so until masonry has dried, but not less than seven days after completing cleaning.

1.8 COORDINATION

A. Advise installers of adjacent Work about specific requirements for placement of reinforcement, veneer anchors, flashing, and similar items to be built into stone masonry.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Stone: Obtain each variety of stone, regardless of finish, from single quarry, whether specified in this Section or in another Section of the Specifications, with resources to provide materials of consistent quality in appearance and physical properties.

B. Source Limitations for Cast Stone: Obtain each variety of cast stone, regardless of finish, from single source, whether specified in this Section or in another Section of the Specifications, with resources to provide materials of consistent quality in appearance and physical properties.

C. Source Limitations for Mortar Materials: Obtain mortar ingredients of uniform quality for each cementitious component from single manufacturer and each aggregate from single source or producer.

2.2 LIMESTONE

A. Material Standard: Comply with ASTM C568/C568M.

B. Description: Dimensional, snapped limestone, buff/white

C. Match Landscape Architect's samples for color, finish, and other stone characteristics relating to aesthetic effects.

2.3 CAST STONE

A. General: Provide shapes as indicated and as follows, with exposed surfaces matching finish and color of exposed faces of adjacent units:

B. Cast Stone: Fabricated cast stone coping for seat wall and fire pit. complying with ASTM C1364.
   1. Coping: White, Buff color; fine grain texture
   2. Cast Stone Inset Panel with Lettering: White, Buff color, fine grain texture, paint inside letterings with latex paint, charcoal gray color. Lettering to be 6” high, Calibri font or equivalent.

C. Compressive Strength: comply with ASTM C1194: 6,500 psi minimum for products at 28 days.

D. Absorption: comply with ASTM C1195, 6.0% maximum by cold water method.
2.4 MORTAR MATERIALS

A. Portland Cement: ASTM C150/C150M, Type I or Type II, except Type III may be used for cold-weather construction; natural color or white cement may be used as required to produce mortar color indicated.

B. Water: Potable.

2.5 VENEER ANCHORS

A. Materials:
   1. Stainless Steel Wire: ASTM A580/A580M.
   2. Dowels: ½ inch diameter, round bars from Type 304 stainless steel complying with ASTM A240.
   3. Anchors: L-Strap, Z-Strap, Split Tail; Stainless Steel, Type 304, ASTM A666, ATM A480.

2.6 MORTAR MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.

B. Mortar for Stone Masonry: Comply with ASTM C270.

2.7 JOINTS

A. Use a full bed of mortar for all joints. Leave all joints with exposed tops open to receive sealant.

B. Sealant: Elastomeric sealant or approved equal.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces indicated to receive stone masonry, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of stone masonry.

B. Examine substrate to verify that dovetail slots, inserts, reinforcement, veneer anchors, flashing, and other items installed in substrates and required for or extending into stone masonry are correctly installed.

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

A. Clean dirty or stained stone surfaces by removing soil, stains, and foreign materials before setting. Clean stone by thoroughly scrubbing with fiber brushes and then drenching with clear water. Use only mild cleaning compounds that contain no caustic or harsh materials or abrasives.

3.3 SETTING STONE MASONRY

A. Perform necessary field cutting and trimming as stone is set.

1. Use power saws to cut stone that is fabricated with saw-cut surfaces. Cut lines straight and true, with edges eased slightly to prevent snipping.

B. Sort stone before it is placed in wall to remove stone that does not comply with requirements relating to aesthetic effects, physical properties, or fabrication, or that is otherwise unsuitable for intended use.

C. Arrange stones with color and size variations uniformly dispersed for an evenly blended appearance.

D. Install supports, fasteners, and other attachments indicated or necessary to secure stone masonry in place.

E. Set stone accurately in locations indicated with edges and faces aligned according to established relationships and indicated tolerances.

F. Maintain uniform joint widths on veneer.

G. Place weep holes and vents in joints where moisture may accumulate, including at base of cavity walls, above shelf angles, and at flashing.

3.4 CONSTRUCTION TOLERANCES

A. Variation from Plumb: For vertical lines and surfaces, do not exceed 1/4 inch in 10 feet.

B. Variation from Level: For bed joints and lines of exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines, do not exceed 1/4 inch in 20 feet or more.

3.5 INSTALLATION OF ANCHORED STONE MASONRY

A. Anchor stone masonry to concrete with veneer anchors unless otherwise indicated.

3.6 ADJUSTING AND CLEANING

A. Remove and replace stone masonry of the following description:

1. Broken, chipped, stained, or otherwise damaged stone.
2. Defective joints.
3. Stone masonry not matching approved samples.
4. Stone masonry not complying with other requirements indicated.

B. Replace in a manner that results in stone masonry matching approved samples and mockups, complying with other requirements, and showing no evidence of replacement.

C. In-Progress Cleaning: Clean stone masonry as work progresses. Remove mortar fins and smears before tooling joints.

D. Final Cleaning: After mortar is thoroughly set and cured, clean stone masonry as follows:
   1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
   2. Protect adjacent stone and non-masonry surfaces from contact with cleaner by covering them with liquid strippable masking agent, polyethylene film, or waterproof masking tape.
   3. Wet wall surfaces with water before applying cleaner; remove cleaner promptly by rinsing thoroughly with clear water.
   4. Clean limestone masonry to comply with recommendations in ILI's "Indiana Limestone Handbook."

END OF SECTION 044313.13
SECTION 051200 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Structural steel.
2. Grout.

1.2 DEFINITIONS

A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
B. Shop Drawings: Show fabrication of structural-steel components.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.
B. Welding certificates.
C. Mill test reports for structural steel, including chemical and physical properties.
D. Source quality-control reports.
E. Field quality-control and special inspection reports.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category STD.
B. Installer Qualifications: A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category CSE.
C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
D. Comply with applicable provisions of the following specifications and documents:

1. AISC 303.
2. AISC 360.
3. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

PART 2 - PRODUCTS

2.1 STRUCTURAL-STEEL MATERIALS

A. W-Shapes: ASTM A 992/A 992M.
B. Channels, Angles: ASTM A 36/A 36M.
C. Plate and Bar: ASTM A 36/A 36M.
D. Cold-Formed Hollow Structural Sections: ASTM A 500/A 500M, Grade C, structural tubing.
E. Steel Pipe: ASTM A 53/A 53M, Type E or Type S, Grade B.
F. Welding Electrodes: Comply with AWS requirements.

2.2 BOLTS, CONNECTORS, AND ANCHORS

A. Zinc-Coated High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade DH heavy-hex carbon-steel nuts; and ASTM F 436, Type 1, hardened carbon-steel washers.

1. Finish: Hot-dip or mechanically deposited zinc coating.
2. Direct-Tension Indicators: ASTM F 959, Type 325, compressible-washer type with mechanically deposited zinc coating finish.

B. Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1/D1.1M, Type B.

C. Unheaded Anchor Rods: ASTM F 1554, Grade 36.


D. Headed Anchor Rods: ASTM F 1554, Grade 36, straight.


E. Threaded Rods: ASTM A 36/A 36M.

2.3 PRIMER

A. Primer: Comply with Section 099600 "High-Performance Coatings."

B. Primer: SSPC-Paint 25, **Type I**, zinc oxide, alkyd, linseed oil primer.

C. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.

2.4 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107/C 1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.5 FABRICATION


B. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.

2.6 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

   1. Joint Type: Snug tightened.

B. Weld Connections: Comply with AWS D1.1/D1.1M and AWS D1.8/D1.8M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

2.7 SHOP PRIMING

A. Shop prime steel surfaces except the following:

   1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
   2. Surfaces to be field welded.
   4. Surfaces to receive sprayed fire-resistant materials (applied fireproofing).
   5. Galvanized surfaces.
B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:

1. SSPC-SP 2, "Hand Tool Cleaning."
2. SSPC-SP 3, "Power Tool Cleaning."
3. SSPC-SP 7/NACE No. 4, "Brush-off Blast Cleaning."

C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

2.8 SOURCE QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform shop tests and inspections.

1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.

B. Bolted Connections: Inspect and test shop-bolted connections according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

C. Welded Connections: Visually inspect shop-welded connections according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:

1. Liquid Penetrant Inspection: ASTM E 165.
2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
4. Radiographic Inspection: ASTM E 94.

D. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify, with certified steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.

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

3.2 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.

1. Set plates for structural members on wedges, shims, or setting nuts as required.
2. Weld plate washers to top of baseplate.
3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
4. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

C. Maintain erection tolerances of structural steel within AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

3.3 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

1. Joint Type: Snug tightened.

B. Weld Connections: Comply with AWS D1.1/D1.1M and AWS D1.8/D1.8M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
2. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.

3.4 FIELD QUALITY CONTROL

A. Special Inspections: Engage a qualified special inspector to perform the following special inspections:

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

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

C. Bolted Connections: Inspect and test bolted connections according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
D. Welded Connections: Visually inspect field welds according to AWS D1.1/D1.1M.

1. In addition to visual inspection, test and inspect field welds according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:

   a. Liquid Penetrant Inspection: ASTM E 165.
   b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
   c. Ultrasonic Inspection: ASTM E 164.
   d. Radiographic Inspection: ASTM E 94.

END OF SECTION 051200
SECTION 053100 - STEEL DECKING

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. Cellular roof deck
      2. Composite floor deck.
   B. Related Requirements:
      1. Section 033000 "Cast-in-Place Concrete" for normal-weight and lightweight structural concrete fill over steel deck.
      2. Section 051200 "Structural Steel Framing" for shop- and field-welded shear and moment connectors.
      3. Section 099600 "High-Performance Coatings" for repair painting of primed deck and finish painting of deck.

1.3 ACTION SUBMITTALS
   A. Product Data: For each type of deck, accessory, and product indicated.
   B. Shop Drawings:
      1. Include layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

1.4 INFORMATIONAL SUBMITTALS
   A. Welding certificates.
   B. Product Certificates: For each type of steel deck.
   C. Product Test Reports: For tests performed by a qualified testing agency, indicating that each of the following complies with requirements:
      1. Power-actuated mechanical fasteners.
   D. Evaluation Reports: For steel deck, from ICC-ES.
E. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.


C. Electrical Raceway Units: Provide UL-labeled cellular floor-deck units complying with UL 209 and listed in UL's "Electrical Construction Equipment Directory" for use with standard header ducts and outlets for electrical distribution systems.


1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

1. Protect and ventilate acoustical cellular roof deck with factory-installed insulation to maintain insulation free of moisture.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."

2.2 ROOF DECK

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Canam United States; Canam Group Inc.
2. Epic Metals Corporation
3. Nucor Corp.
B. Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 31, and with the following:

1. Prime-Painted Steel Sheet: ASTM A 1008/A 1008M, Structural Steel (SS), Grade 33 (230) minimum, shop primed with manufacturer's standard baked-on, rust-inhibitive primer.
   a. Color: Manufacturer's standard

2. Galvanized-Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33, G90 zinc coating.
3. Deck Profile: As indicated.
5. Span Condition: Simple span.
6. Side Laps: Overlapped

2.3 COMPOSITE FLOOR DECK

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Canam United States; Canam Group Inc.
2. Epic Metals Corporation
3. Nucor Corp.

B. Composite Floor Deck: Fabricate panels, with integrally embossed or raised pattern ribs and interlocking side laps, to comply with "SDI Specifications and Commentary for Composite Steel Floor Deck," in SDI Publication No. 31, with the minimum section properties indicated, and with the following:

1. Prime-Painted Steel Sheet: ASTM A 1008/A 1008M, Structural Steel (SS), Grade 33 minimum, with top surface phosphatized and unpainted and underside surface shop primed with manufacturers' standard gray baked-on, rust-inhibitive primer.
2. Galvanized-Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33, G90 zinc coating.
3. Profile Depth: As indicated.

2.4 ACCESSORIES

A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.

B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.
C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.

D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.

E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi, not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.

F. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 33,000 psi, of same material and finish as deck, and of thickness and profile recommended by SDI Publication No. 31 for overhang and slab depth.

G. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck unless otherwise indicated.

H. Weld Washers: Uncoated steel sheet, shaped to fit deck rib, 0.0598 inch and 0.0747 inch thick, with factory-punched hole of 3/8-inch minimum diameter.

I. Flat Sump Plates: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck. For drains, cut holes in the field.

J. Recessed Sump Pans: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck, with 3-inch-wide flanges and level recessed pans of 1-1/2-inch minimum depth. For drains, cut holes in the field.

K. Galvanizing Repair Paint: ASTM A 780/A 780M.

L. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

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

3.2 INSTALLATION, GENERAL

A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 31, manufacturer's written instructions, and requirements in this Section.

B. Install temporary shoring before placing deck panels if required to meet deflection limitations.

C. Locate deck bundles to prevent overloading of supporting members.
D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.

1. Align cellular deck panels over full length of cell runs and align cells at ends of abutting panels.

E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.

F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.

G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.

H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

I. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

3.3 ROOF-DECK INSTALLATION

A. Fasten roof-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter that is not less than 1-1/2 inches long, and as follows:

2. Weld Spacing: Weld edge and interior ribs of deck units with a minimum of two welds per deck unit at each support. Space welds as indicated.
3. Weld Washers: Install weld washers at each weld location.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of one-half of the span or 18 inches], and as follows:

1. Fasten with a minimum of 1-1/2-inch- (38-mm-) long welds.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:

1. End Joints: Lapped 2 inches minimum.

D. Roof Sump Pans and Sump Plates: Install over openings provided in roof deck and mechanically fasten flanges to top of deck. Space mechanical fasteners not more than 12 inches apart with at least one fastener at each corner.

1. Install reinforcing channels or zees in ribs to span between supports and weld or mechanically fasten.
E. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. Weld or mechanically fasten to substrate to provide a complete deck installation.

1. Weld cover plates at changes in direction of roof-deck panels unless otherwise indicated.

F. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive according to manufacturer's written instructions to ensure complete closure.

3.4 FLOOR-DECK INSTALLATION

A. Fasten floor-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated and as follows:

2. Weld Spacing: Weld edge ribs of panels at each support. Space additional welds an average of 12 inches apart, but not more than 18 inches apart.
3. Weld Spacing: Space and locate welds as indicated.
4. Weld Washers: Install weld washers at each weld location.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of one-half of the span or 36 inches, and as follows:

1. Fasten with a minimum of 1-1/2-inch- (38-mm-) long welds.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:

1. End Joints: Lapped.

D. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure according to SDI recommendations unless otherwise indicated.

E. Floor-Deck Closures: Weld steel sheet column closures, cell closures, and Z-closures to deck, according to SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of deck.

3.5 FIELD QUALITY CONTROL

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

B. Field welds will be subject to inspection.

C. Prepare test and inspection reports.
3.6 PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780/A 780M and manufacturer's written instructions.

B. Repair Painting: Wire brush and clean rust spots, welds, and abraded areas on both surfaces of prime-painted deck immediately after installation and apply repair paint.

1. Apply repair paint, of same color as adjacent shop-primed deck, to bottom surfaces of deck exposed to view.
2. Wire brushing, cleaning, and repair painting of bottom deck surfaces are included in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

C. Repair Painting: Wire brushing, cleaning, and repair painting of rust spots, welds, and abraded areas of both deck surfaces are included in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

END OF SECTION 053100
SECTION 055213 - PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Steel pipe and tube railings.

1.2 ACTION SUBMITTALS

A. Product Data: For the following:
   1. Manufacturer’s product lines of mechanically connected railings.
   2. Railing brackets.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

C. Samples: For each type of exposed finish required.

1.3 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For pipe and tube railings, for tests performed by a qualified testing agency, according to ASTM E 894 and ASTM E 935.

PART 2 - PRODUCTS

2.1 STEEL AND IRON

A. Tubing: ASTM A 500 (cold formed).

B. Pipe: ASTM A 53/A 53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.
   1. Provide galvanized finish for exterior installations and where indicated.

C. Plates, Shapes, and Bars: ASTM A 36/A 36M.
2.2 PERFORMANCE REQUIREMENTS

A. Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Infill of Guards:
   a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft.
   b. Infill load and other loads need not be assumed to act concurrently.

2.3 FASTENERS

A. General: Provide the following:

1. Hot-Dip Galvanized Railings: Type 304 stainless-steel or hot-dip zinc-coated steel fasteners complying with ASTM A 153/A 153M or ASTM F 2329 for zinc coating.

B. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors capable of sustaining, without failure, a load equal to 6 times the load imposed when installed in unit masonry and 4 times the load imposed when installed in concrete, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.


2.4 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Etching Cleaner for Galvanized Metal: Complying with MPI#25.

C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

D. Shop Primers: Provide primers that comply with Section 099600 "High-Performance Coatings."

E. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.

F. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.

G. Epoxy Intermediate Coat: Complying with MPI #77 and compatible with primer and topcoat.

H. Epoxy Topcoat: Complying with MPI #77 and compatible with undercoat.

I. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.
2.5 FABRICATION

A. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

B. Form work true to line and level with accurate angles and surfaces.

C. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
   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 flux immediately.
   4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.

D. Welded Connections for Aluminum Pipe: Fabricate railings to interconnect members with concealed internal welds that eliminate surface grinding, using manufacturer's standard system of sleeve and socket fittings.

E. Nonwelded Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.

F. For changes in direction made by bending, use jigs to produce uniform curvature for each repetitive configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

G. Close exposed ends of railing members with prefabricated end fittings.

H. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated.

I. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.
   1. At brackets and fittings fastened to plaster or gypsum board partitions, provide crush-resistant fillers or other means to transfer loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.

2.6 STEEL AND IRON FINISHES

A. Galvanized Railings:
   1. Hot-dip galvanize exterior steel railings, including hardware, after fabrication.
   2. Comply with ASTM A 123/A 123M for hot-dip galvanized railings.

B. Preparing Galvanized Railings for Shop Priming: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with etching cleaner.
C. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with Section 099600 "High-Performance Coatings."

D. Primer Application: Apply shop primer to prepared surfaces of railings unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Shop, Field, and Maintenance Painting of Steel," for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.

1. Do not apply primer to galvanized surfaces.

E. High-Performance Coating: Apply epoxy intermediate and polyurethane topcoats to prime-coated surfaces. Comply with coating manufacturer's written instructions and with requirements in SSPC-PA 1, "Shop, Field, and Maintenance Painting of Steel," for shop painting. Apply at spreading rates recommended by coating manufacturer.


PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.

1. Do not weld, cut, or abrade surfaces of railing components that are coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
2. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.

B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1. Coat, with a heavy coat of bituminous paint, concealed surfaces of aluminum that are in contact with grout, concrete, masonry, wood, or dissimilar metals.

3.2 ANCHORING POSTS

A. Use metal sleeves preset and anchored into concrete for installing posts. After posts are inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions.

B. Form or core-drill holes not less than 5 inches deep and 3/4 inch larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions.
C. Anchor posts to metal surfaces with oval flanges, angle type, or floor type as required by conditions, connected to posts and to metal supporting members.

3.3 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 requirements for touching up shop-painted surfaces.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas, and repair galvanizing to comply with ASTM A 780/A 780M.

END OF SECTION 055213
SECTION 061053 - MISCELLANEOUS ROUGH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Wood blocking, cants, and nailers.
   2. Wood furring and grounds.

1.3 DEFINITIONS

A. Boards or Strips: Lumber of less than 2 inches nominal (38 mm actual) size in least dimension.

B. Dimension Lumber: Lumber of 2 inches nominal (38 mm actual) or greater size but less than 5 inches nominal (114 mm actual) size in least dimension.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
   1. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
   2. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D5664.
   3. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

1.5 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For the following, from ICC-ES:
   1. Fire-retardant-treated wood.
1.6 QUALITY ASSURANCE

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

1.7 DELIVERY, STORAGE, AND HANDLING

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

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.

B. Maximum Moisture Content of Lumber: 15 percent unless otherwise indicated.

2.2 FIRE-RETARDANT-TREATED MATERIALS

A. General: Where fire-retardant-treated materials are indicated, materials shall comply with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet (3.2 m) beyond the centerline of the burners at any time during the test.

1. Treatment shall not promote corrosion of metal fasteners.

2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D2898. Due to the small amount needed for Interior work, all material used for this project shall be Exterior type.
3. Design Value Adjustment Factors: Treated lumber shall be tested according to ASTM D5664, and design value adjustment factors shall be calculated according to ASTM D6841.

C. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent.

D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.

E. Application: Treat all miscellaneous carpentry unless otherwise indicated.

2.3 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

1. Blocking.
2. Nailers.
3. Rooftop equipment bases and support curbs.
5. Furring.

B. Dimension Lumber Items: Construction or No. 2 grade lumber of any of the following species:

1. Hem-fir (north); NLGA.
2. Mixed southern pine or southern pine; SPIB.
3. Spruce-pine-fir; NLGA.
4. Hem-fir; WCLIB or WWPA.
5. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.
6. Western woods; WCLIB or WWPA.
7. Northern species; NLGA.
8. Eastern softwoods; NeLMA.

C. Concealed Boards: 15 percent maximum moisture content of any of the following species and grades:

1. Mixed southern pine or southern pine, No. 2 grade; SPIB.
2. Eastern softwoods, No. 2 Common grade; NELMA.
3. Northern species, No. 2 Common grade; NLGA.
4. Western woods, Construction or No. 2 Common grade; WCLIB or WWPA.

D. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.
E. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

F. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.4 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

1. Where carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners of Type 304 stainless steel.

B. Nails, Brads, and Staples: ASTM F1667.

C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

D. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC58 or ICC-ES AC308 as appropriate for the substrate.


2.5 METAL FRAMING ANCHORS

A. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A653/A653M, G60 (Z180) coating designation.

1. Use for interior locations unless otherwise indicated.

B. Stainless-Steel Sheet: ASTM A666, Type 304 or better.

1. Use for exterior locations and where indicated.

2.6 MISCELLANEOUS MATERIALS

A. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch (0.6 mm).
PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

B. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry accurately to other construction. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.

C. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.

D. Do not splice structural members between supports unless otherwise indicated.

E. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.

1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches (406 mm) o.c.

F. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:

1. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than 96 inches (2438 mm) o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.

2. Fire block concealed spaces of wood-framed walls and partitions at each floor level, at ceiling line of top story, and at not more than 96 inches (2438 mm) o.c. Where fire blocking is not inherent in framing system used, provide closely fitted solid wood blocks of same width as framing members and 2-inch nominal (38-mm actual) thickness.

3. Fire block concealed spaces between floor sleepers with same material as sleepers to limit concealed spaces to not more than 100 sq. ft. (9.3 sq. m) and to solidly fill space below partitions.

G. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

H. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

1. Use inorganic boron for items that are continuously protected from liquid water.

2. Use copper naphthenate for items not continuously protected from liquid water.
I. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

J. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
   2. ICC-ES evaluation report for fastener.

K. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

3.2 WOOD BLOCKING AND NAILER INSTALLATION

A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

C. Provide permanent grounds of dressed, fire-retardant-treated, key-beveled lumber not less than 1-1/2 inches (38 mm) wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

3.3 WOOD FURRING INSTALLATION

A. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.

B. Furring to Receive Gypsum Board or Plaster Lath: Install 1-by-2-inch nominal- (19-by-38-mm actual-) size furring vertically at 16 inches (406 mm) o.c.

3.4 PROTECTION

A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

B. Protect miscellaneous rough carpentry from weather. If, despite protection, miscellaneous rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 061053
SECTION 061063 - EXTERIOR ROUGH CARPENTRY

PART 1 - GENERAL

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

1.2 SUMMARY
   A. Section Includes:
      1. Wood fences.
   B. Related Requirements:
      1. Section 033000 “Cast-In-Place Concrete”

1.3 DEFINITIONS
   A. Boards: Lumber of less than 2” nominal in thickness and 2” nominal or greater in width.
   B. Dimension Lumber: Lumber of 2” nominal or greater but less than 5” nominal in least
      dimension.
   C. Lumber grading agencies, and the abbreviations used to reference them, include the following:
      2. NLGA: National Lumber Grades Authority.
      3. WWPA: Western Wood Products Association.

1.4 ACTION SUBMITTALS
   A. Product Data: For each type of product

1.5 DELIVERY, STORAGE, AND HANDLING
   A. Store materials under cover and protected from weather and contact with damp or wet surfaces.
      Stack lumber flat with spacers between each bundle to provide air circulation.
PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Bidders are hereby informed that the wood stain specs were written as performance specs. Basis of design and alternate manufacturers are designated as follow:

1. Benches
   a. Basis of Design: Sikkens – Cetol Semi-Transparent SRD color range
   b. Alternate: Sherwin Williams – SuperDeck Log Home & Deck Stain color range
   c. Alternate: Benjamin Moore – Arborcoat Stain – Semi Transparent color range

2.2 LUMBER, GENERAL

A. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by American Lumber Standard Committee (ALSC) Board of Review.

1. Factory mark each item with grade stamp of grading agency.
2. For items that are exposed to view in the completed Work, mark grade stamp on end or back of each piece.
3. Provide dressed lumber, S4S, unless otherwise indicated.

B. Maximum Moisture Content:

1. Boards: 15 percent.
2. Dimension Lumber: 15 percent for 2-inch nominal thickness or less; 19 percent for more than 2-inch nominal thickness.

2.3 LUMBER

A. Hand select wood for freedom from characteristics, on exposed surfaces and edges, that would impair finish appearance, including decay, honeycomb, knot holes, shake, splits, and torn grain.

B. Dimension Lumber: No. 2 grade minimum; Western Red Cedar.

C. Boards:
   1. No. 2 grade minimum; Western red cedar

2.4 POSTS

A. Dimension Lumber Posts: Construction grade and the following species:

1. Western red cedar.
2.5 POST ANCHORS

A. Galvanized steel anchors adhered to anchor bolt imbedded in concrete footing or adhered to concrete footing through drive pin anchors. Final finish to be black, acrylic paint.

2.6 FASTENERS

A. General: Provide fasteners of size and type indicated and that comply with requirements specified in this article for material and manufacture. Provide nails or screws, in sufficient length, to penetrate not less than 1-1/2 inches into wood substrate.

1. Use fasteners with hot-dip zinc coating complying with ASTM A153/A153M or ASTM F2329 unless otherwise indicated.

B. Nails: ASTM F1667.

C. Power-Driven Fasteners: ICC-ES AC70.


E. Finish: All fasteners to be painted with black, acrylic paint for final finish.

2.7 EXTERIOR PAINTING SCHEDULE

A. Wood Substrates: Apply finish.

1. Stain Type: Semi-Transparent

2. Finish: Matte

3. Description: One coat non-film forming semi-transparent wood stain, water based

4. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products List."

5. Material Compatibility:

a. 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.

6. Water-Based Semitransparent Stain System MPI EXT 6.3N:


b. Topcoat: Stain, exterior, water based, semitransparent, MPI #156.
PART 3 - EXECUTION

3.1 PREPARATION

A. Refer to line 3.3 of this section for Paint on Wood Fence in Northeast corner of East Courtyard.
   1. Assemble panels of rails and pailings off site. Sand smooth, front facing side and edges of pailings. Use a minimum, 180 grit sanding paper for fine finish of the cedar pailings.

3.2 INSTALLATION, GENERAL

A. Set work to required levels and lines, with members plumb, true to line, cut, and fitted. Fit work to other construction; scribe and cope as needed for accurate fit.

B. Install metal framing anchors to comply with manufacturer's written instructions.

C. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of members or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

D. Use common wire nails unless otherwise indicated. Select fasteners of size that do not fully penetrate members where opposite side is exposed to view.

END OF SECTION 061063
SECTION 072413 - POLYMER-BASED EXTERIOR INSULATION AND FINISH SYSTEM (EIFS)

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. EIFS-clad barrier-wall assemblies that are field applied over substrate which are small (10 sq ft maximum) infill patches in existing facades.

1.3 DEFINITIONS

Retain terms that remain after this Section has been edited for a project.

A. Definitions in ASTM E2110 apply to Work of this Section.

B. EIFS: Exterior insulation and finish system(s).


D. Polymer-Based Exterior Insulation and Finish System: Class PB EIFS, as defined in ASTM E2568.

1.4 PREINSTALLATION MEETINGS

Retain "Preinstallation Conference" Paragraph below if Work of this Section is extensive or complex enough to justify a conference.

A. Preinstallation Conference: Conduct conference at Project site.

If needed, insert list of conference participants not mentioned in Section 013100 "Project Management and Coordination."

1.5 ACTION SUBMITTALS

A. Product Data: For each EIFS component, trim, and accessory.

B. Samples: For each exposed product and for each color and texture specified, 8 inches (200 mm) square in size.
1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Manufacturer Certificates: Signed by EIFS manufacturer, certifying the following:
   1. EIFS substrate is acceptable to EIFS manufacturer.
   2. Accessory products installed with EIFS, including joint sealants, flashing, water-resistant barriers, whether or not furnished by EIFS manufacturer and whether or not specified in this Section, are acceptable to EIFS manufacturer.

C. Product Certificates: For cementitious materials and aggregates and for insulation, from manufacturer.

D. Product Test Reports: For each EIFS assembly and component, for tests performed by a qualified testing agency.

E. Field quality-control reports.

F. Sample Warranty: For manufacturer's special warranty.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For EIFS to include in maintenance manuals.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: An installer who is certified in writing by AWCI International as qualified to install Class PB EIFS using trained workers.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original, unopened packages with manufacturers' labels intact and clearly identifying products.

B. Store materials inside and under cover; keep them dry and protected from weather, direct sunlight, surface contamination, aging, corrosion, damaging temperatures, construction traffic, and other causes.
   1. Stack insulation board flat and off the ground.
   2. Protect plastic insulation against ignition at all times. Do not deliver plastic insulating materials to Project site before installation time.
   3. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.
1.10 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions and ambient outdoor air, humidity, and substrate temperatures permit EIFS to be applied, dried, and cured according to manufacturers' written instructions and warranty requirements.

1. Proceed with installation of adhesives or coatings only when ambient temperatures have remained, or are forecast to remain, above 40 deg F (4.4 deg C) for a minimum of 24 hours before, during, and after application. Do not apply EIFS adhesives or coatings during rainfall.

1.11 WARRANTY

A. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace components of EIFS that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Bond integrity and weathertightness.

b. Deterioration of EIFS finishes and other EIFS materials beyond normal weathering.

2. Warranty coverage includes the following EIFS components:

a. EIFS finish, including base coats, finish coats, and reinforcing mesh.

b. Insulation installed as part of EIFS.

c. Insulation adhesive.

d. EIFS accessories, including trim components and flashing.

Verify available warranties and warranty periods for EIFS.

3. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Acrocrete; BASF Corp.

2. BASF Corporation.

3. Corev America, Inc.

4. Dryvit Systems, Inc.

5. Finestone; BASF Corp.

6. H.B. Fuller Construction Products Inc. / TEC.

7. Master Wall Inc.
8. Omega Products International, Inc.
9. Parex USA, Inc.
10. Pleko LLC.
11. Senergy; BASF Corp.
12. Sto Corp.
14. Or Approved Equal

B. Source Limitations: Obtain EIFS from single source from single EIFS manufacturer and from sources approved by EIFS manufacturer as tested and compatible with EIFS components.

2.2 PERFORMANCE REQUIREMENTS

A. EIFS Performance: Comply with ASTM E2568 and with the following:
   1. Weathertightness: Resistant to water penetration from exterior.

2.3 EIFS MATERIALS

A. Flexible-Membrane Flashing: Cold-applied, self-adhering, self-healing, rubberized-asphalt and polyethylene-film composite sheet or tape and primer; EIFS manufacturer's standard or product recommended in writing by EIFS manufacturer.

B. Insulation Adhesive: EIFS manufacturer's standard formulation designed for indicated use; compatible with substrate and complying with one of the following:
   2. Factory-blended dry formulation of portland cement, dry polymer admixture, and fillers specified for base coat.

C. Molded, (Expanded) Rigid Cellular Polystyrene Board Insulation: Comply with ASTM E2430/E2430M, unless otherwise noted, and the following:
   1. Flame-Spread and Smoke-Developed Indexes: 25 and 450 or less, respectively, according to ASTM E84.
   2. Dimensions: Provide insulation boards of not more than 24 by 48 inches (610 by 1219 mm), with thickness indicated on Drawings.

D. Reinforcing Mesh: Balanced, alkali-resistant, open-weave, glass-fiber mesh treated for compatibility with other EIFS materials, made from continuous multi-end strands with retained mesh tensile strength of not less than 120 lbf/in. (21 dN/cm) according to ASTM E2098/E2098M and the following:
   1. Reinforcing Mesh for EIFS, General: Not less than weight required to comply with impact-performance level specified in "Performance Requirements" Article.
   2. Strip-Reinforcing Mesh: As recommended by EIFS manufacturer.
3. Detail-Reinforcing Mesh: As recommended by EIFS manufacturer.
4. Corner-Reinforcing Mesh: As recommended by EIFS manufacturer.

E. Base Coat: EIFS manufacturer's standard mixture complying with one of the following:

1. Job-mixed formulation of portland cement complying with ASTM C150/C150M, Type I, white or natural color; and manufacturer's standard polymer-emulsion adhesive designed for use with portland cement.
2. Job-combined formulation of manufacturer's standard polymer-emulsion adhesive and manufacturer's standard dry mix containing portland cement.
3. Factory-blended dry formulation of portland cement, dry polymer admixture, and inert fillers to which only water is added at Project site.

F. Finish Coat: EIFS manufacturer's standard acrylic-based coating complying with the following:

1. Factory-mixed formulation of polymer-emulsion binder, colorfast mineral pigments, sound stone particles, and fillers.
   a. Aggregate: Marble chips of size and color as selected by Architect from manufacturer's full range of industry colors and color densities.
2. Colors: As selected by Architect from manufacturer's full range.
3. Textures: As selected by Architect from manufacturer's full range.

G. Water: Potable.

H. Trim Accessories: Type as designated or required to suit conditions indicated and to comply with EIFS manufacturer's written instructions; manufactured from UV-stabilized PVC; and complying with ASTM D1784 and ASTM C1063.

1. Casing Bead: Prefabricated, one-piece type for attachment behind insulation, of depth required to suit thickness of coating and insulation, with face leg perforated for bonding to coating and back leg.
2. Drip Screed/Track: Prefabricated, one-piece type for attachment behind insulation, with face leg extended to form a drip, of depth required to suit thickness of coating and insulation, with face leg perforated for bonding to coating and back leg.
3. Expansion Joint: Closed-cell polyethylene backer rod and elastomeric sealant, 3/4-inch (19-mm) minimum.
4. Windowsill Flashing: Prefabricated type for both flashing and sloping sill over framing beneath windows; with end and back dams; designed to direct water to exterior.
5. Parapet Cap Flashing: Type for both flashing and covering parapet top, with design complying with ASTM C1397.

2.4 MIXING

A. Comply with EIFS manufacturer's requirements for combining and mixing materials. Do not introduce admixtures, water, or other materials, except as recommended by EIFS manufacturer. Mix materials in clean containers. Use materials within time period specified by EIFS manufacturer or discard.
PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roof edges, wall framing, flashings, openings, substrates, and junctures at other construction for suitable conditions where EIFS will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.
   1. Begin coating application only after surfaces are dry.
   2. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Protect contiguous work from moisture deterioration and soiling caused by application of EIFS. Provide temporary covering and other protection needed to prevent spattering of exterior finish coats on other work.

B. Protect EIFS, substrates, and wall construction behind them from inclement weather during installation. Prevent penetration of moisture behind EIFS and deterioration of substrates.

C. Prepare and clean substrates to comply with EIFS manufacturer's written instructions to obtain optimum bond between substrate and adhesive for insulation.

3.3 EIFS INSTALLATION, GENERAL

A. Comply with ASTM C1397, ASTM E2511, and EIFS manufacturer's written instructions for installation of EIFS as applicable to each type of substrate.

3.4 SUBSTRATE PROTECTION APPLICATION

A. Flexible-Membrane Flashing: Apply and lap to shed water; seal at openings, penetrations, and terminations. Prime substrates with flashing primer if required and install flashing.

3.5 TRIM INSTALLATION

A. Trim: Apply trim accessories at perimeter of EIFS, at expansion joints and elsewhere as indicated. Coordinate with installation of insulation.
   1. Drip Screed/Track: Use at bottom edges of EIFS unless otherwise indicated.
   2. Window sill Flashing: Use at windows unless otherwise indicated.
   3. Expansion Joint: Use where indicated on Drawings.
   4. Casing Bead: Use at other locations.
3.6 INSULATION INSTALLATION

A. Board Insulation: Adhesively attach insulation to substrate in compliance with ASTM C1397 and the following:

1. Sheathing: Apply adhesive to insulation by notched-trowel method in a manner that results in coating the entire surface of sheathing with adhesive once insulation is adhered to substrate. Apply adhesive to a thickness of not less than 1/4 inch (6.4 mm) for factory mixed and not less than 3/8 inch (10 mm) for field mixed, measured from surface of insulation before placement.

2. Press and slide insulation into place. Apply pressure over entire surface of insulation to accomplish uniform contact, high initial grab, and overall level surface.

3. Allow adhered insulation to remain undisturbed for not less than 24 hours, before beginning rasping and sanding insulation or before applying base coat and reinforcing mesh.

4. Begin first course of insulation from a level base line and work upward.

5. Stagger vertical joints of insulation boards in successive courses to produce running bond pattern. Locate joints, so no piece of insulation is less than 12 inches (300 mm) wide or 6 inches (150 mm) high. Offset joints not less than 6 inches (150 mm) from corners of window and door openings and not less than 4 inches (100 mm) from aesthetic reveals.

a. Adhesive Attachment: Offset joints of insulation not less than 6 inches (150 mm) from horizontal and 4 inches (100 mm) from vertical joints in sheathing.

6. Interlock ends at internal and external corners.

7. Abut insulation tightly at joints within and between each course to produce flush, continuously even surfaces without gaps or raised edges between boards. If gaps greater than 1/16 inch (1.6 mm) occur, fill with insulation cut to fit gaps exactly; insert insulation without using adhesive or other material.

8. Cut insulation to fit openings, corners, and projections precisely and to produce edges and shapes complying with details indicated.

9. Rasp or sand flush entire surface of insulation to remove irregularities projecting more than 1/16 inch (1.6 mm) from surface of insulation and to remove yellowed areas due to sun exposure; do not create depressions deeper than 1/16 inch (1.6 mm). Prevent airborne dispersal and immediately collect insulation raspings or sandings.

10. Cut aesthetic reveals in outside face of insulation with high-speed router and bit configured to produce grooves, rabbets, and other features that comply with profiles and locations indicated. Do not reduce insulation thickness at aesthetic reveals to less than 3/4 inch (19 mm).

11. Interrupt insulation for expansion joints where indicated.

12. Form joints for sealant application by leaving gaps between adjoining insulation edges and between insulation edges and dissimilar adjoining surfaces. Make gaps wide enough to produce joint widths indicated after encapsulating joint substrates with base coat and reinforcing mesh.

13. Before installing insulation and before applying field-applied reinforcing mesh, fully wrap board edges. Cover edges of board and extend encapsulating mesh not less than 2-1/2 inches (64 mm) over front and back face unless otherwise indicated on Drawings.

14. Treat exposed edges of insulation as follows:
a. Except for edges forming substrates of sealant joints, encapsulate with base coat, reinforcing mesh, and finish coat.

b. Encapsulate edges forming substrates of sealant joints within EIFS or between EIFS and other work with base coat and reinforcing mesh.

15. Coordinate installation of flashing and insulation to produce wall assembly that does not allow water to penetrate behind flashing and EIFS lamina.

B. Expansion Joints: Install at locations indicated, where required by EIFS manufacturer, and as follows:

1. At expansion joints in substrates behind EIFS.
2. Where EIFS adjoin dissimilar substrates, materials, and construction, including other EIFS.
3. Where wall height or building shape changes.
4. Where EIFS manufacturer requires joints in long continuous elevations.

3.7 BASE-COAT APPLICATION

A. Base Coat: Apply full coverage to exposed insulation with not less than 1/16-inch (1.6-mm) dry-coat thickness.

B. Reinforcing Mesh: Embed reinforcing mesh in wet base coat to produce wrinkle-free installation with mesh continuous at corners, overlapped not less than 2-1/2 inches (64 mm) or otherwise treated at joints to comply with ASTM C1397. Do not lap reinforcing mesh within 8 inches (200 mm) of corners. Completely embed mesh, applying additional base-coat material if necessary, so reinforcing-mesh color and pattern are invisible.

C. Additional Reinforcing Mesh: Apply strip-reinforcing mesh around openings, extending 4 inches (100 mm) beyond perimeter. Apply additional 9-by-12-inch (230-by-300-mm) strip-reinforcing mesh diagonally at corners of openings (re-entrant corners). Apply 8-inch- (200-mm-) wide, strip-reinforcing mesh at both inside and outside corners unless base layer of mesh is lapped not less than 4 inches (100 mm) on each side of corners.

1. At aesthetic reveals, apply strip-reinforcing mesh not less than 8 inches (200 mm) wide.
2. Embed strip-reinforcing mesh in base coat before applying first layer of reinforcing mesh.

3.8 FINISH-COAT APPLICATION

A. Finish Coat: Apply full-thickness coverage over dry base coat, maintaining a wet edge at all times for uniform appearance, to produce a uniform finish of color and texture matching approved sample and free of cold joints, shadow lines, and texture variations.

1. Embed aggregate in finish coat to produce a uniform applied-aggregate finish of color and texture matching approved sample.
3.9 FIELD QUALITY CONTROL

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

1. As stipulated in Ch. 17 of the IBC.

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

C. EIFS Tests and Inspections: According to ASTM E2568 <Insert tests and inspections>.

D. EIFS will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.10 CLEANING AND PROTECTION

A. Remove temporary covering and protection of other work. Promptly remove coating materials from window and door frames and other surfaces outside areas indicated to receive EIFS coatings.

END OF SECTION 072413
SECTION 075423 - THERMOPLASTIC-POLYOLEFIN (TPO) ROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Adhered thermoplastic polyolefin (TPO) roofing system.
2. Substrate board.
3. Roof insulation.
4. Cover board.

B. Related Requirements:

1. Section 061053 "Miscellaneous Rough Carpentry" for wood nailers, curbs, and blocking
2. Section 077100 "Roof Specialties" for roof edge flashings.

1.3 DEFINITIONS


1.4 PREINSTALLATION MEETINGS

A. Preliminary Roofing Conference: Conduct conference at Project site no earlier than two weeks before the start of the roof work. This conference shall not be scheduled until all submittals have been received and approved by the project Architect.

1. Meet with Owner, Architect, roofing Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
3. Review deck substrate requirements for conditions and finishes, including flatness and fastening.
4. Review structural loading limitations of roof deck during and after roofing.
5. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.
6. Review governing regulations and requirements for insurance and certificates if applicable.
7. Review temporary protection requirements for roofing system during and after installation.
8. Review roof observation and repair procedures after roofing installation.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. For insulation and roof system component fasteners, include copy of FM Approvals' RoofNav listing.

B. Schedule: Submit a complete schedule of all proposed work with a phasing plan indicating sequence of removal and replacement of roof. Show phasing on a roof plan defining each day’s proposed work.

C. Shop Drawings: All details shall be manufacturer approved and project specific. Include roof plans, sections, details, and attachments to other work, including the following:
   1. Layout and thickness of insulation.
   2. Base flashings and membrane termination details.
   3. Flashing details at penetrations.
   4. Tapered insulation layout, thickness, and slopes.
   5. Roof plan showing orientation of steel roof deck and orientation of roof membrane, fastening spacings, and patterns for mechanically fastened roofing system.
   6. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.
   7. Tie-in with adjoining air barrier.
   8. Night Seal or Cut-off flashing to be used at end of each day’s work, if applicable.

D. Samples for Verification: For the following products:
   1. Roof membrane and flashings, of color required.

E. Wind Uplift Resistance Submittal: For roofing system, indicating compliance with wind uplift performance requirements.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer, manufacturer, and testing agency.

B. Manufacturer Certificates:
      a. Submit evidence of compliance with performance requirements.
   2. Special Warranty Certificate: Signed by roof membrane manufacturer, certifying that all materials supplied under this Section are acceptable for special warranty.
C. Product Test Reports: For roof membrane and insulation, for tests performed by a qualified testing agency, indicating compliance with specified requirements.

D. Evaluation Reports: For components of roofing system, from ICC-ES.

E. Field Test Reports:
   1. Fastener-pullout test results and manufacturer's revised requirements for fastener patterns.

F. Field quality-control reports.

G. Sample Warranties: For manufacturer's special warranties.

1.7 CLOSEOUT SUBMITTALS

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

1.8 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that is listed in FM Approvals' RoofNav for roofing system identical to that used for this Project.

B. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.

B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.

   1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.

C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

D. Handle and store roofing materials, and place equipment in a manner to avoid permanent deflection of deck.
1.10 FIELD CONDITIONS

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

1.11 WARRANTY

A. Binding Arbitration Prohibition: The state of Missouri is prohibited from entering into binding arbitration. No warranty shall be accepted with any arbitration clause.

B. Special Warranty: Manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period.

1. The roofing manufacturer shall provide written confirmation, submitted with shop drawings, that: “All roofing components exclusive of the steel deck, contained in the system proposed are approved, and compatible with the warranty requirements of the roof system as specified, and that the warranty specified will be issued at completion of project if system is installed as designed.”

2. Special warranty includes roof membrane, base flashings, roof insulation, fasteners, cover boards, and other components of roofing system.

3. Warranty Period: 20 years from date of Substantial Completion.

4. Warranty shall be executed by both the system manufacturer and the roofing contractor.

C. Special Project Warranty: Submit roofing Installer's warranty, on warranty form at end of this Section, signed by Installer, covering the Work of this Section, including all components of roofing system such as roof membrane, base flashing, roof insulation, fasteners, cover boards, for the following warranty period:

1. Warranty Period: Two years from date of Substantial Completion.

D. Special Warranty Language: The liability of the Surety under the installer warranty provisions of this contract is limited to correcting defective workmanship and materials for a period of two years from the Substantial Completion date of the project. Any warranty beyond this two years is an agreement between the Owner and Contractor and falls outside the performance bond obligation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Installed roofing system and flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roof system and flashings shall remain watertight.
1. Accelerated Weathering: Roof membrane shall withstand 2000 hours of exposure when tested according to ASTM G152, ASTM G154, or ASTM G155.
2. Impact Resistance: Roof membrane shall resist impact damage when tested according to ASTM D3746, ASTM D4272, or the "Resistance to Foot Traffic Test" in FM Approvals 4470.

B. Material Compatibility: Roofing materials shall be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roof membrane manufacturer based on testing and field experience.

C. Wind Uplift Resistance: Design roofing system to resist the following wind uplift pressures when tested according to FM Approvals 4474, UL 580, or UL 1897:

1. Zone 1 (Roof Area Field): 46.48 psf.
2. Zone 2 (Roof Area Perimeter): 70.94 psf.
   a. Location: From roof edge to 3'-0” inside roof edge.
3. Zone 3 (Roof Area Corners): 92.95 psf.
   a. Location: 3’-0” x 3’-0” in each direction from each building corner.

D. FM Approvals' RoofNav Listing: Roof membrane, base flashings, and component materials shall comply with requirements in FM Approvals 4450 or FM Approvals 4470 as part of a roofing system, and shall be listed in FM Approvals' RoofNav for Class 1 or noncombustible construction, as applicable. Identify materials with FM Approvals Certification markings.

1. Fire/Windstorm Classification: Class 1A-90.
2. Hail-Resistance Rating: SH.

E. Exterior Fire-Test Exposure: ASTM E108 or UL 790, Class A; for application and roof slopes indicated; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

2.2 THERMOPLASTIC POLYOLEFIN (TPO) ROOFING


1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Carlisle SynTec Incorporated.
   b. Firestone Building Products.
   c. GAF.
   d. GenFlex Roofing Systems.
   e. Johns Manville; a Berkshire Hathaway company.
   f. Mule-Hide Products Co., Inc.
   g. Versico
   h. Or Approved Equal
2. Source Limitations: Obtain components for roofing system from manufacturers approved by roof membrane manufacturer.
3. Thickness: 60 mils (1.5 mm), nominal.
4. Exposed Face Color: Gray.

2.3 AUXILIARY ROOFING MATERIALS

A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with other roofing components.
   1. Adhesive and Sealants: Comply with VOC limits of authorities having jurisdiction.

B. Sheet Flashing: Manufacturer's standard unreinforced TPO sheet flashing, 55 mils (1.4 mm) thick, minimum, of same color as TPO sheet.

C. Prefabricated Pipe Flashings: As recommended by roof membrane manufacturer.

D. Roof Vents: As recommended by roof membrane manufacturer.
   1. Size: Not less than 4-inch (100-mm) diameter.

E. Bonding Adhesive: Manufacturer's standard, water based.

F. Slip Sheet: Manufacturer's standard, of thickness required for application.

G. Metal Termination Bars: Manufacturer's standard, predrilled stainless steel or aluminum bars, approximately 1 by 1/8 inch (25 by 3 mm) thick; with anchors.

H. Metal Battens: Manufacturer's standard, aluminum-zinc-alloy-coated or zinc-coated steel sheet, approximately 1 inch wide by 0.05 inch thick (25 mm wide by 1.3 mm thick), prepunched.

I. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roofing components to substrate, and acceptable to roofing system manufacturer.

J. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, lap sealants, termination reglets, and other accessories.

2.4 ROOF INSULATION

A. General: Preformed roof insulation boards manufactured or approved by TPO roof membrane manufacturer, and approved for use in FM Approvals' RoofNav-listed roof assemblies.

B. Extruded-Polystyrene Board Insulation: ASTM C578, Type IV, 1.45-lb/cu. ft. (23-kg/cu. m) minimum density, 25-psi (173-kPa) minimum compressive strength, square edged.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
MISSOURI SCHOOL FOR THE BLIND
(E1703-01) – Install Nature Park

2. DiversiFoam Products.
   b. Dow Chemical Company (The).
   c. Kingspan Insulation Limited.
   d. Or Approved Equal

2. Thermal Resistance: R-value of 5.0 per inch (25.4 mm).
3. Size: 48 by 48 inches (1219 by 1219 mm).
4. Thickness:
   a. As needed to achieve slope and meet fascia dimensions.

C. Tapered Insulation: Provide factory-tapered insulation boards.
   1. Material: Match roof insulation.
   3. Slope:
      a. Roof Field: 1/4 inch per foot (1:48) unless otherwise indicated on Drawings.
      b. Saddles and Crickets: 1/2 inch per foot (1:24) unless otherwise indicated on Drawings.

2.5 INSULATION ACCESSORIES

A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with other roofing system components.

B. Fasteners: Factory-coated steel fasteners with metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation and cover boards to substrate, and acceptable to roofing system manufacturer.

C. Insulation Adhesive: Insulation manufacturer's recommended adhesive formulated to attach roof insulation to substrate or to another insulation layer.

D. Cover Board: High density polyisocyanurate, 1/2 inch thick nominally, meeting ASTM C1289 Type II, Class 4, Grade 1 (80 psi minimum).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

1. Verify that roof openings and penetrations are in place, curbs are set and braced, and roof-drain bodies are securely clamped in place.
2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
3. Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Section 053100 "Steel Decking."
B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing system installation according to roofing system manufacturer's written instructions. Remove sharp projections.

B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

C. Perform fastener-pullout tests according to roof system manufacturer's written instructions.

1. Submit test result within 24 hours after performing tests.
   a. Include manufacturer's requirements for any revision to previously submitted fastener patterns required to achieve specified wind uplift requirements.

3.3 ROOFING INSTALLATION, GENERAL

A. Install roofing system according to roofing system manufacturer's written instructions, FM Approvals' RoofNav assembly requirements, and FM Global Property Loss Prevention Data Sheet 1-29.

B. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at end of workday or when rain is forecast. Remove and discard temporary seals before beginning Work on adjoining roofing.

3.4 INSULATION INSTALLATION

A. Coordinate installing roofing system components so insulation is not exposed to precipitation or left exposed at end of workday.

B. Comply with roofing system and roof insulation manufacturer's written instructions for installing roof insulation.

C. Installation Over Metal Decking:

1. Install base layer of insulation with end joints staggered not less than 12 inches (305 mm) in adjacent rows and with long joints continuous at right angle to flutes of decking.
   a. Locate end joints over crests of decking.
   b. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
   c. Make joints between adjacent insulation boards not more than 1/4 inch (6 mm) in width.
d. At internal roof drains, slope insulation to create a square drain sump with each side equal to the diameter of the drain bowl plus 24 inches (610 mm).

1) Trim insulation so that water flow is unrestricted.

e. Fill gaps exceeding 1/4 inch (6 mm) with insulation.

f. Cut and fit insulation within 1/4 inch (6 mm) of nailers, projections, and penetrations.

g. Mechanically attach base layer of insulation and substrate board using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to metal decks.

1) Fasten insulation according to requirements in FM Approvals' RoofNav for specified Windstorm Resistance Classification.

2) Fasten insulation to resist specified uplift pressure at corners, perimeter, and field of roof.

2. Install upper layers of insulation and tapered insulation with joints of each layer offset not less than 12 inches (305 mm) from previous layer of insulation.

a. Install with long joints continuous and with end joints staggered not less than 12 inches (305 mm) in adjacent rows.

b. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.

c. Make joints between adjacent insulation boards not more than 1/4 inch (6 mm) in width.

d. At internal roof drains, slope insulation to create a square drain sump with each side equal to the diameter of the drain bowl plus 24 inches (610 mm).

1) Trim insulation so that water flow is unrestricted.

e. Fill gaps exceeding 1/4 inch (6 mm) with insulation.

f. Cut and fit insulation within 1/4 inch (6 mm) of nailers, projections, and penetrations.

g. Adhere each layer of insulation to substrate using adhesive according to FM Approvals' RoofNav assembly requirements and FM Global Property Loss Prevention Data Sheet 1-29 for specified Windstorm Resistance Classification, as follows:

1) Set each layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.

3.5 INSTALLATION OF COVER BOARDS

A. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches (150 mm) in each direction.

1. Trim cover board neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.

2. At internal roof drains, conform to slope of drain sump.
a. Trim cover board so that water flow is unrestricted.

3. Cut and fit cover board tight to nailers, projections, and penetrations.
4. Adhere cover board to substrate using adhesive according to FM Approvals’ RoofNav assembly requirements and FM Global Property Loss Prevention Data Sheet 1-29 for specified Windstorm Resistance Classification, as follows:
   a. Set cover board in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.

B. Install slip sheet over cover board and beneath roof membrane if recommended by manufacturer.

3.6 ADHERED ROOFING INSTALLATION

A. Adhere roof membrane over area to receive roofing according to roofing system manufacturer's written instructions.

B. Unroll roof membrane and allow to relax before installing.

C. Start installation of roofing in presence of roofing system manufacturer's technical personnel.

D. Accurately align roof membrane, and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.

E. Bonding Adhesive: Apply to substrate and underside of roof membrane at rate required by manufacturer, and allow to partially dry before installing roof membrane. Do not apply to splice area of roof membrane.

F. In addition to adhering, mechanically fasten roof membrane securely at terminations, penetrations, and perimeter of roofing.

G. Apply roof membrane with side laps shingled with slope of roof deck where possible.

H. Seams: Clean seam areas, overlap roof membrane, and hot-air weld side and end laps of roof membrane and sheet flashings, to ensure a watertight seam installation.
   1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of roof membrane and sheet flashings.
   2. Verify field strength of seams a minimum of twice daily, and repair seam sample areas.
   3. Repair tears, voids, and lapped seams in roof membrane that do not comply with requirements.

I. Spread sealant bed over deck-drain flange at roof drains, and securely seal roof membrane in place with clamping ring.

3.7 MECHANICALLY FASTENED ROOFING INSTALLATION

A. Mechanically fasten roof membrane over area to receive roofing according to roofing system manufacturer's written instructions.
B. Unroll roof membrane and allow to relax before installing.

C. Start installation of roofing in presence of roofing system manufacturer's technical personnel.

D. Accurately align roof membrane, and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.

E. Mechanically fasten or adhere roof membrane securely at terminations, penetrations, and perimeter of roofing.

F. Apply roof membrane with side laps shingled with slope of roof deck where possible.

G. In-Seam Attachment: Secure one edge of TPO sheet using fastening plates or metal battens centered within seam, and mechanically fasten TPO sheet to roof deck.

H. Seams: Clean seam areas, overlap roof membrane, and hot-air weld side and end laps of roof membrane and sheet flashings to ensure a watertight seam installation.
   1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of roof membrane and flashing sheet.
   2. Verify field strength of seams a minimum of twice daily, and repair seam sample areas.
   3. Repair tears, voids, and lapped seams in roof membrane that do not comply with requirements.

I. Spread sealant bed over deck-drain flange at roof drains, and securely seal roof membrane in place with clamping ring.

3.8 BASE FLASHING INSTALLATION

A. Install sheet flashings and preformed flashing accessories, and adhere to substrates according to roofing system manufacturer's written instructions.

B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate, and allow to partially dry. Do not apply to seam area of flashing.

C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.

D. Clean seam areas, overlap, and firmly roll sheet flashings into the adhesive. Hot-air weld side and end laps to ensure a watertight seam installation.

E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

3.9 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and to inspect substrate conditions, surface preparation, roof membrane application, sheet flashings, protection, and drainage components, and to furnish reports to Architect.
B. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion, in presence of Architect, and to prepare inspection report.

C. Repair or remove and replace components of roofing system where inspections indicate that they do not comply with specified requirements. Defective or non-conforming conditions defined as follows, unless more stringent criteria required by roofing system manufacturer:

1. Blister, Bubble, Capillaries, or Voids: A spongy raised portion of roofing membrane resulting from improper surface preparation, pressure of entrapped air, entrapped water vapor, inadequate adhesive, adhesive bonding failure, improper attachment method, or resulting from climatic installation conditions. Such condition shall not exceed four (4) inches in individual diameter, multiple occurrences be spaced less than forty-eight (48) inches on center, or multiple occurrences exceeding sixteen (16) inches within one hundred forty-four (144) square feet of surface area.

2. Fishmouth: Opening or void in lapped edge or seam.

3. Punctures or Holes: Condition compromising system watertight effectiveness.

4. Seam or Joint Separation: Unbonded edge condition where proving tool penetrates lapped area under firm pressure.

5. Slope, Drainage, or Ponding (Standing Water): Criteria for judging proper slope for drainage is no ponding water on roof surface forty-eight (48) hours after precipitation event during conditions conducive to drying.

6. Wrinkles or Distortions: Surface condition that impedes the proper flow or water drainage.

7. Insulation and/or Cover Board Joints: Butt joints exceeding ¼” wide or uneven surfaces exceeding 1/4” vertically measured in transition plane.

D. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.

3.10 PROTECTING AND CLEANING

A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction does not affect or endanger roofing system, inspect roofing system for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.

B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

3.11 ROOFING INSTALLER'S WARRANTY

A. WHEREAS _______________________________ of ___________________________, herein called the "Roofing Installer," has performed roofing and associated work ("work") on the following project:

1. Owner: State of Missouri
2. Address: To be confirmed with Ownership.
3. Building Name/Type: Missouri School for the Blind
4. Address: 3815 Magnolia Avenue, St Louis, MO
5. Area of Work: Entry Canopy Roof; East Courtyard Skyway Roof
6. Acceptance Date: _________________.
7. Warranty Period: 20 Years.
8. Expiration Date: _________________.

B. AND WHEREAS Roofing Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said work against leaks and faulty or defective materials and workmanship for designated Warranty Period,

C. NOW THEREFORE Roofing Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period Roofing Installer will, at Roofing Installer's own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in a watertight condition.

D. This Warranty is made subject to the following terms and conditions:

1. Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:
   a. lightning;
   b. peak gust wind speed exceeding 72 mph;
   c. fire;
   d. failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
   e. faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work;
   f. vapor condensation on bottom of roofing; and
   g. activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.

2. When work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.

3. Roofing Installer is responsible for damage to work covered by this Warranty.

4. During Warranty Period, if Owner allows alteration of work by anyone other than Roofing Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void on date of said alterations, but only to the extent said alterations affect work covered by this Warranty. If Owner engages Roofing Installer to perform said alterations, Warranty shall not become null and void unless Roofing Installer, before starting said work, shall have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate work, thereby reasonably justifying a limitation or termination of this Warranty.

5. Owner shall promptly notify Roofing Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.
6. This Warranty is recognized to be the only warranty of Roofing Installer on said work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of original work according to requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

E. IN WITNESS THEREOF, this instrument has been duly executed this __________ day of __________________, ______________.

1. Authorized Signature: _______________________________________

2. Name: _______________________________________

3. Title: _______________________________________

END OF SECTION 075423
SECTION 077100 - ROOF SPECIALTIES

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. Copings.
2. Roof-edge specialties.
3. Roof-edge drainage systems.
4. Reglets and counterflashings.

B. Related Requirements:

1. Section 061053 "Miscellaneous Rough Carpentry" for wood nailers, curbs, and blocking.

C. Preinstallation Conference: Conduct conference at Project site.

1. Meet with Owner, Architect, Owner's insurer if applicable, roofing-system testing and inspecting agency representative, roofing Installer, roofing-system manufacturer's representative, Installer, structural-support Installer, and installers whose work interfaces with or affects roof specialties, including installers of roofing materials and accessories.
2. Examine substrate conditions for compliance with requirements, including flatness and attachment to structural members.
3. Review special roof details, roof drainage, and condition of other construction that will affect roof specialties.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For roof specialties.

1. Include plans, elevations, expansion-joint locations, keyed details, and attachments to other work. Distinguish between plant- and field-assembled work.
2. Include details for expansion and contraction; locations of expansion joints, including direction of expansion and contraction.
3. Indicate profile and pattern of seams and layout of fasteners, cleats, clips, and other attachments.
4. Detail termination points and assemblies, including fixed points.
5. Include details of special conditions.

C. Samples for Initial Selection: For each type of roof specialty indicated with factory-applied color finishes.

D. Samples for Verification:
   1. Include Samples of each type of roof specialty to verify finish and color selection, in manufacturer's standard sizes.
   2. Include roof-edge specialties, roof-edge drainage systems, reglets and counterflashings made from 12-inch (300-mm) lengths of full-size components in specified material, and including fasteners, cover joints, accessories, and attachments.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer.

B. Product Certificates: For each type of roof specialty.

C. Product Test Reports: For roof-edge flashings, for tests performed by a qualified testing agency.

D. Sample Warranty: For manufacturer's special warranty.

1.5 CLOSEOUT SUBMITTALS

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

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer offering products meeting requirements that are FM Approvals listed for specified class.

B. Source Limitations: Obtain roof specialties approved by manufacturer providing roofing-system warranty specified.

C. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and set quality standards for fabrication and installation.
   1. Build mockup of typical roof edge as shown on Drawings.
   2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   3. 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. Do not store roof specialties in contact with other materials that might cause staining, denting, or other surface damage. Store roof specialties away from uncured concrete and masonry.

B. Protect strippable protective covering on roof specialties from exposure to sunlight and high humidity, except to extent necessary for the period of roof-specialty installation.

1.8 FIELD CONDITIONS

A. Field Measurements: Verify profiles and tolerances of roof-specialty substrates by field measurements before fabrication, and indicate measurements on Shop Drawings.

B. Coordination: Coordinate roof specialties with flashing, trim, and construction of parapets, roof deck, roof and wall panels, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.9 WARRANTY

A. Roofing-System Warranty: Roof specialties are included in warranty provisions in Section 075423 “Thermoplastic-Polyolefin Roofing” and 074113 “Standing-Seam Metal Roof Panels”.

B. Special Warranty on Painted Finishes: Manufacturer agrees to repair finish or replace roof specialties that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:

   a. Color fading more than 5 Hunter units when tested according to ASTM D2244.
   b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
   c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Roof specialties shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

B. FM Approvals' Listing: Manufacture and install roof-edge specialties that are listed in FM Approvals' "RoofNav" and approved for windstorm classification, Class 1-90. Identify materials with FM Approvals' markings.
C. SPRI Wind Design Standard: Manufacture and install roof-edge specialties tested according to SPRI ES-1 and capable of resisting required design pressures.

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of thermal movements. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.2 ROOF-EDGE SPECIALTIES

A. Canted Roof-Edge Fascia: Manufactured, two-piece, roof-edge fascia consisting of compression-clamped metal fascia cover in section lengths not exceeding 12 feet (3.6 m) and a continuous formed galvanized-steel sheet cant, 0.028 inch (0.71 mm) thick, minimum, with extended vertical leg terminating in a drip-edge cleat. Provide matching corner units.

B. Roof-Edge Fascia: Manufactured, two-piece, roof-edge fascia consisting of snap-on metal fascia cover in section lengths not exceeding [12 feet (3.6 m)] < and a continuous metal receiver with integral drip-edge cleat to engage fascia cover and secure single-ply roof membrane. Provide matching corner units.

C. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Architectural Products Company.
   b. ATAS International, Inc.
   c. Berridge Manufacturing Company.
   d. Castle Metal Products.
   e. Cheney Flashing Company.
   f. Drexel Metals.
   g. Merchant and Evans.
   h. Metal-Era, Inc.
   i. OMG, Inc.
   j. PAC-CLAD; Petersen Aluminum Corporation; a Carlisle company.
   k. Or Approved Equal

2. Formed Aluminum Sheet Fascia Covers: Aluminum sheet, thickness as required to meet performance requirements.

   a. Surface: Smooth, flat finish.
   b. Finish: Two-coat fluoropolymer.
   a. Color: Medium bronze or Dark bronze, and to match existing flashing.


4. Splice Plates: Concealed, of same material, finish, and shape as fascia cover.
2.3 ROOF-EDGE DRAINAGE SYSTEMS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Architectural Products Company.
2. ATAS International, Inc.
4. Castle Metal Products.
5. Cheney Flashing Company.
6. CopperCraft by FABRAL.
8. Exceptional Metals.
10. Metal-Era, Inc.
11. OMG, Inc.
12. Perimeter Systems; a division of SAF.
13. Or Approved Equal.

B. Gutters: Manufactured in uniform section lengths, with matching corner units, ends, outlet tubes, and other accessories. Elevate back edge at least 1 inch (25 mm) above front edge. Furnish flat-stock gutter straps, gutter brackets, expansion joints, and expansion-joint covers fabricated from same metal as gutters.

1. Aluminum Sheet: 0.050 inch (1.27 mm) thick, minimum.
4. Gutter Supports: Manufacturer's standard supports as selected by Architect with finish matching the gutters.

C. Downspouts: Plain rectangular complete with mitered elbows, manufactured from the following exposed metal. Furnish with metal hangers, from same material as downspouts, and anchors.

1. Formed Aluminum: 0.050 inch (1.27 mm) thick, minimum.

D. Aluminum Finish: To match gutters.

2.4 REGLETS AND COUNTERFLASHINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

2. Castle Metal Products.
3. Cheney Flashing Company.
5. Exceptional Metals.
6. Fry Reglet Corporation.
7. Heckmann Building Products, Inc.
9. Metal-Era, Inc.
10. Or Approved Equal
B. Reglets: Manufactured units formed to provide secure interlocking of separate reglet and counterflashing pieces, from the following exposed metal:
   1. Formed Aluminum: 0.050 inch (1.27 mm) thick.
   2. Masonry Type, Embedded: Provide reglets with offset top flange for embedment in masonry mortar joint.

C. Counterflashings: Manufactured units of heights to overlap top edges of base flashings by 4 inches (100 mm) and in lengths not exceeding 12 feet (3.6 m) designed to snap into reglets and compress against base flashings with joints lapped, from the following exposed metal:
   1. Formed Aluminum: 0.032 inch (0.81 mm) thick.

D. Accessories:
   1. Flexible-Flashing Retainer: Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard metal counterflashing or where reglet is provided separate from metal counterflashing.
   2. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing lower edge.

E. Aluminum Finish: Two-coat fluoropolymer.
   1. Color: Medium bronze or Dark bronze; and to match existing flashing.

2.5 MATERIALS

A. Aluminum Sheet: ASTM B209 (ASTM B209M), alloy as standard with manufacturer for finish required, with temper to suit forming operations and performance required.

2.6 UNDERLAYMENT MATERIALS

A. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils (0.76 to 1.0 mm) thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.

B. Slip Sheet: Rosin-sized building paper, 3-lb/100 sq. ft. (0.16-kg/sq. m) minimum.

2.7 MISCELLANEOUS MATERIALS

A. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to meet performance requirements. Furnish the following unless otherwise indicated:
   1. Exposed Penetrating Fasteners: Gasketed screws with hex washer heads matching color of sheet metal.
   2. Fasteners for Aluminum: Aluminum or Series 300 stainless steel.
B. Elastomeric Sealant: ASTM C920, elastomeric polyurethane polymer sealant of type, grade, class, and use classifications required by roofing-specialty manufacturer for each application.

C. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type joints with limited movement.

D. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

2.8 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Coil-Coated Aluminum Sheet Finishes:

   1. High-Performance Organic Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

      a. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

      b. Concealed Surface Finish: Apply pretreatment and manufacturer's standard acrylic or polyester backer finish consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil (0.013 mm).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.

B. Examine walls, roof edges, and parapets for suitable conditions for roof specialties.

C. Verify that substrate is sound, dry, smooth, clean, sloped for drainage where applicable, and securely anchored.

D. Proceed with installation only after unsatisfactory conditions have been corrected.
3.2 UNDERLAYMENT INSTALLATION

A. Self-Adhering Sheet Underlayment: Apply primer if required by manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation. Apply wrinkle free, in shingle fashion to shed water, and with end laps of not less than 6 inches (152 mm) staggered 24 inches (610 mm) between courses. Overlap side edges not less than 3-1/2 inches (90 mm). Roll laps with roller. Cover underlayment within 14 days.

1. Apply continuously under roof-edge specialties and reglets and counterflashings.
2. Coordinate application of self-adhering sheet underlayment under roof specialties with requirements for continuity with adjacent air barrier materials.

B. Slip Sheet: Install with tape or adhesive for temporary anchorage to minimize use of mechanical fasteners under roof specialties. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches (50 mm).

3.3 INSTALLATION, GENERAL

A. General: Install roof specialties according to manufacturer's written instructions. Anchor roof specialties securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, underlayments, sealants, and other miscellaneous items as required to complete roof-specialty systems.

1. Install roof specialties level, plumb, true to line and elevation; with limited oil-canning and without warping, jogs in alignment, buckling, or tool marks.
2. Provide uniform, neat seams with minimum exposure of solder and sealant.
3. Install roof specialties to fit substrates and to result in weathertight performance. Verify shapes and dimensions of surfaces to be covered before manufacture.
4. Torch cutting of roof specialties is not permitted.
5. Do not use graphite pencils to mark metal surfaces.

B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.

1. Coat concealed side of uncoated aluminum roof specialties with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
2. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof specialties for waterproof performance.


1. Space movement joints at a maximum of 12 feet (3.6 m) with no joints within 18 inches (450 mm) of corners or intersections unless otherwise indicated on Drawings.
2. When ambient temperature at time of installation is between 40 and 70 deg F (4 and 21 deg C), set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures.

D. Fastener Sizes: Use fasteners of sizes that penetrate [wood blocking or sheathing not less than 1-1/4 inches (32 mm) for nails and not less than 3/4 inch (19 mm) for wood screws.]
E. Seal concealed joints with butyl sealant as required by roofing-specialty manufacturer.
F. Seal joints as required for weathertight construction. Place sealant to be completely concealed in joint. Do not install sealants at temperatures below 40 deg F (4 deg C).

3.4 ROOF-EDGE SPECIALITIES INSTALLATION

A. Install cleats, cants, and other anchoring and attachment accessories and devices with concealed fasteners.
B. Anchor roof edgings with manufacturer's required devices, fasteners, and fastener spacing to meet performance requirements.

3.5 ROOF-EDGE DRAINAGE-SYSTEM INSTALLATION

A. General: Install components to produce a complete roof-edge drainage system according to manufacturer's written instructions. Coordinate installation of roof perimeter flashing with installation of roof-edge drainage system.
B. Gutters: Join and seal gutter lengths. Allow for thermal expansion. Attach gutters to firmly anchored gutter supports spaced not more than 24 inches (610 mm) apart. Attach ends with rivets and seal with sealant to make watertight. Slope to downspouts.
C. Downspouts: Join sections with manufacturer's standard telescoping joints. Provide hangers with fasteners designed to hold downspouts securely to walls and 1 inch (25 mm) away from walls; locate fasteners at top and bottom and at approximately 60 inches (1500 mm) o.c.
1. Provide elbows at base of downspouts at grade to direct water away from building.
2. Connect downspouts to underground drainage system indicated where indicated on drawings.
3. Anchor scupper closure trim flange to exterior wall and seal or solder to scupper.
4. Loosely lock front edge of scupper with conductor head.
5. Seal or solder exterior wall scupper flanges into back of conductor head.

3.6 REGLET AND COUNTERFLASHING INSTALLATION

A. General: Coordinate installation of reglets and counterflashings with installation of base flashings.
B. Counterflashings: Insert counterflashings into reglets or other indicated receivers; ensure that counterflashings overlap 4 inches (100 mm) over top edge of base flashings. Lap counterflashing joints a minimum of 4 inches (100 mm) and bed with butyl sealant. Fit counterflashings tightly to base flashings.
3.7 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder and sealants.

C. Remove temporary protective coverings and strippable films as roof specialties are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain roof specialties in a clean condition during construction.

D. Replace roof specialties that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 077100
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 PREINSTALLATION MEETINGS
A. Preinstallation Conference: Conduct conference at Project site.

1.4 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.

1.5 INFORMATIONAL SUBMITTALS
A. Qualification Data: For Installer.
B. Product Test Reports: For each penetration firestopping system, for tests performed by a qualified testing agency.
1.6 CLOSEOUT SUBMITTALS

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

1.7 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."

2.2 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 one of the following:

   a. 3M Fire Protection Products.
   c. Construction Solutions.
   d. Grabber Construction Products.
   e. Hilti, Inc.
   f. HOLDRITE; Reliance Worldwide Company.
   g. NUCO Inc.
   i. Specified Technologies, Inc.

B. Penetrations in Fire-Resistance-Rated Walls: Penetration firestopping systems with ratings determined per ASTM E814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa).

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

C. Penetrations in Horizontal Assemblies: Penetration firestopping systems with ratings determined per ASTM E814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa).

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

D. Penetrations in Smoke Barriers: Penetration firestopping systems with ratings determined per UL 1479, based on testing at a positive pressure differential of 0.30-inch wg (74.7 Pa).

   1. L-Rating: Not exceeding 5.0 cfm/sq. ft. (0.025 cu. m/s per sq. m) of penetration opening at and no more than 50-cfm (0.024-cu. m/s) cumulative total for any 100 sq. ft. (9.3 sq. m) at both ambient and elevated temperatures.

E. Exposed Penetration Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, per ASTM E84.

F. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping system manufacturer and approved by qualified testing and inspecting agency for conditions indicated.

   1. Permanent forming/damming/backing materials.
   2. Substrate primers.
   3. Collars.
   4. Steel sleeves.
2.3 FILL MATERIALS

A. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer sleeve lined with an intumescent strip, a flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.

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

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

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

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

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

G. 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.

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


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 FIELD QUALITY CONTROL

A. Contractor will engage a qualified testing agency to perform tests and inspections according to ASTM E2174.

B. Where deficiencies are found or penetration firestopping system is damaged or removed because of testing, repair or replace penetration firestopping system to comply with requirements.

C. Proceed with enclosing penetration firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

3.6 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.
SECTION 081213 - HOLLOW METAL FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Interior custom hollow-metal frames.

B. Related Requirements:
   1. Section 081416 "Flush Wood Doors" for wood doors in hollow-metal frames.
   2. Section 087100 "Door Hardware" for door hardware.

1.2 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.

1.3 COORDINATION

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

B. Coordinate requirements for installation of door hardware, electrified door hardware, and access control and security systems.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, fire-resistance ratings, and finishes.

B. Shop Drawings: Include the following:
   1. Elevations of each frame type.
   2. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
   3. Locations of reinforcement and preparations for hardware.
   4. Details of each different wall opening condition.
5. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
6. Details of anchorages, joints, field splices, and connections.
7. Details of accessories.
8. Details of moldings, removable stops, and glazing.

C. Product Schedule: For hollow-metal frames, prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final door hardware schedule.

1.6 INFORMATIONAL SUBMITTALS

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

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow-metal frames palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
1. Provide additional protection to prevent damage to factory-finished units.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow-metal frames vertically under cover at Project site with head up. Place on minimum 4-inch- (102-mm-) high wood blocking. Provide minimum 1/4-inch (6-mm) space between each stacked door to permit air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Gensteel Doors, Inc.
2. HMF Express, LLC.
3. Hollow Metal Inc.
4. Hollow Metal Xpress.
5. JR Metal Frames Manufacturing, Inc.
7. L.I.F. Industries, Inc.
8. LaForce, Inc.
10. Mesker Door Inc.
11. Metropolitan Door Industries Corp.
12. Michbi Doors Inc.
13. MPI Group, LLC (The).
15. North American Door Corp.
17. Pioneer Industries.
18. Premier Products, Inc.
20. Rocky Mountain Metals, Inc.
21. Security Metal Products; a brand of ASSA ABLOY.
23. Steelcraft; an Allegion brand.
24. Steward Steel Door & Frame Division.
25. Stiles Custom Metal, Inc.
27. Or Approved Equal

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Rated Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings indicated on Drawings, based on testing at positive pressure according to NFPA 252 or UL 10C.

1. Smoke- and Draft-Control Assemblies: Listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL 1784 and installed in compliance with NFPA 105.

2. Oversize Fire-Rated Frames: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that frames comply with standard construction requirements for tested and labeled fire-rated assemblies except for size.

B. Fire-Rated, Borrowed-Lite Assemblies: Complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9.

2.3 CUSTOM HOLLOW-METAL FRAMES

A. Interior Frames: NAAMM-HMMA 861.

1. Materials: Uncoated steel sheet, minimum thickness of 0.053 inch (1.3 mm).
2. Construction: Full profile welded.
2.4 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 according to ASTM A153/A153M, Class B.

2.5 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B.

D. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A153/A153M.

E. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.

2.6 FABRICATION

A. 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. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
   2. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.
      a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
B. Hardware Preparation: Factory prepare hollow-metal frames to receive templated mortised hardware, and electrical wiring; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.

1. Reinforce frames to receive nontemplated, mortised, and surface-mounted door hardware.
2. Comply with BHMA A156.115 for preparing hollow-metal frames for hardware.

2.7 STEEL FINISHES

A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.

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

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 frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.2 INSTALLATION

A. General: Install hollow-metal frames plumb, rigid, properly aligned, and securely fastened in place. Comply with approved Shop Drawings and with manufacturer's written instructions. Comply with NAAMM-HMMA 840.

B. 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.

1. 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.
2. Install frames with removable stops located on secure side of opening.

C. Fire-Rated Openings: Install frames according to NFPA 80.

D. Floor Anchors: Secure with postinstalled expansion anchors.

E. Solidly pack mineral-fiber insulation inside frames.
F. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout or mortar.

G. Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.

H. Installation Tolerances: Adjust hollow-metal frames to the following tolerances:

1. 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.
2. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
3. 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.
4. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs at floor.

I. Glazing: Comply with installation requirements in Section 088000 "Glazing" and with hollow-metal manufacturer's written instructions.

3.3 CLEANING AND TOUCHUP

A. Dent Prevention: Contractor shall take care to protect and prevent dents which cannot be easily touched-up with primer/paint. If frame cannot be repaired to the architect’s satisfaction it shall be completely replaced.

B. 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.

END OF SECTION 081213
PART 1 - GENERAL

1.1 SUMMARY
   A. Section Includes:
      1. Five-ply flush wood veneer-faced doors for transparent finish.

   B. Related Requirements:
      1. Section 081213 "Hollow Metal Frames" for door frames.
      2. Section 088813 "Fire-Resistant Glazing" for glass view panels in rated wood doors.

1.2 PREINSTALLATION MEETINGS
   A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS
   A. Product Data: For each type of product, including the following:
      1. Door core materials and construction.
      2. Door edge construction
      3. Door face type and characteristics.
      4. Door louvers.
      5. Door trim for openings.
      6. Door frame construction.
      7. Factory-machining criteria.

   B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each type of door; construction details not covered in Product Data; and the following:
      1. Door schedule indicating door and frame location, type, size, fire protection rating, and swing.
      2. Door elevations, dimension and locations of hardware, lite and louver cutouts, and glazing thicknesses.
      3. Details of frame for each frame type, including dimensions and profile.
      4. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
      5. Dimensions and locations of blocking for hardware attachment.
      6. Dimensions and locations of mortises and holes for hardware.
      7. Clearances and undercuts.
      8. Requirements for veneer matching.
      9. Doors to be factory finished and application requirements.
C. Sample for Initial Selection: For factory-finished doors.

D. Samples for Verification:
   1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches (200 by 250 mm), for each material and finish.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For door inspector.
   1. Fire-Rated Door Inspector: Submit documentation of compliance with NFPA 80, Section 5.2.3.1.
   2. Egress Door Inspector: Submit documentation of compliance with NFPA 101, Section 7.2.1.15.4.
   3. Submit copy of DHI's Fire and Egress Door Assembly Inspector (FDAI) certificate.

B. Field quality-control reports.

C. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Special warranties.

B. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

1.6 QUALITY ASSURANCE

A. Fire-Rated Door Inspector Qualifications: Inspector for field quality-control inspections of fire-rated door assemblies shall comply with qualifications set forth in NFPA 80, Section 5.2.3.1.

B. Egress Door Inspector Qualifications: Inspector for field quality-control inspections of egress door assemblies shall comply with qualifications set forth in NFPA 101, Section 7.2.1.15.4.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Package doors individually in cardboard cartons, and wrap bundles of doors in plastic sheeting.

C. Mark each door on bottom rail with opening number used on Shop Drawings.
1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.

   1. Failures include, but are not limited to, the following:
      a. Delamination of veneer.
      b. Warping (bow, cup, or twist) more than 1/4 inch (6.4 mm) in a 42-by-84-inch (1067-by-2134-mm) section.
      c. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch (0.25 mm in a 76.2-mm) span.

   2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.


PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain flush wood doors from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Rated Wood Door and Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated on Drawings, based on testing at positive pressure in accordance with UL 10C or NFPA 252.

   1. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.

   B. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing in accordance with UL 1784 and installed in compliance with NFPA 105.

2.3 FLUSH WOOD DOORS, GENERAL

A. Quality Standard: In addition to requirements specified, comply with WDMA I.S. 1A.

2.4 FIVE-PLY FLUSH WOOD VENEER-FACED DOORS FOR TRANSPARENT FINISH

A. Interior Doors: As noted on drawings.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Eggers Industries.
   b. Graham Wood Doors; an Assa Abloy Group company
   c. Marshfield Door Systems, Inc.
   d. Mohawk Door Systems, Inc.
   e. Or Approved Equal

2. Performance Grade: WDMA I.S. 1A Extra Heavy Duty.
3. WDMA I.S. 1A Grade: Premium.
4. Faces: Single-ply wood veneer not less than 1/50 inch (0.508 mm) thick.
   a. Species: Select white birch.
   b. Cut: Plain sliced.
   c. Match between Veneer Leaves: Book match.
   d. Assembly of Veneer Leaves on Door Faces: Center-balance match.
   e. Room Match: Provide door faces of compatible color and grain within each separate room or area of building.

5. Exposed Vertical Edges: Same species as faces or a compatible species - Architectural Woodwork Standards edge Type A
   a. Fire-Rated Single Doors: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed vertical edges.
   b. Mineral-Core Doors: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.
      1) Screw-Holding Capability: 550 lbf (2440 N) in accordance with WDMA T.M. 10.

6. Core for Fire-Rated Doors: As required to achieve fire-protection rating indicated on Drawings.
   a. Blocking for Mineral-Core Doors: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated on Drawings as needed to eliminate through-bolting hardware.

7. Construction: Five plies, hot-pressed bonded (vertical and horizontal edging is bonded to core), with entire unit abrasive planed before veneering.

2.5 LIGHT FRAMES

A. Wood-Veneered Beads for Light Openings in Fire-Rated Doors: Manufacturer's standard wood-veneered noncombustible beads matching veneer species of door faces and approved for use in doors of fire-protection rating indicated on Drawings. Include concealed metal glazing clips where required for opening size and fire-protection rating indicated.
B. Metal Frames for Light Openings in Fire-Rated Doors: Manufacturer's standard frame formed of 0.048-inch- (1.2-mm-) thick, cold-rolled steel sheet; with baked-enamel- or powder-coated finish; and approved for use in doors of fire-protection rating indicated on Drawings.

1. Wood Species: Same species as door faces.
2. Profile: Flat.

2.6 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated.

1. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
2. Comply with NFPA 80 requirements for fire-rated doors.

B. Factory machine doors for hardware that is not surface applied.

1. Locate hardware to comply with DHI-WDHS-3.
2. Comply with final hardware schedules, door frame Shop Drawings, BHMA-156.115-W, and hardware templates.
3. Coordinate with hardware mortises in metal frames, to verify dimensions and alignment before factory machining.
4. For doors scheduled to receive electrified locksets, provide factory-installed raceway and wiring to accommodate specified hardware.

C. Openings: Factory cut and trim openings through doors.

1. Light Openings: Trim openings with moldings of material and profile indicated.
2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 088813 "Fire-Resistant Glazing."

2.7 FACTORY FINISHING

A. Comply with referenced quality standard for factory finishing.

1. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
2. Finish faces, all four edges, edges of cutouts, and mortises.
3. Stains and fillers may be omitted on top and bottom edges, edges of cutouts, and mortises.

B. Factory finish doors.

C. Transparent Finish:

1. WDMA I.S. 1A Grade: Premium.
3. Staining: As selected by Architect from manufacturer's full range.

FLUSH WOOD DOORS
3.1 EXAMINATION

A. Examine doors and installed door frames, with Installer present, before hanging doors.
   1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
   2. Reject doors with defects.

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

3.2 INSTALLATION

A. Hardware: For installation, see Section 087100 "Door Hardware."

B. Install doors and frames to comply with manufacturer's written instructions and referenced quality standard, and as indicated.

C. Install frames level, plumb, true, and straight.
   1. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches (3.2 mm in 2400 mm).
   2. Anchor frames to anchors or blocking built in or directly attached to substrates.
      a. Secure with countersunk, concealed fasteners and blind nailing.
      b. Use fine finishing nails for exposed fastening, countersunk and filled flush with woodwork.

   1) For factory-finished items, use filler matching finish of items being installed.

   3. Install fire-rated doors and frames in accordance with NFPA 80.
   4. Install smoke- and draft-control doors in accordance with NFPA 105.

D. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

E. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.3 FIELD QUALITY CONTROL

A. Inspection Agency: Engage a qualified inspector to perform inspections and to furnish reports to Architect.

B. Inspections:
   1. Fire-Rated Door Inspections: Inspect each fire-rated door in accordance with NFPA 80, Section 5.2.
2. Egress Door Inspections: Inspect each door equipped with panic hardware, each door equipped with fire exit hardware, each door located in an exit enclosure, each electrically controlled egress door, and each door equipped with special locking arrangements in accordance with NFPA 101, Section 7.2.1.15.

C. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.

D. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

E. Prepare and submit separate inspection report for each fire-rated door assembly indicating compliance with each item listed in NFPA 80 and NFPA 101.

3.4 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 081416
SECTION 083323 - OVERHEAD COILING DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Insulated service doors.

B. Related Requirements:
   1. Section 061053 "Miscellaneous Rough Carpentry" for wood nailers, curbs, and blocking.

1.3 ACTION SUBMITTALS

A. Product Data: For each type and size of overhead coiling door and accessory.
   1. Include construction details, material descriptions, dimensions of individual components, profiles for slats, and finishes.

B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data.
   1. Include plans, elevations, sections, and mounting details.
   2. Include details of equipment assemblies, and indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
   3. Include points of attachment and their corresponding static and dynamic loads imposed on structure.
   4. For exterior components, include details of provisions for assembly expansion and contraction and for excluding and draining moisture to the exterior.

C. Samples for Initial Selection: Manufacturer's finish charts showing full range of colors and textures available for units with factory-applied finishes.
   1. Include similar Samples of accessories involving color selection.

D. Samples for Verification: For each type of exposed finish on the following components, in manufacturer's standard sizes:
   1. Curtain slats.
   2. Bottom bar.
   3. Guides.
5. Hood.
6. Locking device(s).
7. Include similar Samples of accessories involving color selection.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Special warranty.

B. Maintenance Data: For overhead coiling doors to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.

1. Maintenance Proximity: Not more than two hours' normal travel time from Installer's place of business to Project site.

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of doors that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain overhead coiling doors, all parts, from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Structural Performance, Exterior Doors: Capable of withstanding the following design wind loads:
1. Design Wind Load: As indicated on Structural Drawings.
2. Testing: According to ASTM E330/E330M.
3. Deflection Limits: Design overhead coiling doors to withstand design wind load without evidencing permanent deformation or disengagement of door components.

B. Seismic Performance: Overhead coiling doors shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

   1. Component Importance Factor: 1.0.

2.3 DOOR ASSEMBLY

A. Insulated Service Door: Overhead coiling door formed with curtain of interlocking metal slats.

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

      a. Clopay Building Products.
      b. Cookson Company.
      c. Cornell.
      d. Overhead Door Corporation.
      e. Raynor.
      f. Or Approved Equal

B. Operation Cycles: Door components and operators capable of operating for not less than 10,000. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.

C. Air Infiltration: Maximum rate of 1.0 cfm/sq. ft. (5.1 L/s per sq. m) at 15 and 25 mph (24.1 and 40.2 km/h) when tested according to ASTM E283.

D. Curtain R-Value: 4.5 deg F x h x sq. ft./Btu (0.792 K x sq. m/W).

E. Door Curtain Material: Aluminum

F. Door Curtain Slats: Flat profile slats of 1-7/8-inch (48-mm), 2-5/8-inch (67-mm), or 3-1/4-inch (83-mm) center-to-center height.

   1. Insulated-Slat Interior Facing: Metal.
   2. Gasket Seal: Manufacturer's standard continuous gaskets between slats.

G. Bottom Bar: Two angles, each not less than 1-1/2 by 1-1/2 by 1/8 inch (38 by 38 by 3 mm) thick; fabricated from aluminum extrusions and finished to match door.

H. Curtain Jamb Guides: Galvanized steel with exposed finish matching curtain slats.

I. Hood: Match curtain material and finish.

   1. Shape: Square.
J. Locking Devices: Equip door with slide bolt locks, inside at both jamb sides.


L. Curtain Accessories: Equip door with weatherseals, push/pull handles, pull-down strap.

M. Door Finish:
   1. Aluminum Finish: Factory Finish, color to be selected from manufacturer’s standard line of colors.
   2. Interior Curtain-Slat Facing: Match finish of exterior curtain-slat face.

2.4 DOOR CURTAIN MATERIALS AND CONSTRUCTION

A. Door Curtains: Fabricate overhead coiling-door curtain of interlocking metal slats, designed to withstand wind loading indicated, in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:
   1. Aluminum Door Curtain Slats: ASTM B209 (ASTM B209M) sheet or ASTM B221 (ASTM B221M) extrusions, alloy and temper standard with manufacturer for type of use and finish indicated; thickness of 0.050 inch (1.27 mm); and as required.
   2. Insulation: Fill slats for insulated doors with manufacturer's standard thermal insulation complying with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to ASTM E84 or UL 723. Enclose insulation completely within slat faces.
   3. Metal Interior Curtain-Slat Facing: Match metal of exterior curtain-slat face, with minimum aluminum thickness of 0.032 inch (0.80 mm).

B. Curtain Jamb Guides: Manufacturer's standard angles or channels and angles of same material and finish as curtain slats unless otherwise indicated, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Slot bolt holes for guide adjustment. Provide removable stops on guides to prevent overtravel of curtain.

2.5 HOODS

A. General: Form sheet metal hood to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Form closed ends for surface-mounted hoods and fascia for any portion of between-jamb mounting that projects beyond wall face. Equip hood with intermediate support brackets as required to prevent sagging.
   1. Aluminum: 0.040-inch- (1.02-mm-) thick aluminum sheet complying with ASTM B209 (ASTM B209M), of alloy and temper recommended by manufacturer and finisher for type of use and finish indicated.
2.6  LOCKING DEVICES

A. Slide Bolt: Fabricate with side-locking bolts to engage through slots in tracks for locking by padlock, located on both left and right jamb sides, operable from coil side.

2.7  CURTAIN ACCESSORIES

A. Weatherseals for Exterior Doors: Equip each exterior door with weather-stripping gaskets fitted to entire exterior perimeter of door for a weather-resistant installation unless otherwise indicated.

1. At door head, use 1/8-inch-(3-mm-) thick, replaceable, continuous-sheet baffle secured to inside of hood or field-installed on the header.
2. At door jambs, use replaceable, adjustable, continuous, flexible, 1/8-inch-(3-mm-) thick seals of flexible vinyl, rubber, or neoprene.

B. Push/Pull Handles: Equip each push-up-operated or emergency-operated door with lifting handles on each side of door, finished to match door.

C. Pull-Down Strap: Provide pull-down straps for doors more than 84 inches (2130 mm) high.

2.8  COUNTERBALANCE MECHANISM

A. General: Counterbalance doors by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.

B. Counterbalance Barrel: Fabricate spring barrel of manufacturer's standard hot-formed, structural-quality, welded carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats and to limit barrel deflection to not more than 0.03 in./ft. (2.5 mm/m) of span under full load.

C. Counterbalance Spring: One or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Secure ends of springs to barrel and shaft with cast-steel barrel plugs.

1. Fire-Rated Doors: Equip with auxiliary counterbalance spring and prevent tension release from main counterbalance spring when automatic-closing device operates.

D. Torsion Rod for Counterbalance Shaft: Fabricate of manufacturer's standard cold-rolled steel, sized to hold fixed spring ends and carry torsional load.

E. Brackets: Manufacturer's standard mounting brackets of either cast iron or cold-rolled steel plate.
2.9 MANUAL DOOR OPERATORS

A. Push-up Door Operation: Lift handles and pull rope for raising and lowering doors, with counterbalance mechanism designed so that required lift or pull for door operation does not exceed 25 lbf (111 N).

2.10 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM/NOMMA 500 for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.11 ALUMINUM FINISHES

A. Baked-Enamel or Powder-Coat Finish: AAMA 2603. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates areas and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.

B. Examine locations of electrical connections.

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

3.2 INSTALLATION

A. Install overhead coiling doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.

B. Install overhead coiling doors, hoods, controls, and operators at the mounting locations indicated for each door.

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections and to furnish reports to Architect.
B. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.

C. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

3.4 ADJUSTING

A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.
   1. Adjust exterior doors and components to be weather resistant.

B. Lubricate bearings and sliding parts as recommended by manufacturer.

3.5 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months’ full maintenance by skilled employees of coiling-door Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door operation. Parts and supplies shall be manufacturer’s authorized replacement parts and supplies.
   1. Perform maintenance, including emergency callback service, during normal working hours.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner’s maintenance personnel to adjust, operate, and maintain overhead coiling doors.

END OF SECTION 083323
SECTION 084113 - ALUMINUM-FRAMED STOREFRONTS

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. Storefront framing.
   B. Related Requirements:
      1. Section 084226 "All-Glass Entrances" for systems without aluminum support framing.
      2. Section 088000 “Glazing” for glazing panes.

1.3 PREINSTALLATION MEETINGS
   A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS
   A. Product Data: For each type of product.
      1. Include construction details, material descriptions, dimensions of individual components
         and profiles, and finishes.
   B. Shop Drawings: For aluminum-framed entrances and storefronts. Include plans, elevations,
      sections, full-size details, and attachments to other work.
      1. Include details of provisions for assembly expansion and contraction and for draining
         moisture occurring within the assembly to the exterior.
      2. Include full-size isometric details of each type of vertical-to-horizontal intersection of
         aluminum-framed entrances and storefronts, showing the following:
         a. Joinery, including concealed welds.
         b. Anchorage.
         c. Expansion provisions.
         d. Glazing.
         e. Flashing and drainage.
3. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.
4. Include point-to-point wiring diagrams showing the following:
   a. Power requirements for each electrically operated door hardware.
   b. Location and types of switches, signal device, conduit sizes, and number and size of wires.

C. Samples for Initial Selection: For units with factory-applied color finishes.

D. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

E. Fabrication Sample: Of each vertical-to-horizontal intersection of assemblies, made from 12-inch (300-mm) lengths of full-size components and showing details of the following:
   1. Joinery, including concealed welds.
   2. Anchorage.
   5. Flashing and drainage.

F. Delegated-Design Submittal: For aluminum-framed storefronts indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Preconstruction Laboratory Mockup Testing Submittals:
   1. Testing Program: Developed specifically for Project.
   2. Test Reports: Prepared by a qualified preconstruction testing agency for each mockup test.
   3. Record Drawings: As-built drawings of preconstruction laboratory mockups showing changes made during preconstruction laboratory mockup testing.

B. Qualification Data: For Installer.

C. Energy Performance Certificates: For aluminum-framed entrances and storefronts, accessories, and components, from manufacturer.
   1. Basis for Certification: NFRC-certified energy performance values for each aluminum-framed entrance and storefront.

D. Product Test Reports: For aluminum-framed entrances and storefronts, for tests performed by a qualified testing agency.

E. Source quality-control reports.

F. Field quality-control reports.
G. Sample Warranties: For special warranties.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For aluminum-framed entrances and storefronts to include in maintenance manuals.

B. Maintenance Data for Structural Sealant: For structural-sealant-glazed storefront to include in maintenance manuals. Include ASTM C1401 recommendations for post-installation-phase quality-control program.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Testing Agency Qualifications: Qualified according to ASTM E699 for testing indicated and accredited by the International Accreditation Service or the International Laboratory Accreditation Cooperation Mutual Recognition Arrangement as complying with ISO/IEC 17025.

C. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.

1.8 WARRANTY

A. Special Warranty: Installer agrees to repair or replace components of aluminum-framed entrances and storefronts that do not comply with requirements or that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

   a. Structural failures, including, but not limited to, excessive deflection.
   b. Noise or vibration created by wind and thermal and structural movements.
   c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
   d. Water penetration through fixed glazing and framing areas.
   e. Failure of operating components.

2. Warranty Period: Five years from date of Substantial Completion.
PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain all components of aluminum-framed entrance and storefront system, including framing, spandrel panels, and accessories, from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design aluminum-framed entrances and storefronts.

B. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed entrances and storefronts representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.

1. Aluminum-framed entrances and storefronts shall withstand movements of supporting structure, including, but not limited to, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.

2. Failure also includes the following:

   a. Thermal stresses transferring to building structure.
   b. Glass breakage.
   c. Noise or vibration created by wind and thermal and structural movements.
   d. Loosening or weakening of fasteners, attachments, and other components.
   e. Failure of operating units.

C. Structural Loads:

1. Wind Loads: As indicated on Drawings.

D. Deflection of Framing Members: At design wind pressure, as follows:

1. Deflection Normal to Wall Plane: Limited to edge of glass in a direction perpendicular to glass plane not exceeding 1/175 of the glass edge length for each individual glazing lite or an amount that restricts edge deflection of individual glazing lites to 3/4 inch (19.1 mm), whichever is less.

2. Deflection Parallel to Glazing Plane: Limited to 1/360 of clear span or 1/8 inch (3.2 mm), whichever is smaller.

   a. Operable Units: Provide a minimum 1/16-inch (1.6-mm) clearance between framing members and operable units.

E. Structural: Test according to ASTM E330/E330M as follows:

1. When tested at positive and negative wind-load design pressures, storefront assemblies, including entrance doors, do not evidence deflection exceeding specified limits.
2. When tested at 150 percent of positive and negative wind-load design pressures, storefront assemblies, including entrance doors and anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.

3. Test Durations: As required by design wind velocity, but not less than 10 seconds.

F. Air Infiltration: Test according to ASTM E283 for infiltration as follows:

1. Fixed Framing and Glass Area:
   a. Maximum air leakage of 0.06 cfm/sq. ft. (0.30 L/s per sq. m) at a static-air-pressure differential of 1.57 lbf/sq. ft. (75 Pa).

2. Entrance Doors:
   a. Single Doors: Maximum air leakage of 0.5 cfm/sq. ft. (2.54 L/s per sq. m) at a static-air-pressure differential of 1.57 lbf/sq. ft. (75 Pa).

G. Water Penetration under Static Pressure: Test according to ASTM E331 as follows:

1. No evidence of water penetration through fixed glazing and framing areas, including entrance doors, when tested according to a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft. (300 Pa).

H. Seismic Performance: Aluminum-framed entrances and storefronts shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. Seismic Drift Causing Glass Fallout: Complying with criteria for passing based on building occupancy type when tested according to AAMA 501.6 at design displacement.

I. Energy Performance: Certify and label energy performance according to NFRC as follows:

1. Thermal Transmittance (U-factor): Fixed glazing and framing areas as a system shall have U-factor of not more than U = 0.38 as determined according to NFRC 100.

2. Solar Heat Gain Coefficient (SHGC): Fixed glazing and framing areas as a system shall have SHGC of no greater than 0.40 as determined according to NFRC 200.

J. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes.

1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.3 STOREFRONT SYSTEMS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Arcadia, Inc.
2. Avanti Systems, Inc.
3. CMI Architectural.
5. Coral Industries, Inc.
6. EFCO Corporation.
8. Leed Himmel Industries, Inc.
10. Oldecastle BuildingEnvelope™.
12. SAFTI FIRST Fire Rated Glazing Solutions.
13. Trulite Glass & Aluminum Solutions, LLC.
14. Tubelite Inc.
15. U.S. Aluminum; a brand of C.R. Laurence.
16. Or Approved Equal

B. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.

2. Glazing System: [Retained mechanically with gaskets on four sides.
5. Fabrication Method: Field-fabricated stick system.
6. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
7. Steel Reinforcement: As required by manufacturer.

C. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.

D. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

E. Spandrel Glass: Match typical glass with back-painted finish.

2.4 GLAZING

A. Glazing: Comply with Section 088000 "Glazing."

B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.

C. Glazing Sealants: As recommended by manufacturer.

2.5 MATERIALS

A. Sheet and Plate: ASTM B209 (ASTM B209M).

B. Extruded Bars, Rods, Profiles, and Tubes: ASTM B221 (ASTM B221M).
C. Extruded Structural Pipe and Tubes: ASTM B429/B429M.

D. Structural Profiles: ASTM B308/B308M.

2.6 ACCESSORIES

A. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
2. Reinforce members as required to receive fastener threads.
3. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system.

B. Anchors: Three-way adjustable anchors with minimum adjustment of 1 inch (25.4 mm) that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.

1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A123/A123M or ASTM A153/A153M requirements.

C. Concealed Flashing: Dead-soft, 0.018-inch- (0.457-mm-) thick stainless steel, complying with ASTM A240/A240M, of type recommended by manufacturer.

D. Bituminous Paint: Cold-applied asphalt-mastic paint containing no asbestos, formulated for 30-mil (0.762-mm) thickness per coat.

2.7 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

C. Fabricate components that, when assembled, have the following characteristics:

1. Profiles that are sharp, straight, and free of defects or deformations.
2. Accurately fitted joints with ends coped or mitered.
3. Physical and thermal isolation of glazing from framing members.
4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
5. Provisions for field replacement of glazing from exterior.
6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

D. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.
E. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.8 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

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

3.2 INSTALLATION

A. General:

1. Comply with manufacturer's written instructions.
2. Do not install damaged components.
3. Fit joints to produce hairline joints free of burrs and distortion.
4. Rigidly secure nonmovement joints.
5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
6. Seal perimeter and other joints watertight unless otherwise indicated.

B. Metal Protection:

1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.
2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Set continuous sill members and flashing in full sealant bed to produce weathertight installation.

D. Install components plumb and true in alignment with established lines and grades.

E. Install glazing as specified in Section 088000 "Glazing."

3.3 ERECTION TOLERANCES

A. Erection Tolerances: Install aluminum-framed entrances and storefronts to comply with the following maximum tolerances:
1. Plumb: 1/8 inch in 10 feet (3.2 mm in 3 m); 1/4 inch in 40 feet (6.35 mm in 12.2 m).
2. Level: 1/8 inch in 20 feet (3.2 mm in 6 m); 1/4 inch in 40 feet (6.35 mm in 12.2 m).
3. Alignment:
   a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch (12.7 mm) wide, limit offset from true alignment to 1/16 inch (1.6 mm).
   b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch (12.7 to 25.4 mm) wide, limit offset from true alignment to 1/8 inch (3.2 mm).
   c. Where surfaces are separated by reveal or protruding element of 1 inch (25.4 mm) wide or more, limit offset from true alignment to 1/4 inch (6 mm).
4. Location: Limit variation from plane to 1/8 inch in 12 feet (3.2 mm in 3.6 m); 1/2 inch (12.7 mm) over total length.

3.4 FIELD QUALITY CONTROL
A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
B. Field Quality-Control Testing: Perform the following test on representative areas of aluminum-framed entrances and storefronts.
   1. Water-Spray Test: Before installation of interior finishes has begun, areas designated by Architect shall be tested according to AAMA 501.2 and shall not evidence water penetration.
      a. Perform a minimum of two tests in areas as directed by Architect.
   2. Air Infiltration: ASTM E783 at 1.5 times the rate specified for laboratory testing in "Performance Requirements" Article but not more than 0.09 cfm/sq. ft. (0.45 L/s per sq. m) at a static-air-pressure differential of 1.57 lbf/sq. ft. (75 Pa).
      a. Perform a minimum of two tests in areas as directed by Architect.
   3. Water Penetration: ASTM E1105 at a minimum uniform static-air-pressure differential of 0.67 times the static-air-pressure differential specified for laboratory testing in "Performance Requirements" Article, but not less than 6.24 lbf/sq. ft. (300 Pa), and shall not evidence water penetration.
C. Aluminum-framed storefronts will be considered defective if they do not pass tests and inspections.
D. Prepare test and inspection reports.

END OF SECTION 084113
SECTION 084226 - ALL-GLASS ENTRANCES

PART 1 - GENERAL

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

1.2 SUMMARY
   A. Section Includes:
      1. Interior swinging all-glass entrance doors.

1.3 PREINSTALLATION MEETINGS
   A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS
   A. Product Data: For each type of product.
      1. Include construction details, material descriptions, dimensions of individual components
         and profiles, and finishes for all-glass system.
   B. Shop Drawings: For all-glass entrances and storefronts.
      1. Include plans, elevations, and sections.
      2. Include details of fittings and glazing, including isometric drawings of patch fittings and
         rail fittings.
      3. Door hardware locations, mounting heights, and installation requirements.
   C. Samples for Initial Selection: For each type of exposed finish indicated.
   D. Samples for Verification: For each type of exposed finish indicated, prepared on Samples of
      size indicated below.
      1. Metal Finishes: 6-inch- (150-mm-) long sections of patch fittings and rail fittings,
         accessory fittings, and other items.
      2. Glass: 6 inches (150 mm) square, showing exposed-edge finish.
      3. Door Hardware: For exposed door hardware of each type, in specified finish, full size.
   E. Entrance Door Hardware Schedule: Prepared by or under supervision of supplier, detailing
      fabrication and assembly of entrance door hardware, as well as procedures and diagrams.
Coordinate final entrance door hardware schedule with doors related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.

F. Delegated-Design Submittal: For all-glass systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For all-glass systems, for tests performed by a qualified testing agency.

C. Field quality-control reports.

D. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For all-glass systems to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

B. Testing Agency Qualifications: Qualified according to ASTM E699 for testing indicated.

C. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.

1.8 WARRANTY

A. Special Warranty: Installer agrees to repair or replace components of all-glass systems that do not comply with requirements or that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

   a. Structural failures
   b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
   c. Failure of operating components.

2. Warranty Period: Two years from date of Substantial Completion.
PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design all-glass entrances and storefronts.

B. General Performance: Comply with performance requirements specified, as determined by testing of all-glass entrances and storefronts representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.

C. Seismic Performance: All-glass entrances and storefronts shall withstand the effects of earthquake motions determined according to [ASCE/SEI 7] <Insert requirement>.

2.2 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

2. J.E. Berkowitz.
3. Dorma
4. CR Laurence
5. Approved Equal

2.3 METAL COMPONENTS

A. Fitting Configuration:

1. Manual-Swinging, All-Glass Entrance Doors: Patch fittings at head and sill on pivot side only, and patch fittings at head for mag-locks.

B. Patch Fittings: Stainless-steel-clad aluminum.

C. Accessory Fittings: Match patch-fitting metal and finish for the following:

1. Overhead doorstop.
2. Overhead mag-lock.

D. Anchors and Fastenings: Concealed.

E. Materials:

1. Stainless-Steel Cladding: ASTM A666, Type 304.
   a. Finish: [No. 4 directional satin finish].
2.4 GLASS

A. Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated surfaces), Type I (transparent), tested for surface and edge compression per ASTM C1048 and for impact strength per 16 CFR 1201 for Category II materials.

1. Class 1: Clear monolithic.
   a. Thickness: 1/2 inch (13 mm).

2. Exposed Edges: Machine ground and flat polished.

2.5 ENTRANCE DOOR HARDWARE

A. General: Heavy-duty entrance door hardware units in sizes, quantities, and types recommended by manufacturer for all-glass entrance systems indicated. For exposed parts, match metal and finish of patch fittings.

B. Concealed Floor Closers and Top Pivots: Center hung; BHMA A156.4, Grade 1; including cases, bottom arms, top walking beam pivots, plates, and accessories required for complete installation.

   a. Positive Dead Stop: Coordinated with hold-open angle if any, or at angle selected.

3. Opening-Force Requirements:
   a. Egress Doors: Not more than 15 lbf (67 N) to release the latch and not more than 30 lbf (133 N) to set the door in motion.
   b. Accessible Interior Swinging Doors: Not more than 5 lbf (22.2 N) to fully open door.

C. Push-Pull Set: As selected from manufacturer's full range.

D. Active-Leaf Locksets: Mag-lock, refer to Security Drawings, Coordinate.

E. Inactive-Leaf Locksets: Mag-lock, refer to Security Drawings, Coordinate.

F. Exit Devices: UL 305.

1. Function: Operation by push-pull when mag-lock is disengaged.
2. Latching: No latch, mag-lock only
3. Provide exit devices on both leaves of pairs of doors.

G. Electromagnetic Locks: BHMA A156.23; electrically powered; with electromagnet attached to frame and armature plate attached to door; full-exterior or full-interior type, as required by application indicated.
1. Provide compatible power supply; coordinate with Control System specified elsewhere.

2. Acceptable Manufacturers:
   a. Hager Companies, Model 2941 or Approved Equal
   b. Dorma
   c. Securitron Magnalock Corp
   d. Or Approved Equal

H. Threshold: No threshold, existing floor to remain.

2.6 FABRICATION

A. Provide holes and cutouts in glass to receive hardware, fittings, and accessory fittings before tempering glass. Do not cut, drill, or make other alterations to glass after tempering.

   1. Fully temper glass using horizontal (roller-hearth) process, and fabricate so that when glass is installed, roll-wave distortion is parallel with bottom edge of door or lite.

B. Factory assemble components and factory install hardware and fittings to greatest extent possible.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

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

3.2 INSTALLATION

A. Install all-glass systems and associated components according to manufacturer's written instructions.

B. Set units level, plumb, and true to line, with uniform joints.

C. Maintain uniform clearances between adjacent components.

D. Lubricate hardware and other moving parts according to manufacturer's written instructions.

E. Set, seal, and grout floor closer cases as required to suit hardware and substrate indicated.

3.3 ADJUSTING AND CLEANING

A. Adjust all-glass entrance doors and hardware to produce smooth operation and tight fit at contact points and weather stripping.
1. For all-glass entrance doors accessible to people with disabilities, adjust closers to provide a three-second closer sweep period for doors to move from a 70-degree open position to 3 inches (75 mm) from the latch measured to the leading door edge.

B. Remove excess sealant and glazing compounds and dirt from surfaces.

END OF SECTION 084126
SECTION 087100 - DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Mechanical door hardware for swinging doors.
2. Electrified door hardware.

B. Related Requirements:
1. Section 081213 "Hollow Metal Frames"
2. Section 081416 "Flush Wood Doors" for items provided as part of labeled fire-rated assemblies.
3. Section 083323 "Overhead Coiling Doors" for door hardware provided as part of overhead coiling door assemblies.
4. Section 084126 "All-Glass Entrances" for entrance door hardware.
5. Section 281000 "Access Control System" for access control devices installed at door openings and provided as part of a security system.

1.2 COORDINATION

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

B. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.

C. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.

D. Existing Openings: Where hardware components are scheduled for application to existing construction or where modifications to existing door hardware are required, field verify existing conditions and coordinate installation of door hardware to suit opening conditions and to provide proper door operation.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site to review existing adjacent hardware.

1. Conference participants shall include Installer's Architectural Hardware Consultant and security vendor.
1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For electrified door hardware.
   1. Include diagrams for power, signal, and control wiring.
   2. Include details of interface of electrified door hardware and building safety and security systems.

C. Samples: For each exposed product in each finish specified, in manufacturer's standard size.
   1. Tag Samples with full product description to coordinate Samples with door hardware schedule.

D. Door Hardware Schedule: Prepared by or under the supervision of Installer's Architectural Hardware Consultant. Coordinate door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
   1. Submittal Sequence: Submit door hardware schedule with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate the fabrication of other work that is critical in Project construction schedule.
   2. Format: Use same scheduling sequence and format as in door hardware schedule in the Contract Documents.
   3. Content: Include the following information:
      a. Identification number, location, hand, fire rating, size, and material of each door and frame.
      b. Locations of each door hardware set, cross-referenced to Drawings on floor plans and to door and frame schedule.
      c. Complete designations, including name and manufacturer, type, style, function, size, quantity, function, and finish of each door hardware product.
      d. Description of electrified door hardware sequences of operation and interfaces with other building control systems.
      e. Fastenings and other installation information.
      f. Explanation of abbreviations, symbols, and designations contained in door hardware schedule.
      g. Mounting locations for door hardware.
      h. List of related door devices specified in other Sections for each door and frame.

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

A. Product Certificates: For each type of electrified door hardware.
   1. Certify that door hardware for use on each type and size of labeled fire-rated doors complies with listed fire-rated door assemblies.

B. Product Test Reports: For compliance with accessibility requirements, for tests performed by manufacturer and witnessed by a qualified testing agency, for door hardware on doors located in accessible routes.

C. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of door hardware to include in maintenance manuals.

B. Schedules: Final schedule.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Supplier of products and an employer of workers trained and approved by product manufacturers and of an Architectural Hardware Consultant who is available during the course of the Work to consult Contractor, Architect, and Owner about door hardware and keying.
   1. Warehousing Facilities: In Project's vicinity.
   2. Scheduling Responsibility: Preparation of door hardware and keying schedule.
   3. Engineering Responsibility: Preparation of data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

B. Architectural Hardware Consultant Qualifications: A person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and who is currently certified by DHI as an Architectural Hardware Consultant (AHC) or an Electrified Hardware Consultant (EHC).

1.8 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.

B. Tag each item or package separately with identification coordinated with the final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.

C. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.
1.9 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Structural failures including excessive deflection, cracking, or breakage.
   b. Faulty operation of doors and door hardware.
   c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.

2. Warranty Period: Three years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain each type of door hardware from single manufacturer.

1. Provide electrified door hardware from same manufacturer as mechanical door hardware unless otherwise indicated. Manufacturers that perform electrical modifications and that are listed by a testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.

2.2 PERFORMANCE REQUIREMENTS

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

B. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that complies with requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.

1. Air Leakage Rate: Maximum air leakage of 0.3 cfm/sq. ft. (3 cu. m per minute/sq. m) at the tested pressure differential of 0.3-inch wg (75 Pa) of water.

C. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Means of Egress Doors: Latches do not require more than 15 lbf (67 N) to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.

E. Accessibility Requirements: For door hardware on doors in an accessible route, comply with ICC A117.1.
1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf (22.2 N).
2. Comply with the following maximum opening-force requirements:
   a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf (22.2 N) applied perpendicular to door.
   b. Sliding or Folding Doors: 5 lbf (22.2 N) applied parallel to door at latch.
   c. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.
3. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch (13 mm) high.
4. Adjust door closer sweep periods so that, from an open position of 90 degrees, the door will take at least 5 seconds to move to a position of 12 degrees from the latch.
5. Adjust spring hinges so that, from an open position of 70 degrees, the door will take at least 1.5 seconds to move to the closed position.

2.3 SCHEDULED DOOR HARDWARE

A. Provide products for each door that comply with requirements indicated in Part 2 and door hardware schedule.

1. Door hardware is scheduled in Part 3 and on Drawings.

2.4 HINGES

A. Hinges: BHMA A156.1.

B. Acceptable Manufacturers:

<table>
<thead>
<tr>
<th>Acceptable Manufacturers</th>
<th>Standard Weight</th>
<th>Heavy Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Hager Companies</td>
<td>BB1279</td>
<td>BB1168</td>
</tr>
<tr>
<td>2. Bommer</td>
<td>BB5000</td>
<td>BB5004</td>
</tr>
<tr>
<td>3. McKinney</td>
<td>TA2714</td>
<td>T4A3786</td>
</tr>
<tr>
<td>4. Or Approved Equal</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2.5 MECHANICAL LOCKS AND LATCHES

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

B. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:

1. Bored Locks: Minimum 1/2-inch (13-mm) latchbolt throw.

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

D. Lock Trim:
1. Description: Per Schedule in Part 3.
2. Levers: Cast.
4. Dummy Trim: Match lever lock trim and escutcheons.

E. Strikes: Provide manufacturer's standard strike for each lock bolt or latchbolt complying with requirements indicated for applicable lock or latch and with strike box and curved lip extended to protect frame; finished to match lock or latch.

F. Mortise Locks: BHMA A156.13; Operational Grade 1; stamped steel case with steel or brass parts; Series 1000.

G. Acceptable Manufacturers
1. Best 93K Series
2. Hager Companies: 3400 Series
3. Schlage: ND Series
4. Or Approved Equal

2.6 ELECTRIC STRIKES

A. Electric Strikes: BHMA A156.31; Grade 1; with faceplate to suit lock and frame.

B. Provide compatible power supply; coordinate with Control System specified elsewhere.

C. Acceptable Manufacturers:
1. Adams Rite Manufacturing
2. Hager Companies
3. Stanley Commercial Hardware
4. Or Approved Equal

2.7 ELECTROMAGNETIC LOCKS

1. Refer to Section 084226 “All Glass Entraces”.

2.8 EXIT DEVICES AND AUXILIARY ITEMS

A. Exit Devices and Auxiliary Items: BHMA A156.3. Grade 1

B. Acceptable Manufacturers
1. Hager Companies
2. Von Duprin
3. Sargent
4. Yale
5. Or Approved Equal
2.9 LOCK CYLINDERS

A. Lock Cylinders: Reuse Existing. Coordinate with Building Maintenance Staff.

2.10 SURFACE CLOSERS

A. Surface Closers: BHMA A156.4; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves and forged-steel main arm. Comply with manufacturer's written instructions for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.

B. Closers shall meet and be adjusted to meet requirements for ADA Compliance, ANSI A117.1.

C. Closers shall all requirements for fire rating specified on drawings.

D. Acceptable Manufacturers:
   1. Hager Companies: 5200 Series
   2. Norton: 8000 Series
   3. Sargent: 1330 Series
   4. Or Approved Equal

2.11 MECHANICAL STOPS AND HOLDERS

A. Wall- and Floor-Mounted Stops: BHMA A156.16. Provide door stops wherever necessary to prevent door or hardware from striking an adjacent partition or obstruction. Door stops and holders mounted in concrete floor or masonry walls shall have stainless steel machine screens lead expansion shields.

B. Acceptable Manufacturers:
   Convex Concave
   1. Hager Companies 232W 236W
   2. Rockwood
   3. Burns
   4. Or Approved Equal

2.12 ELECTROMAGNETIC STOPS AND HOLDERS


2.13 OVERHEAD STOPS AND HOLDERS

A. Overhead Stops and Holders: BHMA A156.8. Grade 1. Provide overhead stop and holders for doors that may open against equipment, casework sidelights and other objects that would make wall stops/holders and floor stops/holders inappropriate. Provide sex bolt attachments for mineral core wood door applications.
B. Acceptable Manufacturers:

<table>
<thead>
<tr>
<th></th>
<th>Heavy Duty Surface</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Hager Companies</td>
<td>7000 SRF Series</td>
</tr>
<tr>
<td>2. Glynn Johnson</td>
<td>90 Series</td>
</tr>
<tr>
<td>3. Sargent</td>
<td>590 Series</td>
</tr>
<tr>
<td>4. Or Approved Equal</td>
<td></td>
</tr>
</tbody>
</table>

2.14 DOOR GASKETING

A. Door Gasketing: BHMA A156.22; with resilient or flexible seal strips that are easily replaceable and readily available from stocks maintained by manufacturer.

B. Maximum Air Leakage: When tested according to ASTM E283 with tested pressure differential of 0.3-inch wg (75 Pa), as follows:

1. Smoke-Rated Gasketing: 0.3 cfm/sq. ft. (3 cu. m per minute/sq. m) of door opening.
2. Gasketing on Single Doors: 0.3 cfm/sq. ft. (3 cu. m per minute/sq. m) of door opening.

2.15 THRESHOLDS

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

2.16 KICK PLATE TRIM

A. Auxiliary Hardware: BHMA A156.6. On Single Doors match door width less two inches on push side, and less one-half inch on the pull side.

1. Height: 8”
2. Corners: Square, Polished
3. Edges: Beveled, Polished, De-burred for no sharp edges
4. Screws: Countersunk; 1/2-inch from edges, 8” Max spacing, Equal Spacing
5. UL Rating: Install at Base of Door in compliance with Door Manufacturer requirements to meet Fire Rating specified.

B. Acceptable Manufacturers:

1. Hager Companies: 194S
2. Trimco
3. Burns
4. Or Approved Equal

2.17 FABRICATION

A. Base Metals: Produce door hardware units of base metal indicated, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18.
B. Fasteners: Provide door hardware manufactured to comply with published templates prepared for machine, wood, and sheet metal screws. Provide screws that comply with commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware unless otherwise indicated.
   1. Fire-Rated Applications:
      a. Wood or Machine Screws: For the following:
         1) Hinges mortised to doors or frames.
         2) Strike plates to frames.
         3) Closers to doors and frames.
      b. Steel Through Bolts: For the following unless door blocking is provided:
         1) Surface hinges to doors.
         2) Closers to doors and frames.
         3) Surface-mounted exit devices.
   2. Spacers or Sex Bolts: For through bolting of hollow-metal doors.
   3. Gasketing Fasteners: Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

2.18 FINISHES

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

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance of the Work.
B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.
C. Proceed with installation only after unsatisfactory conditions have been corrected.
3.2 PREPARATION

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

B. Wood Doors: Comply with door and hardware manufacturers' written instructions.

3.3 INSTALLATION

A. Mounting Heights: Mount door hardware units at heights to comply with the following unless otherwise indicated or required to comply with governing regulations.
   1. Wood Doors: DHI's "Recommended Locations for Architectural Hardware for Wood Flush Doors."

B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work. Do not install surface-mounted items until finishes have been completed on substrates involved.
   1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
   2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

C. Hinges: Install types and in quantities indicated in door hardware schedule, but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30 inches (750 mm) of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.

D. Intermediate Offset Pivots: Where offset pivots are indicated, provide intermediate offset pivots in quantities indicated in door hardware schedule, but not fewer than one intermediate offset pivot per door and one additional intermediate offset pivot for every 30 inches (750 mm) of door height greater than 90 inches (2286 mm).

E. Lock Cylinders: Install construction cores to secure building and areas during construction period.
   1. Replace construction cores with permanent cores.

F. Key Control System:
   1. Key Control Cabinet: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.
   2. Key Lock Boxes: Install where indicated or approved by Architect to provide controlled access for fire and medical emergency personnel.
   3. Key Control System Software: Set up multiple-index system based on final keying schedule.
G. Boxed Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings. Verify location with Architect.
   1. Configuration: Provide one power supply for each door opening with electrified door hardware.

H. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they will impede traffic.

I. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
   1. Do not notch perimeter gasketing to install other surface-applied hardware.

J. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.

K. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

3.4 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
   1. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.
   2. Spring Hinges: Adjust to achieve positive latching when door is allowed to close freely from an open position of 70 degrees and so that closing time complies with accessibility requirements of authorities having jurisdiction.
   3. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.

B. Occupancy Adjustment: Approximately six months after date of Substantial Completion, Installer's Architectural Hardware Consultant shall examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors, door hardware, and electrified door hardware.

3.5 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items as necessary to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.
3.6 MAINTENANCE SERVICE

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

3.7 DOOR HARDWARE SCHEDULE

DOOR G (Sheet A-101):
See Notes on A-101.
See Specification Section 084126 "All-Glass Entrances".

DOOR H (Quantity 2; Sheet A-101):

<table>
<thead>
<tr>
<th>QTY</th>
<th>TYPE</th>
<th>DESCRIPTION</th>
<th>FINISH</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Electric Strike</td>
<td>Hager 2925 or Approved Equal US32D</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Other Hardware</td>
<td>Reuse Existing</td>
<td></td>
</tr>
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</table>

DOOR X (Sheet A-103):

<table>
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<th>QTY</th>
<th>TYPE</th>
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<tbody>
<tr>
<td>3</td>
<td>Hinges</td>
<td>Ball Bearing, 5” x 4.5” US26D</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Rim Exit Device</td>
<td>Hager BB1168 5” X4.5” or Appd Equal US26D</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Stair-side Handle</td>
<td>Passage US26D</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Cylinders/Core</td>
<td>Blank, Non-locking</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Strike</td>
<td>Yes US26D</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Kick Plate</td>
<td>Hager 194S or Approved Equal US32D</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Silencers</td>
<td>Hager 307D or Approved Equal Grey</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Closer</td>
<td>Hager 5200 or Approved Equal Alum</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>FA Hold Open</td>
<td>Reuse Existing</td>
<td></td>
</tr>
</tbody>
</table>

DOOR Y (Sheet A-103):
Existing Door Removed.
Provide Plank Plates at Hinge and Strike Cutouts.

DOOR Z (Sheet A-103):

<table>
<thead>
<tr>
<th>QTY</th>
<th>TYPE</th>
<th>DESCRIPTION</th>
<th>FINISH</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Hinges</td>
<td>Hager BB1168, 5” x 4.5” or Appd Equal US26D</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Rim Exit Device</td>
<td>Reuse Existing</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Outside Cyl/Core</td>
<td>Reuse Existing</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Inside Cyl/Core</td>
<td>Provide Blank (No Dog-down) US26D</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Auto Operator</td>
<td>Reuse Existing</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Kick Plate</td>
<td>Hager 194S or Approved Equal US32D</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Silencers</td>
<td>Hager 307D or Approved Equal Grey</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Electric Strike</td>
<td>Reuse Existing</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Card Reader</td>
<td>Reuse Existing</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Actuators</td>
<td>Reuse Existing</td>
<td></td>
</tr>
</tbody>
</table>

END OF SECTION 087100
SECTION 088000 - GLAZING

PART 1 - GENERAL

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

1.2 SUMMARY
   A. Section includes:
      1. Glass for storefront windows and doors.
      2. Glazing sealants and accessories.
      3. Security film on new & existing glazing
   B. Related Requirements:
      1. Section 084113 “Aluminum-Framed Entrances and Storefronts”
      2. Section 084226 "All-Glass Entrances."
      3. Section 088813 “Fire-Resistant Glazing”

1.3 DEFINITIONS
   A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.
   B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C1036.
   D. Interspace: Space between lites of an insulating-glass unit.

1.4 COORDINATION
   A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

1.5 PREINSTALLATION MEETINGS
   A. Preinstallation Conference: Conduct conference at Project site.
1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

2. Review temporary protection requirements for glazing during and after installation.

1.6 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Glass Samples: For each type of the following products; 12 inches (300 mm) square.
   1. Insulating glass.
   2. Monolithic glass with security film applied

C. Glazing Accessory Samples: For sealants and colored spacers, in 12-inch (300-mm) lengths.

D. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

E. Delegated-Design Submittal: For glass indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.7 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: For glass and film.

C. Product Test Reports: For insulating glass, tempered glass, security film, and glazing sealants, for tests performed by a qualified testing agency.
   1. For glazing sealants, provide test reports based on testing current sealant formulations within previous 36-month period.

D. Preconstruction adhesion and compatibility test report.

E. Sample Warranties: For special warranties.

1.8 QUALITY ASSURANCE

A. Manufacturer Qualifications for Insulating-Glass Units with Sputter-Coated, Low-E Coatings: A qualified insulating-glass manufacturer who is approved and certified by coated-glass manufacturer.

B. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.
C. Film Installer Qualifications: Installed by manufacturer or approved by manufacturer, experienced in performing work of this section, and specialized in installation of work similar to that required for this project.

D. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C1021 to conduct the testing indicated.

E. Mockups: Build mockups to demonstrate aesthetic effects and to set quality standards for materials and execution.
   1. Install glazing in mockups if specified in Section 084113 "Aluminum-Framed Entrances and Storefronts" to match glazing systems required for Project, including glazing methods.
   2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

1.10 FIELD CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

1.11 WARRANTY

A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.
   1. Warranty Period: 10 years from date of Substantial Completion.

B. Manufacturer's Special Warranty for Insulating Glass: Manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.
   1. Warranty Period: 10 years from date of Substantial Completion.

C. Manufacturer’s Special Warranty for Security Film:
1. Manufacturer agrees to replace film due to defects in installation for a period of one year from date of Substantial Completion.
2. Manufacturer agrees to replace film due to defects in materials of security film for a period of fifteen years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Glass Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Guardian Glass; SunGuard.
2. Oldcastle BuildingEnvelope™.
4. Viracon, Inc.
5. Or Approved Equal

B. Source Limitations for Glass: Obtain from single source from single manufacturer for each glass type.

1. Obtain tinted glass from single source from single manufacturer.
2. Obtain reflective-coated glass from single source from single manufacturer.

C. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.

2.2 PERFORMANCE REQUIREMENTS

A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Delegated Design: Engage a qualified professional engineer to design glazing.

C. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined according to the IBC and ASTM E1300.

1. Design Wind Pressures: As indicated on Drawings.
2. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or 1 inch (25 mm), whichever is less.

D. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.
E. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:

1. For monolithic-glass lites, properties are based on units with lites [6 mm thick] [of thickness indicated].
2. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
3. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F (W/sq. m x K).
4. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
5. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

2.3 GLASS PRODUCTS, GENERAL

A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.


B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.

D. Thickness: Provide glass that complies with performance requirements and is not less than the thickness indicated.

1. Minimum Glass Thickness for Exterior Lites: 6 mm.

E. Strength: Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass. Where fully tempered float glass is indicated, provide fully tempered float glass.

2.4 GLASS PRODUCTS

A. Clear Annealed Float Glass: ASTM C1036, Type I, Class 1 (clear), Quality-Q3.

B. Tinted Annealed Float Glass: ASTM C1036, Type I, Class 2 (tinted), Quality-Q3.
C. Fully Tempered Float Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.

1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

D. Heat-Strengthened Float Glass: ASTM C1048, Kind HS (heat strengthened), Type I, Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.

E. Silicone-Coated Spandrel Glass: ASTM C1048, Type I, Condition C, Quality-Q3.

2.5 INSULATING GLASS

A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E2190.

1. Sealing System: Dual seal, with manufacturer's standard primary and secondary sealants.
2. Perimeter Spacer: Aluminum with mill or clear anodic finish or Aluminum with black, color anodic finish, as chosen by Architect.
3. Desiccant: Molecular sieve or silica gel, or a blend of both.

2.6 GLAZING SEALANTS

A. General:

1. Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
3. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.

2.7 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C1281 and AAMA 800 for products indicated below:

1. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:
1. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.
2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.8 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, with requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks:
   1. EPDM, Silicone, Neoprene, or Santoprene with a Shore A durometer hardness of 85, plus or minus 5.
   2. Type recommended by sealant or glass manufacturer.

D. Spacers:
   1. Neoprene blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
   2. Type recommended by sealant or glass manufacturer.

E. Edge Blocks:
   1. EPDM, Silicone, Neoprene, or Santoprene with a Shore A durometer hardness per manufacturer's written instructions.
   2. Type recommended by sealant or glass manufacturer.

F. Cylindrical Glazing Sealant Backing: ASTM C1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

2.9 SECURITY FILM (On Glazing Types [GL-3] and [GL-4])

A. Security Film Manufacturers: Provide film meeting the performance requirements listed.

B. General: Provide security glazing film on existing and new glass noted on Drawings.

C. Film shall meet the following criteria:
   a. Thickness: 6 mils minimum
   b. Color: Clear

D. Film shall meet the following performance requirements:
a. Tensile Strength: 32,000 psi (ASTM D882)

b. Impact Safety Rating: Class A, Unlimited Size (ANSI Z97.1)

c. Impact Safety Rating: Category II (CPSC 16 CFR 1201)

d. Visible Light Transmittance: 80 percent minimum (ASTM E903)

2.10 FABRICATION OF GLAZING UNITS

G. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.

   a. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C).

H. Grind smooth and polish exposed glass edges and corners.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:

   1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
   2. Presence and functioning of weep systems.
   3. Minimum required face and edge clearances.
   4. Effective sealing between joints of glass-framing members.

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

3.2 PREPARATION

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

B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that leave visible marks in the completed Work.
3.3 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.

C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

F. Provide spacers for glass lites where length plus width is larger than 50 inches (1270 mm).
   1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
   2. Provide 1/8-inch (3-mm) minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

I. Set glass lites with proper orientation so that coatings face exterior or interior as specified.

3.4 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Cover vertical framing joints by applying tapes to heads and sills first, then to jambs. Cover horizontal framing joints by applying tapes to jambs, then to heads and sills.
D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Do not remove release paper from tape until right before each glazing unit is installed.

F. Center glass lites in openings on setting blocks, and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

3.5 GASKET GLAZING (DRY)

A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

E. Install gaskets so they protrude past face of glazing stops.

3.6 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.
3.7 SECURITY FILM

A. Confirm in writing with new glass manufacturers that film is acceptable and will not void any warranties.

B. Prepare Glass Surface per film manufacturer’s instructions.

C. Install film per manufacturer’s instructions. Accurately fit, align, securely fasten and install free from distortion or defects. Layout film so there are no seams.

3.8 CLEANING AND PROTECTION

A. Immediately after installation remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.

1. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.

C. Remove and replace glass that is damaged during construction period.

D. Wash glass on both exposed surfaces not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

E. On glass with security film: Clean according to film manufacturer’s instruction and:

1. Do not clean security film for 30 days after installation to allow sufficient time for proper curing of film adhesive to glass surfaces.
2. Do not use bristle brushes, scrubbing sponges, abrasive cleaners, pads, or other cleaning material that could scratch the film.

3.9 MONOLITHIC GLASS SCHEDULE

A. Glass Type [GL-3]: Clear fully tempered float glass.

1. Minimum Thickness: 8 mm.
2. Safety glazing required.
3. Security film required

3.10 INSULATING GLASS SCHEDULE

A. Glass Type [GL-1]: Low-E-coated, clear insulating glass.
1. Overall Unit Thickness: 1 inch (25 mm).
2. Minimum Thickness of Each Glass Lite: 5 mm.
3. Outdoor Lite: Fully tempered float glass.
4. Interspace Content: Argon.
5. Indoor Lite: Fully tempered float glass.
6. Low-E Coating: Pyrolytic or sputtered on second or third.
7. U-Factor: 0.38 maximum.
10. Safety glazing required.

B. Glass Type [GL-2]: Silicone-coated, low-E, insulating spandrel glass.

1. Coating Color: As selected by Architect from manufacturer's full range.
2. Overall Unit Thickness: 1 inch (25 mm).
3. Minimum Thickness of Each Glass Lite: 5 mm.
4. Outdoor Lite: Fully tempered float glass.
5. Interspace Content: Argon.
6. Indoor Lite: Fully tempered float glass.
7. Low-E Coating: Pyrolytic or sputtered on second or third surface.
8. Opaque Coating Location: Fourth surface.
9. U-Factor: 0.38 maximum.

END OF SECTION 088000
SECTION 088813 - FIRE-RESISTANT GLAZING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Fire-protection-rated glazing (Less than 100 square inches).
   2. Fire-resistance-rated glazing (Greater than 100 square inches).

1.3 DEFINITIONS

A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C1036.

1.4 COORDINATION

A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For installers and glass testing agency.

B. Product Certificates: For each type of glass and glazing product, from manufacturer.

C. Sample Warranties: For special warranties.
1.7 QUALITY ASSURANCE

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

1.8 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

1.9 WARRANTY

A. Manufacturer's Special Warranty on Laminated Glass: Manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.

1. Warranty Period: Five years from date of Substantial Completion.

B. Manufacturer's Special Warranty on Double Glazing Units with Clear Gel Fill: Manufacturer agrees to replace units that deteriorate within specified warranty period. Deterioration of double glazing units with clear gel fill is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning glass contrary to manufacturer's written instructions. Evidence of failure is the leakage of gel fill from units, air bubbles within units, or obstruction of vision by contamination or deterioration of gel.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Glass: Obtain from single source from single manufacturer for each glass type.

B. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.

2.2 PERFORMANCE REQUIREMENTS

A. General: Installed glazing systems shall withstand normal thermal movement and impact loads (where applicable) without failure, including loss or glass breakage attributable to the
following: defective manufacture, fabrication, or installation; deterioration of glazing materials; or other defects in construction.

2.3 GLASS PRODUCTS, GENERAL

A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organization below unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.


B. Safety Glazing Labeling: Permanently mark glazing with certification label of the Safety Glazing Certification Council. Label shall indicate manufacturer's name, type of glass, glass thickness, and safety glazing standard with which glass complies.

2.4 GLASS PRODUCTS

A. Float Glass: ASTM C1036, Type I, Quality-Q3, Class I (clear) unless otherwise indicated.

B. Ultraclear Float Glass: ASTM C1036, Type I, Quality-Q3, Class I (clear), with visible light transmission not less than 91 percent.

C. Tempered Float Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class I (clear) unless otherwise indicated, Quality-Q3.

1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

D. Laminated Glass: ASTM C1172. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.

1. Construction: Laminate glass with polyvinyl butyral interlayer unless fire-protection or fire-resistance rating is based on another product.
2. Interlayer Thickness: Provide thickness as needed to comply with requirements.
3. Interlayer Color: Clear unless otherwise indicated.

2.5 FIRE-PROTECTION-RATED GLAZING [GL-5] (LESS THAN 100 SQUARE INCHES)

A. Fire-Protection-Rated Glazing: Listed and labeled by a testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on positive-pressure testing according to NFPA 257 or UL 9, including the hose-stream test, and shall comply with NFPA 80.

B. Fire-Protection-Rated Glazing Labeling: Permanently mark fire-protection-rated glazing with certification label of a testing agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name; test standard; whether glazing is permitted to be used in doors or
openings; if permitted in openings, whether or not glazing has passed the hose-stream test; whether or not glazing meets 450 deg F (250 deg C) temperature-rise limitation; and the fire-resistance rating in minutes.

C. Film-Faced Ceramic Glazing: Clear, ceramic flat glass; 5-mm thickness; faced on one surface with a clear glazing film; and complying with 16 CFR 1201, Category II.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. SAFTI FIRST Fire Rated Glazing Solutions.
   b. Schott North America, Inc.
   c. Technical Glass Products.
   d. Or Approved Equal.

D. Laminated Ceramic Glazing: Laminated glass made from two plies of clear, ceramic glass; 8-mm total thickness; and complying with 16 CFR 1201, Category II.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. SAFTI FIRST Fire Rated Glazing Solutions.
   b. Schott North America, Inc.
   c. Technical Glass Products.
   d. Or Approved Equal.

2.6 FIRE-RESISTANCE-RATED GLAZING [GL-6] (GREATER THAN 100 SQUARE INS)

A. Fire-Resistance-Rated Glazing: Listed and labeled by a testing agency acceptable to authorities having jurisdiction, for fire-resistance ratings indicated, based on testing according to ASTM E119 or UL 263.

B. Fire-Resistance-Rated Glazing Labeling: Permanently mark fire-resistance-rated glazing with certification label of a testing agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, test standard, that the glazing is approved for use in walls, and the fire-resistance rating in minutes.

C. Laminated Glass with Intumescent Interlayers: Laminated glass made from multiple plies of uncoated, ultraclear float glass; with intumescent interlayers; and complying with 16 CFR 1201, Category II.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   b. SAFTI FIRST Fire Rated Glazing Solutions.
   c. Technical Glass Products.
   d. Or Approved Equal.
D. Double Glazing Units with Clear Gel Fill: Double glazing units made from two lites of uncoated, fully tempered, ultraclear float glass; with a perimeter edge seal enclosing a cavity filled with optically clear, intumescent gel; and complying with 16 CFR 1201, Category II.

2.7 GLAZING ACCESSORIES

A. Provide glazing gaskets, glazing sealants, glazing tapes, setting blocks, spacers, edge blocks, and other glazing accessories that are compatible with glazing products and each other and are approved by testing agencies that listed and labeled fire-resistant glazing products with which products are used for applications and fire-protection ratings indicated.

B. Glazing Sealants for Fire-Rated Glazing Products: Neutral-curing silicone glazing sealant complying with ASTM C920, Type S, Grade NS, Class 50, Use NT. Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated.

1. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.

C. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C1281 and AAMA 800 for products indicated below:

1. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
2. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

D. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:

1. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.
2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.8 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Perimeter Insulation for Fire-Resistive Glazing: Product that is approved by testing agency that listed and labeled fire-resistant glazing product with which it is used for application and fire-protection rating indicated.
2.9 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing, glazing channels, and stops, with Installer present, for compliance with manufacturing and installation tolerances, including those for size, squareness, and offsets at corners, and for compliance with minimum required face and edge clearances.

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

3.2 PREPARATION

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

B. Examine glazing units to locate fire side and protected side. Label or mark units as needed so that fire side and protected side are readily identifiable. Do not use materials that leave visible marks in the completed work.

3.3 GLAZING, GENERAL

A. Use methods approved by testing agencies that listed and labeled fire-resistant glazing products.

B. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials unless more stringent requirements are indicated, including those in referenced glazing publications.

C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
G. Provide spacers for glass lites where length plus width is larger than 50 inches (1270 mm).

1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.

2. Provide 1/8-inch (3-mm) minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

I. Set glass lites with proper orientation so that coatings face fire side or protected side as specified.

J. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.4 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Do not remove release paper from tape until right before each glazing unit is installed.

F. Apply heel bead of elastomeric sealant.

G. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 GASKET GLAZING (DRY)

A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
B. Insert soft compression gasket between glass and frame or fixed stop, so it is securely in place with joints miter cut and bonded together at corners.

C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

D. Install gaskets so they protrude past face of glazing stops.

3.6 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial washaway from glass.

3.7 CLEANING AND PROTECTION

A. Immediately after installation, remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.

1. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer.

C. Remove and replace glass that is damaged during construction period.

D. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

END OF SECTION 088813
SECTION 092216 - NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Non-load-bearing steel framing systems for interior partitions.

B. Not included, contact Architect if added to project for revised specifications.

1. Suspension systems for interior ceilings and soffits.

2. Grid suspension systems for gypsum board ceilings.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

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

1.5 QUALITY ASSURANCE

A. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of the Certified Steel Stud Association, the Steel Framing Industry Association, or the Steel Stud Manufacturers Association.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, according to ASTM E119 by an independent testing agency.
B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated on Drawings, according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.

C. Horizontal Deflection: For wall assemblies, limited to 1/240 of the wall height based on horizontal loading of 10 lbf/sq. ft. (480 Pa).

2.2 FRAMING SYSTEMS

A. Framing Members, General: Comply with ASTM C754 for conditions indicated.
   1. Steel Sheet Components: Comply with ASTM C645 requirements for steel unless otherwise indicated.

B. Studs and Tracks: ASTM C645. Use either conventional steel studs and tracks or embossed, high-strength steel studs and tracks.
   1. Steel Studs and Tracks:
      a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
         1) CEMCO; California Expanded Metal Products Co.
         2) ClarkDietrich.
         3) Custom Stud.
         4) Jaimes Industries.
         5) MarinoWARE.
         6) MBA Building Supplies.
         7) MRI Steel Framing, LLC.
         8) Phillips Manufacturing Co.
         9) SCAF CO Steel Stud Company.
         10) Steel Construction Systems.
         11) Telling Industries.
         12) Or Approved Equal
      b. Minimum Base-Steel Thickness: As required by performance requirements for horizontal deflection.
      c. Depth: As indicated on Drawings.
   2. Embossed, High Strength Steel Studs and Tracks: Roll-formed and embossed with surface deformations to stiffen the framing members so that they are structurally comparable to conventional ASTM C645 steel studs and tracks.
      a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
         1) CEMCO; California Expanded Metal Products Co.
         2) ClarkDietrich.
3) MarinoWARE.
4) MBA Building Supplies.
5) Phillips Manufacturing Co.
6) SCAFCO Steel Stud Company.
7) Steel Construction Systems.
8) Telling Industries.
9) Or Approved Equal

b. Minimum Base-Steel Thickness: As required by horizontal deflection performance requirements.
c. Depth: As indicated on Drawings.

C. Slip-Type Head Joints: Where indicated, provide one of the following:

1. Clip System: Clips designed for use in head-of-wall deflection conditions that provide a positive attachment of studs to tracks while allowing 1-1/2-inch (38-mm) minimum vertical movement.

2. 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.

2.3 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 one of the following:


2. 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.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.

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

A. Coordination with Sprayed Fire-Resistive Materials:
   1. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of non-load-bearing steel framing. Do not reduce thickness of fire-resistant materials below that are required for fire-resistance ratings indicated. Protect adjacent fire-resistant materials from damage.

3.3 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.

3.4 INSTALLING FRAMED ASSEMBLIES

A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
   2. Multilayer Application: As required by horizontal deflection performance requirements unless otherwise indicated.

B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

C. Install studs so flanges within framing system point in same direction.
D. Install tracks at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts that penetrate partitions above ceiling.

1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.

2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install track section (for cripple studs) at head and secure to jamb studs.
   a. Install two studs at each jamb unless otherwise indicated.
   b. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.

3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.

4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
   a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.

5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.

E. Direct Furring:

1. Screw to wood framing.
2. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches (610 mm) o.c.

F. Z-Shaped Furring Members:

1. Erect insulation, specified in Section 072100 "Thermal Insulation," vertically and hold in place with Z-shaped furring members spaced 24 inches (610 mm) o.c.
2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches (610 mm) o.c.
3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches (305 mm) from corner and cut insulation to fit.

G. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch (3 mm) from the plane formed by faces of adjacent framing.

END OF SECTION 092216
SECTION 092300 - GYPSUM PLASTERING

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. Gypsum plastering on expanded-metal lath.

B. Related Requirements:
   1. Section 092216 "Non-Structural Metal Framing".

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show locations and installation of control and expansion joints, including plans, elevations, sections, details of components, and attachments to other work.

1.4 QUALITY ASSURANCE

A. Mockups: Build mockups to demonstrate aesthetic effects and to set quality standards for materials and execution.
   1. Build mockups for each substrate and finish texture indicated for gypsum plastering, including accessories.
      a. Size: 100 sq. ft. (9 sq. m) in surface area.
   2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store materials inside under cover, and keep them dry and protected against damage from weather, moisture, direct sunlight, contamination, corrosion, construction traffic, and other causes.
1.6 FIELD CONDITIONS

A. Comply with ASTM C842 requirements or gypsum plaster manufacturer's written recommendations, whichever are more stringent.

B. Room Temperatures: Maintain temperatures at not less than 55 deg F (13 deg C) or greater than 80 deg F (27 deg C) for at least seven days before application of gypsum plaster, continuously during application, and for seven days after plaster has set or until plaster has dried.

C. Avoid conditions that result in gypsum plaster drying out too quickly.
   1. Distribute heat evenly; prevent concentrated or uneven heat on plaster.
   2. Maintain relative humidity levels for prevailing ambient temperature that produce normal drying conditions.
   3. Ventilate building spaces in a manner that prevents drafts of air from contacting surfaces during plaster application and until plaster is dry.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance Ratings: Where indicated, provide gypsum plaster assemblies identical to those of assemblies tested for fire resistance according to ASTM E119 by a qualified testing agency.

2.2 EXPANDED-METAL LATH

   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Alabama Metal Industries Company; a Gibraltar Industries company.
      b. CEMCO; California Expanded Metal Products Co.
      c. ClarkDietrich.
      d. MarinoWARE.
      e. Or Approved Equal

2.3 ACCESSORIES

A. General: Comply with ASTM C841, and coordinate depth of trim and accessories with thicknesses and number of plaster coats required.

B. Metal Accessories:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Alabama Metal Industries Company; a Gibraltar Industries company.
b. CEMCO; California Expanded Metal Products Co.
c. ClarkDietrich.
d. MarinoWARE.
e. Or Approved Equal

4. Cornerbeads: Fabricated from zinc or zinc-coated (galvanized) steel.
   a. Smallnose cornerbead with expanded flanges; use unless otherwise indicated.
   b. Smallnose cornerbead with perforated flanges; use on curved corners.

5. Casing Beads: Fabricated from zinc or zinc-coated (galvanized) steel; square-edged style; with expanded flanges.
6. Control Joints: Fabricated from zinc or zinc-coated (galvanized) steel; one-piece-type, folded pair of unperforated screeds in M-shaped configuration; with perforated flanges and removable protective tape on plaster face of control joint.

2.4 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. Fasteners for Attaching Metal Lath to Substrates: ASTM C841.

C. Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper, not less than 0.0475-inch (1.21-mm) diameter unless otherwise indicated.

D. 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.

2.5 BASE-COAT PLASTER MATERIALS


   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. CertainTeed Corporation.
      b. USG
c. National Gypsum Company.
d. Or Approved Equal

C. Aggregates for Base-Coat Plasters: ASTM C35, sand and perlite.

2.6 FINISH-COAT PLASTER MATERIALS

A. Gypsum Gaging Plaster: ASTM C28/C28M.


C. Gypsum Keene's Cement: ASTM C61/C61M.

D. Aggregates for Float Finishes: ASTM C35, sand; graded according to ASTM C842.

2.7 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 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

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

3.2 PREPARATION

A. Protect adjacent work from soiling, spattering, moisture deterioration, and other harmful effects caused by plastering.
3.3 INSTALLATION, GENERAL

A. Fire-Resistance-Rated Assemblies: Install components according to requirements for design designations from listing organization and publication indicated on Drawings.

3.4 INSTALLING EXPANDED-METAL LATH

A. Expanded-Metal Lath: Install according to ASTM C841.

3.5 INSTALLING ACCESSORIES

A. General: Install according to ASTM C841.

B. Cornerbeads: Install at external corners.

C. Casing Beads: Install at terminations of plasterwork, except where plaster passes behind and is concealed by other work and where metal screeds, bases, or frames act as casing beads.

D. Control Joints: Locate as approved by Architect for visual effect, with spacing between joints in either direction not exceeding the following:

   1. Partitions: 30 feet (9 m).

E. Aluminum Trim: Install according to manufacturer's written instructions.

3.6 PLASTER APPLICATION

A. General: Comply with ASTM C842.

   1. Do not deviate more than plus or minus 1/8 inch in 10 feet (3 mm in 3 m) from a true plane in finished plaster surfaces when measured by a 10-foot (3-m) straightedge placed on surface.

   2. Finish plaster flush with metal frames and other built-in metal items or accessories that act as a plaster ground unless otherwise indicated. Where casing bead does not terminate plaster at metal frame, cut base coat free from metal frame before plaster sets and groove finish coat at junctures with metal.

   3. Provide plaster surfaces that are ready to receive field-applied finishes indicated.

B. Base-Coat Plaster:

   1. Over Expanded-Metal Lath:

      a. Scratch Coat: Gypsum neat plaster with job-mixed sand or High-strength gypsum neat plaster with job-mixed sand.

      b. Brown Coat: Lightweight-gypsum ready-mixed plaster, Gypsum neat plaster with job-mixed sand, Gypsum neat plaster with job-mixed perlite, or High-strength gypsum neat plaster with job-mixed sand.
C. Finish Coats:
   1. Match texture of existing, adjacent walls.
      a. Materials: As suitable to chosen base coat.

3.7 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.

3.8 CLEANING AND PROTECTION
A. Remove temporary protection and enclosure of other work after plastering is complete. Promptly remove plaster from door frames, windows, and other surfaces not indicated to be plastered. Repair floors, walls, and other surfaces stained, marred, or otherwise damaged during plastering.

END OF SECTION 092300
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.
   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. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."

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

C. 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.

D. 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.

E. 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. Contractor will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
   2. Testing agency will perform tests for compliance with product requirements.
   3. Owner may direct Contractor to stop applying 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

1. Institutional Low-Odor/VOC Latex System MPI INT 3.1M:
3.7 GRAPHIC MURAL

A. The Entry Mural shall approximate the following with at least (4) colors including white, two greys, and a red. Exact colors shall be chosen by the Architect from the full range offered by the manufacturer chosen by the General Contractor.

B. Large Missouri Graphic / Mule Mascot Logo: Refer to Section 101423 “Panel Signage”.

C. Dimension Letters: Refer to Section 101423 “Panel Signage”.

D. Small State Graphics: Refer to Section 101423 “Panel Signage.”

END OF SECTION 099123
SECTION 099600 - HIGH-PERFORMANCE COATINGS

PART 1 - GENERAL

1.1 SUMMARY
A. Section includes surface preparation and the application of high-performance coating systems on the following substrates:
   1. Exterior Substrates:
      a. Steel.

B. Related Requirements:
   1. Section 051200 "Structural Steel Framing" for shop priming of structural steel with primers specified in this Section.
   2. Section 055213 "Pipe and Tube Railings" for shop priming pipe and tube railings with coatings specified in this Section.
   3. Section 099123 "Interior Painting" for general field painting.

1.2 DEFINITIONS
A. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D523.

1.3 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 indicated.

C. Samples for Verification: For each type of coating system and each color and gloss of topcoat indicated.
   1. Submit Samples on rigid backing, 12 inches (200 mm) square.
   2. Apply coats on Samples in steps to show each coat required for system.
   3. Label each coat of each Sample.
   4. Label each Sample for location and application area.

D. Product List: Cross-reference to coating system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.
1.4 MAINTENANCE MATERIAL SUBMITTALS

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

   1. Coatings: 2 gal. (3.8 L) of each material and color applied.

1.5 QUALITY ASSURANCE

A. Mockups: Apply mockups of each coating system indicated to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

   1. Architect will select one surface to represent surfaces and conditions for application of each coating system.
      a. Architect will designate items or areas required, 10 sq ft. minimum.

   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.

1.6 DELIVERY, STORAGE, AND HANDLING

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

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

1.7 FIELD CONDITIONS

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

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

C. Do not apply exterior coatings in snow, rain, fog, or mist.
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. PPG Paints.
4. Or Approved Equal

B. Products: Provide one product which meets all of the performance requirements.

2.2 HIGH-PERFORMANCE COATINGS, GENERAL

A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."

B. Material Compatibility:

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

C. Colors: As selected by Architect from manufacturer's full range.

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. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.

C. 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 coating systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

   1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Clean substrates of substances that could impair bond of coatings, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

   1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce coating systems indicated.

D. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer but not less than the following:

   1. SSPC-SP 10/NACE No. 2.

E. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

F. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied coatings.

3.3 APPLICATION

A. Apply high-performance coatings according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."

   1. Use applicators and techniques suited for coating and substrate indicated.
   2. Coat surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, coat surfaces behind permanently fixed equipment or furniture with prime coat only.
   3. Coat backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
   4. Do not apply coatings over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

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

C. Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Produce sharp glass lines and color breaks.
3.4 FIELD QUALITY CONTROL

A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test coatings for dry film thickness.

1. Contractor shall touch up and restore coated surfaces damaged by testing.
2. If test results show that dry film thickness of applied coating does not comply with coating manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with coating manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from coating operation. Correct damage to work of other trades by cleaning, repairing, replacing, and recoating, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces.

3.6 EXTERIOR HIGH-PERFORMANCE COATING SCHEDULE

A. Steel Substrates:

1. Epoxy System, MPI EXT 5.1F:
   a. Prime Coat: Primer, epoxy, anti-corrosive, for metal, MPI #101.
   b. Intermediate Coat: Epoxy, high build, low gloss, MPI #108.
   c. Topcoat: Epoxy, gloss, MPI #77.

B. Galvanized-Metal Substrates:

1. Epoxy System, MPI EXT 5.3C:
   a. Prime Coat: Primer, epoxy, anti-corrosive, for metal, MPI #101.
   c. Topcoat: Epoxy, gloss, MPI #77.
SECTION 101423 - PANEL SIGNAGE

PART 1 - GENERAL

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

1.2 SUMMARY
A. Section Includes:
   1. Panel signs.
B. Related Requirements:
   1. Section 099123 "Interior Painting" for coordinated accents and graphics.

1.3 DEFINITIONS
A. Accessible: In accordance with the accessibility standard.

1.4 ACTION SUBMITTALS
A. Product Data: For each type of product.
B. Shop Drawings: For panel signs.
   1. Include fabrication and installation details and attachments to other work.
   2. Show sign mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
   3. Show message list, typestyles, graphic elements, including raised characters and Braille, and layout for each sign at full scale.
C. Samples for Initial Selection: For each type of sign assembly, exposed component, and exposed finish.
   1. Include representative Samples of available typestyles and graphic symbols.
D. Samples for Verification: For each type of sign assembly showing all components and with the required finish(es), in manufacturer's standard size unless otherwise indicated and as follows:
   1. Panel Signs: Full-size Sample.
   2. Exposed Accessories: Full-size Sample of each accessory type, if any.
   3. Full-size Samples, if approved, will be returned to Contractor for use in Project.
E. Product Schedule: For panel signs. Use same designations indicated on Drawings or specified.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

B. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For signs to include in maintenance manuals.

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Deterioration of finishes beyond normal weathering.
   b. Deterioration of embedded graphic image.
   c. Separation or delamination of sheet materials and components.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Signs and supporting elements shall withstand the effects of gravity and other loads within limits and under conditions indicated.

1. Uniform Wind Load: As indicated on Drawings.

B. Thermal Movements: For exterior signs, allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

C. Accessibility Standard: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design" and ICC A117.1.
2.2 PANEL SIGNS – SMALL STATE OUTLINE

A. Panel Sign: Sign with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:

1. Laminated-Sheet Sign: Photopolymer face sheet with raised graphics laminated to phenolic backing sheet to produce composite sheet.
   a. Composite-Sheet Thickness: 0.25 inch (6.35 mm).
   c. All materials shall be exterior-rated and UV stable.

   a. Edge Condition: Square cut.
   b. Corner Condition in Elevation: Rounded to radius indicated.

   a. Edge Condition: Square cut.
   b. Corner Condition in Elevation: N/A; Follow state border within five percent variance (minor smoothing allowed at irregular edges, usually rivers; level of smoothing must be graphically shown on shop drawings).

4. Small Sign Mounting: Surface mounted to column with exterior-rated, two-face tape. Tape shall have a minimum thickness of 1/32-inch to mediate uneven surfaces.

5. Text and Typeface: Accessible raised characters and Braille. Finish raised characters to contrast with background color, and finish Braille to match background color.

6. Flatness Tolerance: Sign shall remain flat or uniformly curved under installed conditions as indicated on Drawings and within a tolerance of plus or minus 1/16 inch (1.5 mm) measured diagonally from corner to corner.

B. Panel Sign Materials

1. Phenolic sheet and polymer sheet: Exterior-rated, Type UVF (UV filtering).
2. Paints and Coatings for Sheet Materials: Inks, dyes, and paints that are recommended by manufacturer for optimum adherence to surface and are UV and water resistant for colors and exposure indicated.

2.3 PANEL SIGNS – LARGE MISSOURI STATE & MASCOT EMBLEM

A. Panel Sign: Sign with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:

1. Large Sheet Sign: Acrylic face sheet router cut.
   a. Sheet Thickness: 0.125 inch minimum.
   c. All materials shall be exterior-rated and UV stable.
a. Edge Condition: Square cut.
b. Corner Condition in Elevation: N/A; Follow state border within five percent variance (minor smoothing allowed at irregular edges, usually rivers; level of smoothing must be graphically shown on shop drawings).

3. Large Sign Mounting: Signs greater than two square feet in size shall have concealed pins on the back size for embedding in wall. Also apply silicone at a fully concealed location to firmly adhere the sign the substrate.

4. Flatness Tolerance: Sign shall remain flat or uniformly curved under installed conditions as indicated on Drawings and within a tolerance of plus or minus 1/16 inch (1.5 mm) measured diagonally from corner to corner.

2.4 PANEL SIGNS – DIMENSIONAL LETTERS

A. Panel Sign Letters: Sign with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:

   a. Sheet Thickness: 0.25 inch minimum.
   c. All materials shall be exterior-rated and UV stable.

   a. Edge Condition: Square cut.
   b. Corner Condition in Elevation: 1/16” radius.

3. Letter Mounting: Letters shall have concealed pins on the back size for embedding in wall. Also apply silicone at a fully concealed location to firmly adhere the sign the substrate.

4. Flatness Tolerance: Sign shall remain flat or uniformly curved under installed conditions as indicated on Drawings and within a tolerance of plus or minus 1/16 inch (1.5 mm) measured diagonally from corner to corner.

2.5 ACCESSORIES

A. Two-Face Tape: Manufacturer's standard high-bond, foam-core tape, 0.045 inch (1.14 mm) thick, with adhesive on both sides.

2.6 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Verify that sign-support surfaces are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces unless otherwise indicated.

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

3.2 INSTALLATION

A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.

1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
2. Install signs so they do not protrude or obstruct according to the accessibility standard.
3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.

B. Accessible Signage: Install in locations on walls as indicated on Drawings and according to the accessibility standard.

C. Mounting Methods:
   1. Two-Face Tape: Clean bond-breaking materials from substrate surface and remove loose debris. Apply tape strips symmetrically to back of sign and of suitable quantity to support weight of sign without slippage. Keep strips away from edges to prevent visibility at sign edges. Place sign in position, and push to engage tape adhesive.

3.3 ADJUSTING AND CLEANING

A. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.

B. Remove temporary protective coverings and strippable films as signs are installed.

C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION 101423
SECTION 101423.01 – 3-DIMENSIONAL TACTILE PRINT

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. 3-Dimensional tactile print

1.3 DEFINITIONS
   A. Accessible: In accordance with the accessibility standard.

1.4 COORDINATION
   A. Furnish templates for placement of art piece anchorage devices embedded in permanent construction by other installers.
   B. Furnish templates for placement of electrical service embedded in permanent construction by other installers.

1.5 ACTION SUBMITTALS
   A. Product Data: For each type of product.
   B. Shop Drawings: For art piece.
      1. Include fabrication and installation details and attachments to other work.
      2. Show art piece mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
      3. Show message list, typestyles, graphic elements including raised characters and Braille.
      4. Show locations of electrical service connections.
      5. Include diagrams for power, signal, and control wiring.
1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.7 FIELD CONDITIONS

A. Field Measurements: Verify locations of anchorage devices and electrical service embedded in permanent construction by other installers by field measurements before fabrication and indicate measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 ART PIECE:

A. General: Provide a 3-Dimensional tactile print of the 2-Dimensional painting titled the “Golden Rule” by Norman Rockwell.

B. Size: 4.5 feet by 4 feet

C. Depth: 1.75 inch

D. Printing: Use full 4-color process to obtain the original color of the image.

E. Electronics: Provide sensors embedded throughout the art to activate “sensory stimulants” and provide additional information to the view as they are activated by touch.

1. List of stimulants that shall be added to the art piece include:
   A. Audio

2. List of stimulants that may be added to the art piece include:
   A. Scent
   B. Mist
   C. Heat
   D. Breeze

3. Control panel functionality: Bilinqual language delivery and multi-audio track functionality.

F. Braille: Grade 2

2.2 Art Piece Perimeter: Finish edges smooth

A. Edge Condition at Vertical Edges and Horizontal Edges: As specified by the Manufacturer

B. Corner Condition in Elevation: As specified by the Manufacturer
C. Frame: Entire perimeter
   1. Material: As selected by Owner from manufacturer’s full range
   2. Frame Depth: As specified by the Manufacturer
   3. Finish and Color: As selected by Owner from manufacturer’s full range

D. Mounting: Manufacturer’s standard method for substrates indicated

E. Text and Typeface: accessible raised characters and Braille

2.3 ACCESSORIES

A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of art piece, noncorrosive and compatible with each material joined, and complying with the following unless otherwise indicated:
   1. Use concealed fasteners and anchors unless indicated to be exposed.
   2. For exterior exposure, furnish stainless-steel devices unless otherwise indicated.
   3. Exposed Metal-Fastener Components, General:
      A. Fabricated from same basic metal and finish of fastened metal unless otherwise indicated.

4. Art Piece Mounting Fasteners:
   A. Concealed Studs: Concealed (blind), threaded studs welded or brazed to back of sign material or screwed into back of sign assembly unless otherwise indicated.
   B. Projecting Studs: Threaded studs with sleeve spacer, welded or brazed to back of sign material or screwed into back of sign assembly, unless otherwise indicated.
   C. Through Fasteners: Exposed metal fasteners matching sign finish, with type of head indicated, and installed in predrilled holes.

5. Inserts: Furnish inserts to be set by other installers into concrete or masonry work.

2.4 FABRICATION

A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.
   1. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
   2. Internally brace signs for stability, to meet structural performance loading without oil-canning or other surface deformation, and for securing fasteners.
   3. Provide rabbets, lugs, and tabs necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.

B. Brackets: Fabricate brackets, fittings, and hardware for bracket-mounted art work to suit artwork mounting conditions indicated.
2.5 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Verify that support surfaces are within tolerances to accommodate art piece without gaps or irregularities between back of art piece and support surfaces unless otherwise indicated.

C. Verify that anchorage devices embedded in permanent construction are correctly sized and located to accommodate signs.

D. Verify that electrical service is correctly sized and located to accommodate art piece.

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

3.2 INSTALLATION

A. General: Install art piece using mounting methods indicated and according to manufacturer's written instructions.

1. Install art piece level, plumb, true to line, and at locations and heights indicated, with surface free of distortion and other defects in appearance.

2. Install art piece so it does not protrude or obstruct according to the accessibility standard.

3. Before installation, verify that art piece surfaces are clean and free of materials or debris that would impair installation.

B. Accessible Signage: Install in locations on walls as indicated on Manufacturers drawings.

C. Mounting Methods:

1. Concealed Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.

   A. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place sign in position and push until flush to surface, embedding studs in holes. Temporarily support sign in position until adhesive fully sets.

   B. Thin or Hollow Surfaces: Place sign in position and flush to surface, install washers and nuts on studs projecting through opposite side of surface, and tighten.

2. Projecting Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.
A. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place spacers on studs, place sign in position, and push until spacers are pinched between sign and substrate, embedding the stud ends in holes. Temporarily support sign in position until adhesive fully sets.

B. Thin or Hollow Surfaces: Place spacers on studs, place sign in position with spacers pinched between sign and substrate, and install washers and nuts on stud ends projecting through opposite side of surface, and tighten.

3. Through Fasteners: Drill holes in substrate using predrilled holes in sign as template. Countersink holes in sign if required. Place sign in position and flush to surface. Install through fasteners and tighten.

4. Brackets: Remove loose debris from substrate surface and install backbar or bracket supports in position so that signage is correctly located and aligned.

3.3 ADJUSTING AND CLEANING

A. Remove and replace damaged or deformed art piece that do not comply with specified requirements. Replace art piece with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.

B. Remove temporary protective coverings as art piece is installed.

C. On completion of installation, clean exposed surfaces of art piece according to manufacturer's written instructions. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION 101423
SECTION 116800 - PLAY FIELD EQUIPMENT AND STRUCTURES

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 playground equipment as follows:
   1. Freestanding playground equipment.

B. Related Requirements:
   1. Section 033000 “Cast-in-Place Concrete”
   2. Section 116801 “Play Field Equipment and Structures Rope Courses and Climbing Wall”

1.3 DEFINITIONS

A. Definitions in ASTM F1487 apply to Work of this Section.


C. Glass Fiber Reinforced Concrete (GFRC)

D. High Density Polyethylene (HDPE)

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For each type of playground equipment.
   1. Include plans, elevations, sections, and attachment details.
   2. Include fall heights and use zones for playground equipment, coordinated with the critical-height values of protective surfacing specified in Section 321816.13 "Playground Protective Surfacing."

C. Samples for Initial Selection: For each type of exposed finish.
   1. Manufacturer's color charts.
   2. Include Samples of accessories involving color selection.

D. Samples for Verification: For each type of exposed finish on the following products:
1. Include Samples of accessories to verify color and finish selection.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and testing agency.
B. Product Certificates: For each type of playground equipment.
C. Material Certificates: For the following items:
   1. Shop finishes.
D. Field quality-control reports.
E. Sample Warranty: For manufacturer's special warranties.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For playground equipment and finishes to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: A firm whose playground equipment components have been certified by IPEMA's third-party product certification service.
B. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of playground equipment that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Structural failures.
   b. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.

2. Warranty Period: One year from date of Substantial Completion.
PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Bidders are hereby informed that the play field equipment and structures were written as performance specs. Basis of design and alternate manufacturers are designated as follow:

1. Swing Set
   a. Basis of Design: Landscape Structures
   b. Alternate: Gametime
   c. Alternate: Miracle Recreation

2. Log Crawl Tunnel
   a. Basis of Design: Landscape Structures
   b. Alternate: Gametime
   c. Alternate: Pro Playgrounds

3. Rotating Climber or Climber Merry-Go-Round
   a. Basis of Design: B.C.I. Burke
   b. Alternate: Gametime
   c. Alternate: Miracle Recreation

4. Composite Play Structure – Backyard Tree House Unit
   a. Basis of Design: Themed Concepts
   b. Alternate: Gametime
   c. Alternate: Landscape Structures

5. Leaning Tree Rings
   a. Basis of Design: Themed Concepts
   b. Alternate: Gametime
   c. Alternate: Landscape Structures

6. Lion and Mule Climbing Sculptures
   a. Basis of Design: Themed Concepts
   b. Alternate: Experiential Systems, Inc.
   c. Alternate: Gametime

2.2 PERFORMANCE REQUIREMENTS

A. Safety Standard: Provide playground equipment according to ASTM F1487.

2.3 FREESTANDING PLAYGROUND EQUIPMENT

A. Swing Set: Contemporary style with 4 legs providing upright support.
   1. Metal Frame: Galvanized-steel pipe or tubing.
      a. Leg Upright(s): Not less than 3-1/2” O.D.
      b. Overhead Beam: Not less than 3-1/2” O.D.
c. Color: As selected by Owner and Landscape Architect from manufacturer's full range.

2. Overhead Beam Height: 9’-6” from top of arch to protective surfacing below.

   a. Color: As selected by Owner and Landscape Architect from manufacturer's full range.

4. Swing Fasteners: Primary fasteners shall be socketed and pinned tamperproof in design, stainless steel (SST) per ASTM F 879 unless otherwise indicated.

5. Swing Hanger Assembly: Comprised of 300 series stainless steel knuckle and yoke, stainless steel swing pin, stainless steel spring pin and oilite bushings.

6. Swing Seats: Rigid disk seat, molded from U.V. stabilized linear low density polyethylene. Seat Dimension:: 48” wide
   a. Color: As selected by Owner and Landscape Architect from manufacturer's full range.

7. Swing Seat Clearance: The lowest part of the swing seat should be at a minimum of 13-3/4” above the finished grade of the Playground Protective Surfacing.
   a. Color: As selected by Owner and Landscape Architect from manufacturer's full range.

8. Weight Capacity: 395 pounds.

9. Fall Height: 90”.

B. Log Crawl Tunnel: Freestanding, straight-aligned configuration.
   1. Metal Frame: 1.90” OD RS20 (0.90”-0.10”) wall
   2. Material: Glass fiber reinforced concrete; fiberglass
   3. Color: natural color; simulated wood.

C. Rotating Climber or Climber Merry-Go-Round: Rotating platform around a vertical axis.
   1. Rotating Mechanism: Permanently sealed and lubricated ball bearings with hydraulic or mechanical speed-limiting device.
   2. Platform: Round, flat steel sheet, not less than 0.12-inch- nominal thickness, with slip-resistant footing.
      a. Color: As selected by Owner and Landscape Architect from manufacturer's full range.

3. Rope Assembly: Rope holds of regular strands, closed around a core of synthetic fiber, of strands consisting of 8 galvanized steel wires tightly covered with polypropylene fibers. End connectors of aluminum ferrules with stainless steel screws.
   a. Color: As selected by Owner and Landscape Architect from manufacturer's full range.

4. Platform Ring Section: All welded construction, galvanized steel tubing of 2-3/8” O.D., 10 gauge.
   a. Color: As selected by Owner and Landscape Architect from manufacturer's full range.

5. Age Appropriateness: 5 through 12 years
2.4 COMPOSITE PLAYGROUND EQUIPMENT

A. Composite Play Structure Backyard Tree House Unit: Integral play assembly that provides more than one play activity; manufactured as a system or assembled from manufacturer's standard modular-sized units. Treehouse unit to include climbing ladders, slides, and other elements as selected by client.

1. Metal Frame: Galvanized-steel pipe or tubing connected with bolts. Composite to be overlaid galvanized steel lathe material, with #4 steel reinforcing bars
   a. Main Frame Posts: Not less than 4-inch O.D.
   b. Color: As selected by Owner and Landscape Architect from manufacturer's full range.

2. Composite Cladding: HDPE Plastic or Glass Fiber Reinforced Concrete
   a. Color: As selected by Owner and Landscape Architect from manufacturer's full range.

3. Platforms: HDPE Plastic or Glass Fiber Reinforced Concrete
   a. Color: As selected by Owner and Landscape Architect from manufacturer's full range.

4. Roofs: HDPE Plastic or Glass Fiber Reinforced Concrete
   a. Color: As selected by Owner and Landscape Architect from manufacturer's full range.

5. Play Structure Access Component(s):
   a. Rope Climber (Crew Net) – Rope ladder assembly of 3 vertical ropes and a minimum of 6 horizontal ropes; ropes to be a minimum of 5/8” diameter. Ropes to consist of steel core polypropylene ropes. Connections to be aluminum ferrules with stainless steel hardware.
   b. Rope Climber (Rope Ladder) – Rope ladder assembly of 2 vertical ropes and a minimum of 6 horizontal ropes; ropes to be a minimum of 5/8” diameter. Ropes to consist of steel core polypropylene ropes. Connections to be aluminum ferrules with stainless steel hardware.
   c. Straight Slide – Straight open slide of HDPE or GFRC, reinforced, secured to tree house unit at the top with fasteners and to substrate/footing at finished grade at the bottom.
   d. Log Tunnel Slide – Enclosed slide of HDPE or GFRC, reinforced, secured to tree house unit at the top with fasteners and to substrate/footing at finished grade at the bottom. Exterior surface of slide to have texture, pattern and color to replicate a natural hardwood log.
   e. Internal Climber Stairs – Projections of handholds/footholds(steps) to allow a child to climb from finished grade to exterior viewing platform. Composed of HDPE or GFRC, reinforced, secured to tree house unit with fasteners. Exterior surface handholds/footholds (steps) to have texture, pattern and color to replicate wood timbers or stones or mushrooms.
f. Exterior Viewing Platform – Horizontal platform, adhered to tree house unit, composed of HDPE or GFRC, with steel reinforcing. Guardrail/handrails with vertical slats, minimum 3’-0” high, to enclose viewing platform except for openings for slides and access to interior of tree house unit. Guardrail/handrails to be composed of HDPE or GFRC.

g. Animal Reliefs on Tree House Unit – A minimum of two (2) animal relief profiles, projecting from the tree house unit wall are to be incorporated into the design of the tree house unit. Provide potential animal relief options to Owner and Landscape Architect for selection.

6. Fall Height: 60-96”.
7. Age Appropriateness: 5 through 12 years

B. Leaning Tree Rings: Integral play assembly that which allows a child to swing from suspended rings adhered to reinforced steel frame assembly. Manufactured as a system or assembled from manufacturer's standard modular-sized units.

1. Metal Frame: Galvanized-steel pipe or tubing connected with bolts. Composite to be overlaid galvanized steel lathe material, with #4 steel reinforcing bars.
   a. Main Frame Posts: Not less than 4-inch O.D.
   b. Color: As selected by Owner and Landscape Architect from manufacturer's full range.

2. Metal Suspended Rings: Galvanized-steel pipe or tubing connected with cable rope to Main Frame. Color and finish per manufacturer’s standards.

3. Composite Cladding: HDPE Plastic or Glass Fiber Reinforced Concrete
   a. Color: As selected by Owner and Landscape Architect from manufacturer's full range.

4. Fall Height: 96”.
5. Age Appropriateness: 5 through 12 years

C. Mule and Lion Climbing Sculptures: Integral play assembly that which allows a child to climb on each sculpture. Each sculpture to be adhered to foundation below finished grade of the playground protective surfacing.

1. Metal Frame: Galvanized-steel pipe or tubing connected with bolts. Composite to be overlaid galvanized steel lathe material, with #4 steel reinforcing bars.
   a. Main Frame Posts: Not less than 2-inch O.D.
   b. Color: As selected by Owner and Landscape Architect from manufacturer's full range.

2. Composite Cladding: HDPE Plastic or Glass Fiber Reinforced Concrete
a. Color: As selected by Owner and Landscape Architect from manufacturer's full range.

3. Fall Height: 48-60”.
4. Age Appropriateness: 5 through 12 years

2.5 FABRICATION

A. Provide sizes, strengths, thicknesses, wall thickness, and weights of components as required to comply with requirements in ASTM F1487. Factory drill components for field assembly. Unnecessary holes in components, not required for field assembly, are not permitted. Provide complete play structures, including supporting members and connections, means of access and egress, designated play surfaces, barriers, guardrails, handrails, handholds, and other components indicated or required for equipment indicated.

B. Metal Frame: Fabricate main-frame upright support posts from metal pipe or tubing with cross-section profile and dimensions as required. Unless otherwise indicated, provide each pipe or tubing main-frame member with manufacturer's standard drainable bottom plate or support flange. Fabricate secondary frame members, bracing, and connections from either steel or aluminum.

C. Composite Frame: Fabricate main-frame upright support posts from metal and plastic. Fabricate secondary frame members, bracing, and connections from either steel or aluminum.

D. Play Surfaces: Manufacturer's standard elevated drainable decks, platforms, landings, walkways, ramps, and similar transitional play surfaces, designed to withstand loads; fabricated from molded plastic made into floor units with slip-resistant finish. Fabricate units in modular sizes and shapes to form assembled play surfaces indicated.

E. Protective Barriers: Fabricate according to ASTM F1487. Extend barriers to height above the protected elevated surface according to requirements for use by age group indicated. Fabricate from one or more of the following:
   a. Reinforced HDPE Plastic or Glass Fiber Reinforced Concrete
   b. Color: As selected by Owner and Landscape Architect from manufacturer's full range.

F. Guardrails: Provide guardrails configured to completely surround the protected area, except for access openings. Fabricate from one or more of the following:
   a. Reinforced HDPE Plastic or Glass Fiber Reinforced Concrete
   b. Color: As selected by Owner and Landscape Architect from manufacturer's full range.

G. Roofs and Canopies: Designed to discourage and minimize climbing by users.

H. Signs: Manufacturer's standard sign panels, fabricated from opaque plastic with graphics molded in or cast into the plastic.
2.6 MATERIALS

A. Aluminum: Material, alloy, and temper recommended by manufacturer for type of use and finish indicated.

B. Steel: Material types, alloys, and forms recommended by manufacturer for type of use and finish indicated, hot-dip galvanized.

C. Stainless-Steel Sheet: Type 304; finished on exposed faces with No. 2B finish.

D. Opaque Plastics: Color impregnated, UV stabilized, and mold resistant.

E. Hardware: Manufacturer's standard; commercial-quality; corrosion-resistant; hot-dip galvanized steel and iron, stainless steel, or aluminum; of a vandal-resistant design.

F. Fasteners: Manufacturer's standard; corrosion-resistant; hot-dip galvanized or zinc-plated steel and iron, or stainless steel; permanently capped; and theft resistant.

2.7 ALUMINUM FINISHES

A. Baked-Enamel or Powder-Coat Finish: Minimum dry film thickness of 1.5 mils, medium gloss. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

B. PVC Finish: UV-stabilized, mold-resistant, slip-resistant, matte-textured, dipped or sprayed-on PVC finish, with flame retardant added, and with minimum dry film thickness of 80 mils. Comply with coating manufacturer's written instructions for pretreatment and application.

2.8 IRON AND STEEL FINISHES

A. Baked-Enamel or Powder-Coat Finish: After cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat to a minimum dry film thickness of 2 mils. Comply with coating manufacturer's written instructions for pretreatment, applying, and baking.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for earthwork, subgrade elevations, surface and subgrade drainage, and other conditions affecting performance of the Work.

1. Do not begin installation before final grading required for placing playground equipment and protective surfacing is completed.

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

A. Comply with manufacturer's written installation instructions for each equipment type unless more stringent requirements are indicated. Anchor playground equipment securely, positioned at locations and elevations indicated.

1. Maximum Equipment Height: Coordinate installed fall heights of equipment with finished elevations and critical-height values of protective surfacing. Set equipment so fall heights and elevation requirements for age group use and accessibility are within required limits. Verify that playground equipment elevations comply with requirements for each type and component of equipment.

3.3 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative.

1. Perform inspection and testing for each type of installed playground equipment according to ASTM F1487.

B. Playground equipment items will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

D. Notify Landscape Architect and Owner 48 hours in advance of date(s) and time(s) of testing and inspection.

END OF SECTION 116800
SECTION 116801 – PLAY FIELD EQUIPMENT AND STRUCTURES - ROPES COURSES AND CLIMBING WALL

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 playground equipment as follows:
   1. Freestanding ropes course.
   2. Freestanding Climbing Wall

B. Related Requirements:
   1. Section 033000 “Cast-in-Place Concrete”
   2. Section 116800 “Play Field Equipment and Structures”

1.3 DEFINITIONS

A. Definitions in ASTM F1487 apply to Work of this Section.


1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For each type of playground equipment.
   1. Include plans, elevations, sections, and attachment details.
   2. Include fall heights and use zones for ropes course equipment, coordinated with the critical-height values of protective surfacing specified in Section 321816.13 "Playground Protective Surfacing."

C. Samples for Initial Selection: For each type of exposed finish.
   1. Manufacturer's color charts.
   2. Include Samples of accessories involving color selection.

D. Samples for Verification: For each type of exposed finish on the following products:
1. Include Samples of accessories to verify color and finish selection.
5. Sun shade: Minimum 6 inches square.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and testing agency.
B. Product Certificates: For each type of ropes course component.
C. Material Certificates: For the following items:
   1. Shop finishes.
   2. Structural Members
   3. Wire Rope Cable
D. Field quality-control reports.
E. Sample Warranty: For manufacturer's special warranties.

1.6 CLOSEOUT SUBMITTALS

A. Operations and Maintenance Data: For ropes course and finishes to include in operations and maintenance manuals.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: A firm whose playground equipment components have been certified by IPEMA's third-party product certification service.
B. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of playground equipment that fail in materials or workmanship within specified warranty period.

   1. Failures include, but are not limited to, the following:
      a. Structural failures.
      b. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.
2. Warranty Period: One year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Bidders are hereby informed that the ropes course and climbing wall were written as performance specs. Basis of design and alternate manufacturers are designated as follow:

1. Ropes Course
   a. Basis of Design: Ropes Courses, Inc.
   b. Alternate: Experiential Systems, Inc.
   c. Alternate: Skywalker – Adventure Builders

2. Climbing Wall
   a. Basis of Design: Ropes Courses, Inc.
   b. Alternate: Everlast Climbing
   c. Alternate: Park Planet

2.2 PERFORMANCE REQUIREMENTS

A. Safety Standard: Provide playground equipment according to ASTM F1487.

2.3 FREESTANDING EQUIPMENT

A. Ropes Course: Contemporary style with varied play surfaces.
   1. Metal Frame: HSS structural steel piping and tubing.
      a. Tube Steel: A-500 grade C
      b. Structural Steel Plates: A-36
      c. Pipes: A53 grade B or A500 grade C
      d. SS Round: 304/304L stainless steel (fy = 50 KSI)
   2. Color: As selected by Owner and Landscape Architect from manufacturer's full range.
   3. All welding to be in accordance with the latest edition of the American Welding Society (AWS) “structural welding code – steel” D1.1 and as indicated on structural drawings. Electrodes to be min 70 KSI material.
   4. Anchor Bolts: A36 or F1554 Grade 36.
   5. Platforms: designed to accommodate loads of 100 lb/sf. Areas to be surrounded by guard rails meeting minimum requirements from IBC for assembly areas.
   6. Fasteners: Hot dip galvanized A325 bolts with heavy hex nuts. Bolts to be installed using the “specification for structural joints using ASTM A325 or A490 bolts”. Bolts shall be installed as pretensioned using direct tension indicating washers.
   7. Sun Shades: Canvas or flexible polyethylene material, with fasteners and assemblies to allow for removal during high winds and winter weather. Color to be a light green or as selected by Owner and Landscape Architect.

B. Overhead Zip Track:
   1. Metal Frame: HSS structural steel piping and tubing
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a. Tube Steel: A-500 grade C
b. Structural Steel Plate: A-36
c. Pipes: A53 grade B or A500 grade C
d. SS Round: 304/304L stainless steel (fy = 50 KSI)

2. Color: As selected by Owner and Landscape Architect from manufacturer's full range.

3. All welding to be in accordance with the latest edition of the American Welding Society (AWS) “structural welding code – steel” D1.1 and as indicated on structural drawings. Electrodes to be min 70 KSI material.

4. Anchor Bolts: A36 or F1554 Grade 36.

5. Fasteners: Hot dip galvanized A325 bolts with heavy hex nuts. Bolts to be installed using the “specification for structural joints using ASTM A325 or A490 bolts”. Bolts shall be installed as pretensioned using direct tension indicating washers.

6. Overhead Zip Track: Tube steel (HSS) for rigid zip track to allow connection to tethered harness assembly.

C. Small Children’s Ropes Course: Contemporary style with varied play surfaces.

1. Metal Frame: HSS structural steel piping and tubing.
   a. Tube Steel: A-500 grade C
   b. Structural Steel Plates: A-36
   c. Pipes: A53 grade B or A500 grade C
   d. SS Round: 304/304L stainless steel (fy = 50 KSI)

2. Color: As selected by Owner and Landscape Architect from manufacturer's full range.

3. All welding to be in accordance with the latest edition of the American Welding Society (AWS) “structural welding code – steel” D1.1 and as indicated on structural drawings. Electrodes to be min 70 KSI material.

4. Platforms: designed to accommodate loads of 50 lb/sf.

5. Anchor Bolts: A36 or F1554 Grade 36.

6. Fasteners: Hot dip galvanized A325 bolts with heavy hex nuts. Bolts to be installed using the “specification for structural joints using ASTM A325 or A490 bolts”. Bolts shall be installed as pretensioned using direct tension indicating washers.

7. Maximum height for participants is 48” tall. Design will conform to ASTM F24 – Amusement Rides and Devices.

D. Climbing Wall: Contemporary style conforming to EN 12572-1 and EN 12572-3.

1. Metal Frame: HSS structural steel piping and tubing.
   a. Tube Steel: A-500 grade C
   b. Structural Steel Plates: A-36
   c. Pipes: A53 grade B or A500 grade C
   d. SS Round: 304/304L stainless steel (fy = 50 KSI)

2. Color: As selected by Owner and Landscape Architect from manufacturer's full range.

3. All welding to be in accordance with the latest edition of the American Welding Society (AWS) “structural welding code – steel” D1.1 and as indicated on structural drawings. Electrodes to be min 70 KSI material.

4. Anchor Bolts: A36 or F1554 Grade 36.

5. Fasteners: Hot dip galvanized A325 bolts with heavy hex nuts. Bolts to be installed using the “specification for structural joints using ASTM A325 or A490 bolts”. Bolts shall be installed as pretensioned using direct tension indicating washers.

6. Belay Unit: Hot dip galvanized or per manufacturer’s recommendations.
2.4 FABRICATION

A. Provide sizes, strengths, thicknesses, wall thickness, and weights of components as required to comply with requirements in ASTM F1487. Factory drill components for field assembly. Unnecessary holes in components, not required for field assembly, are not permitted. Provide complete play structures, including supporting members and connections, means of access and egress, designated play surfaces, barriers, guardrails, handrails, handholds, and other components indicated or required for equipment indicated.

B. Metal Frame: Fabricate main-frame upright support posts from metal pipe or tubing with cross-section profile and dimensions as required. Unless otherwise indicated, provide each pipe or tubing main-frame member with manufacturer's standard drainable bottom plate or support flange. Fabricate secondary frame members, bracing, and connections from either steel or aluminum.

C. Play Surfaces: Manufacturer's standard elevated drainable decks, platforms, landings, walkways, ramps, and similar transitional play surfaces, designed to withstand loads; fabricated from molded plastic made into floor units with slip-resistant finish. Fabricate units in modular sizes and shapes to form assembled play surfaces indicated.

D. Protective Barriers: Fabricate according to ASTM F1487. Extend barriers to height above the protected elevated surface according to requirements for use by age group indicated. Fabricate from one or more of the following:

1. Welded-metal pipe or tubing with vertical bars.
2. Metal-pipe or -tubing frame with wire-mesh infill panels.

E. Guardrails: Provide guardrails configured to completely surround the protected area, except for access openings. Fabricate from welded metal pipe or tubing. Extend guardrails according to requirements for use by age group indicated.

F. Handrails: Welded metal pipe or tubing, maximum OD between 0.95 and 1.55 inches.

1. Provide handrails at heights to comply with requirements for use by age group indicated according to ASTM F1487.

G. Signs: Manufacturer's standard sign panels, fabricated from opaque plastic with graphics molded in, attached directly to playground equipment.

1. Text: Minimum informational content according to ASTM F1487.
2. Colors: As selected by Owner and Landscape Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for earthwork, subgrade elevations, surface and subgrade drainage, and other conditions affecting performance of the Work.
1. Do not begin installation before final grading required for placing playground equipment and protective surfacing is completed.

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

3.2 INSTALLATION

A. Comply with manufacturer's written installation instructions for each equipment type unless more stringent requirements are indicated. Anchor playground equipment securely, positioned at locations and elevations indicated.

1. Maximum Equipment Height: Coordinate installed fall heights of equipment with finished elevations and critical-height values of protective surfacing. Set equipment so fall heights and elevation requirements for age group use and accessibility are within required limits. Verify that playground equipment elevations comply with requirements for each type and component of equipment.

B. Post Set with Concrete Footing: Comply with Section 033000 "Cast-in-Place Concrete" ACI 301 for measuring, batching, mixing, transporting, forming, and placing concrete.

1. Set equipment posts on concrete footing. As indicated on drawings. Protect portion of posts above footing from concrete splatter. Verify that posts are set plumb or at the correct angle, alignment, height, and spacing.

2. Embedded Items: Follow equipment manufacturer's written instructions and drawings to ensure correct installation of anchorages for equipment.

3. Finishing Footings: Smooth top, and shape to shed water.

3.3 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative.

1. Perform inspection and testing for each type of installed playground equipment according to ASTM F1487.

B. Playground equipment items will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

D. Notify Landscape Architect and Owner 48 hours in advance of date(s) and time(s) of testing and inspection.

END OF SECTION 116801
SECTION 117000 - GREENHOUSE

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. Design, provide and install gutter-connected greenhouse, as shown on drawings and in accordance with these specifications.

1.3 RELATED SECTIONS
   A. Section 033000 “Cast-In-Place Concrete”
   B. Section 042200 “Concrete Unit Masonry”
   C. Section 061053 “Miscellaneous Rough Carpentry”
   D. Division 22 – Plumbing
   E. Division 23 – Heating, Ventilating and Air Conditioning
   F. Division 26 - Electrical

1.4 ACTION SUBMITTALS
   A. Approval submittals shall include shop drawings of engineered signed/sealed drawings and a full set of engineering calculations, signed and sealed by a structural engineer licensed to practice in the State of Missouri.
   B. Submit a full warranty as specified herein.
   C. Provide submittals for all equipment in the greenhouse.

1.5 PERFORMANCE REQUIREMENTS
   A. General: Provide the manufacturer’s standard greenhouse components that have been adapted to the application indicated and comply with performance requirements.
   B. Type of Structure: Galvanized steel or aluminum structure with aluminum substructure.
   C. Unacceptable Conditions: Include noise and vibration created by thermal movement, structural movement and wind, loosening, weakening or failure of fasteners, attachments and other components.
   D. Structural Performance Design: Design, fabricate and install the greenhouse to withstand the effects of the following loads and stresses under conditions indicated without material failure or permanent deformation of structural members.
E. Design Load Criteria: Use the following criteria to design the greenhouse structure:

1. Dead Load – structure, glazing and equipment
2. Wind:
   a. Basic wind speed: 115 mph
   b. Exposure C
   c. Importance Factor: 1.0 (Occupancy II)
3. Snow
   a. Ground snow load: \( P_g = 20 \text{ psf} \)
   b. Snow Load Terrain Category = C
   c. Snow Exposure Factor \( C_e = 1.0 \)
   d. Thermal Factor \( C_t = 1.2 \)
   e. Importance Factor: 1.0 (Occupancy II)
4. Roof Live loads: 20 psf
5. Roof Bars shall be designed to carry a 100 lb. concentrated load at the center of the span.
6. Seismic:
   a. Site Class D
   b. \( S_s = 0.430 \)
   c. \( S_l = 0.165 \)
   d. Seismic Design Category C
   e. Importance Factor: 1.0 (Occupancy II)

F. Structural design shall consider all load combinations dictated by ASCE-07 and applicable codes.

G. Maximum allowable deflection of all greenhouse components shall be \( L/175 \) of the span.

H. Comply with the following codes and standards:

   a. Section 2405 – Sloped Glazing and Skylights.

1.6 QUALITY ASSURANCE

A. The entire greenhouse structure shall be the product of a single manufacturer. The greenhouse shall be manufactured by a firm with a record of successfully fabricating greenhouses similar to the type indicated which have performed satisfactorily for a period of no less than five (5) years.

B. Greenhouse Installer shall be a company regularly engaged in installation of pre-
engineered greenhouses and with at least five (5) years’ experience building greenhouses of the type specified. Installer shall be approved or licensed by manufacturer of greenhouse systems.

C. Greenhouse Aesthetic: The greenhouse design to be an historic period aesthetic reflected of the Victorian era, of the latter 19th century. The detailing of the greenhouse assembly should have finials, metal fretwork and scrollwork details to emulate the aesthetic of late 19th century or a Post-Modern interpretation of that time period aesthetic.

1.7 STORAGE AND HANDLING

A. Handle and store all greenhouse materials with care, in accordance with manufacturer's instructions. Time delivery and erection of materials to avoid extended on-site storage. Store materials on skids or platforms; do not store directly on ground.

1.8 WARRANTY

A. General: Submit a written warranty, signed by the manufacturer, warranting that the structure of the greenhouses is of good quality, free from defects and in conformance with the requirements of the Contract Documents and further promising to repair or replace defective Work during a 1-year period following Final Acceptance. Warranty to include material and labor.

B. Defective Work: Defective work is defined to include the following:

1. Structural failure.
2. Sealant failure.
3. Uncontrolled leakage.
4. Deterioration of metal beyond normal weathering.
6. Failure of the system to meet performance requirements.
7. Glazing breakage due to structural movement.

1.9 COORDINATION

A. Coordinate sequence of installation of the system with that of related works described in other sections to ensure that assembling, including flashings, fittings and joint sealants are protected against weather and other damages caused by weathering, corrosion, etc.

B. This section has the obligation to coordinate column locations with the masonry contractor to size and locate perfectly any embedments in the CMU kneewalls where columns will be anchored.

C. All equipment, piping, conduit, and other devices and fittings shall be installed without interfering with any other greenhouse equipment or systems. Specifically, no installed materials shall obstruct doorways, vent windows, exhaust fan openings, thermal curtains or other greenhouse systems.

D. Equipment and other components of greenhouse shall be located and installed in a way
that minimizes shading of the greenhouse interior.

E. High pressure fog nozzles shall be located and oriented so as to minimize the accumulation of spray drift on greenhouse components, equipment, fixtures and plants.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Bidders are hereby informed that the greenhouse was written as a performance spec. Basis of design and alternate manufacturers are designated as follow:

1. Greenhouse
   a. Basis of Design: Hartley Botanic
   b. Alternate: Miracle Recreation
   c. Alternate: Gothic Arch Greenhouses

2.2 MATERIALS

A. The structure shall be designed and detailed according to good engineering practice by a structural engineer licensed in the State of Missouri.

B. Structural and Bracing Components

2. Extruded Aluminum Bars and Shapes: Comply with requirements of ASTM B 221, alloy 6063-T6.

C. Plate and Sheet Flashing

1. Galvanized Steel: For supported flashing, pre-galvanized 0.063 in minimal thickness, to ASTM A 623M-Z275 and ASTM A 123 galvanization standards. For unsupported steel flashing, use 0.125 in.
2. Aluminum: To ASTM B 209, 3003-H4 alloy, AA-CZZA41 mill finish, 0.080 in for supported flashing and 0.125 in thickness for unsupported flashing.

D. Aluminum Extrusions

1. Aluminum, alloy 6063T6, machinable, 30 kips ultimate tensile strength.

E. Finish: In all cases, provide mill finish for aluminum and standard finish for pre-galvanized or hot-dip galvanized steel. Sheared or cut pieces of galvanized steel shall be painted with 2 coats of specified galvanized coating. Any welded steel component shall be hot-dip galvanized after welding.

F. Anchor Bolts: SAE Grade 5 or ASTM A449 screws and anchor bolts made of rustproof steel, per design. Fastening devices are generally concealed; where
otherwise allowed by the Engineer, use screws and ties of rustproof quality and of a finish matching that of contiguous works. For chemical anchor bolts, use products providing twice the lift reaction as submitted in detailed structural calculations.

G. **Bolts, Nuts and Washers: To ASTM A 307 grade A. Plain washers to ASTM F 844. Beveled washers: ANSI B27.4 Type B. High strength bolts, nuts and washers: ASTM A 325 Type 1.**

H. **Hot Dip Galvanizing:** Galvanize steel, where indicated, to ASTM A 123 and ASTM A 653.

I. **Accessories:** Steel cables, turnbuckles, rods, clamps and all other accessories are aluminum or hot-dip galvanized steel.

J. **Gaskets and Joint Fillers:** Provide the manufacturer's standards.

K. **Fasteners and Accessories:** Provide noncorrosive fasteners and accessories that are compatible with materials used in the framing system. For fastening to foundation kneewall, use ANSI steel bolts. Provide neoprene washers on fasteners to ensure weather tight enclosure. Do not provide on anchor bolts to structure.

L. **Provide a system of integral gutters in roof framing and glazing bars designed to collect condensation and weep moisture to the exterior. Under gutter drip channels shall collect condensation on gutters.**

M. **Provide extruded aluminum glazing bars, sized to provide sufficient strength for design loads specified. Typical glass length will be from roof purlin to roof purlin. Provide shoulders to receive roof glass and grooves to conduct condensation to suitable disposal points. Raise glazing bars a minimum of ¼ inch above the top of the purlin using aluminum straps or clips to allow condensation to pass to suitable collection points.**

N. **Provide and install an extruded aluminum ridge at the peak of the structure.**

O. **Provide all other structural components; such as bracing, clips, and fasteners not mentioned above but required to complete the framework of the greenhouse.**

2.3 **GREENHOUSE STRUCTURE**

A. **Greenhouse structure shall be a metal frame gutter connected house. Structures shall conform to all conditions of these specifications, and overall dimensions. The greenhouse elevation shown on drawings is illustrative in nature – the greenhouse roof and other structural components shall be manufacturer’s standard styles and profiles.**

B. **Greenhouse columns shall be spaced and sized to provide a single span across the width of the greenhouse. Trusses between columns shall be adequate to support design dead, wind and snow loads as well as live loads indicated.**

C. **Connections shall be made with galvanized steel bolts. Bolts ¼ inch to ½ inch diameter shall be A307. Larger bolts shall be Grade 5.**

D. **Aluminum plates used for connections shall be pre-punched. Prefabricate all purlins for attachment of glazing bars and connecting lugs.**
E. Structural Support Movement: Provide aluminum extrusion system that accommodates structural movements including, but not limited to, sway, twist, column shortening, long-term creep, and deflection.

F. Kneewall to support greenhouse assembly.

2.4 FABRICATION

A. Fabricate greenhouses to meet aesthetic and performance criteria indicated. Prepare, fit and assemble components in the manufacturer's shop to the fullest extent possible. Before shipment, shop-assemble, mark and disassemble components that cannot be permanently shop assembled. Always mark on non-exposed areas.

B. Shop Welding: Where shop welding is permissible or required, use only the Gas Tungsten Arc Welding (TIG) or Gas Metal Arc Welding (MIG) process. Remove excess weld material. If welded steel is pre-galvanized, hot dip galvanize the assembly after welding.

C. Fabricate architecturally exposed structural members with exposed surfaces smooth, square, and free of surface blemishes, including pitting, rust and scale seam marks, roller marks, rolled trade names, and roughness.

1. Remove blemishes by filling, grinding, or by welding and grinding, prior to cleaning, treating, and shop priming/coating.

2. Comply with fabrication requirements, including tolerance limits, of AISC’s “Code of Standard Practice for Steel Buildings and Bridges” for architecturally exposed structural steel.

2.5 EXPANSION CONTROL

A. Suitable expansion joints shall be provided in all longitudinal members to take care of the longitudinal expansion in framing members. No longitudinal members shall exceed 21'-0". All members shall be so joined as to require each joint to handle the expansion in the individual member and to prevent an accumulation of expansion in several members in one direction.

B. Thermal Movements: Provide aluminum extrusion system, including anchorage, that accommodates thermal movements of system and supporting elements resulting from the following maximum change (range) in ambient and surface temperatures without buckling, damaging stresses on glazing, failure of joint sealants, damaging loads on fasteners, noise or vibration, and other detrimental effects.

1. Temperature Change (Range): 200 deg F, material surfaces.

2.6 GUTTERS

A. Connections for gutter downspouts shall be provided where indicated on drawing. Final connection and downspout materials are covered in other sections of these specifications.
2.7 RIDGE & SIDE VENT

A. Vent construction to be manufacturer’s standard type, continuous hinge and arranged to open outward.

B. Provide a minimum of 36 vent openings, panes in total, comprising of (7) 3-pane roof vents, and (5) 3-pane vertical face vents, 3-in the rear elevation and 2-in the front elevation manually operated. The vents are approximately 2’2” deep from top to bottom and are 3 panes wide, measuring approximately 3’ 8”.
   1. Provide additional roof and sidewall vents per manufacturer recommendations due to climate specific requirements.

2.8 VENT OPERATORS

A. Roof vents are to be automatically controlled by manufacturer’s standard temperature sensitive hydraulic auto vent operators.
   1. If power is required, coordinate requirements with electrical contractor. All associated costs to be included in proposal.

B. Sidewall vents to be manually controlled by manufacturer’s standard hand operated control system.

2.9 VENT SCREENS

A. Screen frames shall be assembled with die cast aluminum corners and designed to allow for re-screening of units in the field.

B. Brush seals shall be provided at ends of screen frames where vent operator arms penetrate.

2.10 GLAZING

A. Roof and sidewall glazing to be manufacturer’s standard, greenhouse quality, clear tempered safety glass, minimum 4mm with all edges cushioned by glazing seals bonded to the glass. Each pane to be held within individual framework on all sides – no glass to glass, or glass to metal, nor overlapping glass contact.

B. Alternate: Self-Cleaning Glass:
   1. Provide self-cleaning glazing at roof in lieu of manufacturer’s standard glazing.
      (a) Pyrolytic-Coated, Low-Maintenance Glass: Clear float glass with a coating on first surface having both photocatalytic and hydrophilic properties that act to loosen dirt and to cause water to sheet evenly over the glass instead of beading.

2.11 GLAZING SEALS

A. Lay Butyl rope in the corners of the glazing bar shoulders before placing the glass.
B. After placing the glass apply a bead of clear silicone top seal to the side edges of the roof glass only. Top seal is not required on vertical lapped glass.

2.12 FASTENERS

A. Non-load bearing screws and bolts shall be 18-8 stainless steel or 2024-T4 aluminum. All structure fasteners shall be A325 high strength, hot-dipped galvanized bolts.

2.13 DOORS

A. Doors shall be 1 ¾-inch by 3'0" by 6'-8” anodized with 5-inch extruded tube rails and 4-inch extruded aluminum tube frame with wool pile seals; hinges with non-removable pins, lever handles, aluminum threshold and door sweep. Door shall be glazed with ¼-inch clear safety glazing and bottom panel shall be an aluminum faced panel.

2.14 LOW PRESSURE IRRIGATION SYSTEM

A. Provide low-pressure drip irrigation kit capable of servicing entire greenhouse, mounted on shelving.
   1. Include all hoses, nozzles, and accessories required for complete installation.

B. System to be connected to water source listed in Plumbing documents.

2.19 SHELVES

A. Horizontal surface shelving assemblies, for the interior of the greenhouse, should be provided for planters and containers. Shelving units should allow for proper drainage of moisture and water away from horizontal surfaces. Shelves to be designed and fabricated to manufacturer’s recommendations.

2.20 SHADES

A. Provide manually operated roof mounted roller shades. Manufacturer to recommend extent of shades based on greenhouse location and orientation. Shades to be designed and fabricated to manufacturer’s recommendations.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine areas and conditions under which greenhouse work is to be installed. Notify Contractor in writing of conditions detrimental to proper and timely installation of work.

B. Coordinate and furnish anchorages, setting diagrams, templates and directions for installation of anchorages. Coordinated delivery of such items to project site.
3.2 GREENHOUSE ERECTION
   A. Comply with manufacturers’ instructions, except where more stringent requirements are shown or specified, and except where project conditions require extra precautions or provisions to ensure satisfactory performance of the work.
   B. Greenhouse Contractor is responsible for all unloading of greenhouse materials, systems, equipment and to provide any lift or installation equipment required.

3.3 ENCLOSURE INSTALLATION
   A. Install equipment in accordance with Manufacturer’s installation instructions and recognized industry practices to insure intended function.
   B. Provide supplemental framing for door openings. Anchor door frames securely and install flashing, trim, sealants, and the like to minimize air and water infiltration.

3.4 GLAZING PANELS
   A. Handle and install panels in strict accordance with the manufacturer's instructions and recommendations.
   B. Replace any damaged panels.
   C. Install glazing panel system so it is watertight and to allow for thermal movement considerations.

3.5 GREENHOUSE EQUIPMENT
   A. Install mechanical, electrical and other equipment specified in this section in strict accordance with manufacturer's recommendations.

3.6 ADJUSTING
   A. Final Adjustments: Upon achieving substantial completion of the work, adjust all operable components to ensure that they are properly installed and functioning smoothly. Replace any component which cannot be adjusted for proper operation.

3.7 DISSIMILAR MATERIALS
   A. Separate aluminum from cementitious material with polyurethane or asphaltic coating.

3.8 GROUTING
   A. After the Greenhouse Manufacturer has placed the wall sills, the Masonry Contractor shall provide the necessary materials and labor to grout between the wall and the sill to
eliminate any discrepancies between the two and produce a finished joint, if required.

3.9 CLEANING

A. During progress of the work, remove from project site all discarded materials, rubbish, and debris resulting from the work.

B. Upon completion, clean all surfaces which have become soiled or coated as a result of work of this section, using proper methods which will not scratch or otherwise damage finished surfaces. Use only products and techniques acceptable to manufacturer of products being cleaned.

C. Final cleaning of glazing shall be the responsibility of the General Contractors, or selected Subcontractors other than the Greenhouse Contractor.
SECTION 123661.19 - QUARTZ AGGLOMERATE COUNTERTOPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Quartz agglomerate countertops.

1.2 ACTION SUBMITTALS

A. Product Data: For countertop materials.

B. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.
   1. Show locations and details of joints.
   2. Show direction of directional pattern, if any.

C. Samples for Initial Selection: For each type of material exposed to view.

D. Samples for Verification: For the following products:
   1. One full-size quartz agglomerate countertop, with front edge, 8 by 10 inches (200 by 250 mm), of construction and in configuration specified.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For quartz agglomerate countertops to include in maintenance manuals. Include Product Data for care products used or recommended by Installer and names, addresses, and telephone numbers of local sources for products.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate countertops similar to that required for this Project, and whose products have a record of successful in-service performance.

B. Installer Qualifications: Fabricator of countertops.
1.6  FIELD CONDITIONS

A. Field Measurements: Verify dimensions of countertops by field measurements after finished interior window framing is installed but before countertop fabrication is complete.

1.7  COORDINATION

A. Coordinate locations of utilities that will penetrate countertops or backsplashes.

PART 2 - PRODUCTS

2.1  QUARTZ AGGLOMERATE COUNTERTOP MATERIALS

A. Quartz Agglomerate: Solid sheets consisting of quartz aggregates bound together with a matrix of filled plastic resin and complying with ICPA SS-1, except for composition.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Caesarstone.
   b. Cambria.
   c. Corian Quartz
   d. Or Approved Equal.

2. Colors and Patterns: As selected by Architect from manufacturer's full range.

B. Plywood: Exterior softwood plywood complying with DOC PS 1, Grade C-C Plugged, touch sanded.

2.2  COUNTERTOP FABRICATION

A. Fabricate countertops according to quartz agglomerate manufacturer's written instructions and the AWI/AWMAC/WI's "Architectural Woodwork Standards."

1. Grade: Premium.

B. Countertops: 3/4-inch- (19-mm-) thick, quartz agglomerate with front edge built up with same material.
   a. Front/Sides: Straight, slightly eased at top and bottom

C. Fabricate tops with shop-applied edges unless otherwise indicated. Comply with quartz agglomerate manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.

D. Joints: Fabricate countertops without joints.
Cutouts and Holes: Prepare countertops in shop for field cutting openings for accessory trays. Mark trays for cutouts and drill holes at corners of cutout locations. Make corner holes of largest radius practical.

2.3 INSTALLATION MATERIALS

A. Adhesive: Product recommended by quartz agglomerate manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates to receive quartz agglomerate countertops and conditions under which countertops will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of countertops.

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

3.2 INSTALLATION

A. Install countertops level to a tolerance of 1/8 inch in 8 feet (3 mm in 2.4 m), 1/4 inch (6 mm) maximum. Do not exceed 1/64-inch (0.4-mm) difference between planes of adjacent units.

B. Secure countertops to subtops with adhesive according to quartz agglomerate manufacturer's written instructions. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with quartz agglomerate manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

C. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.

END OF SECTION 123661.19
SECTION 220510 - BASIC PLUMBING REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this and the other sections of Division 22.

1.2 SUMMARY

A. This Section includes general administrative and procedural requirements for mechanical installations. The following administrative and procedural requirements are included in this Section to expand the requirements specified in Division 1:

1. Submittals
2. Material and Equipment Selection
3. Coordination drawings
4. Record documents
5. Maintenance manuals

1.3 SUBMITTALS

A. General: Follow the procedures specified in Division 1. In addition to the requirements specified in Division 1, comply with the following:

1. Increase by two (2) the quantity of copies required by Division 1 for submittals.
2. Submit line-by-line specification verification for equipment other than the “basis of design” as further described in the following article “Material and Equipment Selection”.
3. Prepare and submit Coordination Drawings as further described herein.
   a. The Engineer shall receive one copy of all coordination drawings supplied to the Owner as required in this specification. It is the responsibility of the Contractor to coordinate the work as outlined herein. Receipt by the Engineer of a copy of the coordination drawings 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 coordination proposed.
4. Provide a list of all equipment, including type and all nameplate information and where it is located. Refer to drawings for required tagging information for labeling each piece of equipment. A copy of this list shall be provided to the Owner in Microsoft Excel format, and included in the operation and maintenance manual.
5. Comply with each individual Division 22 Section for additional submittal requirements.

1.4 MATERIAL AND EQUIPMENT SELECTION

A. Product Options: The specification of each item of major equipment required for the project may include a list of manufacturers, with one “basis of design” manufacturer, type, and model identified by virtue of their being the first listed manufacturer in the specifications. Where several manufacturers in addition to the “basis of design” manufacturer are listed in the specifications, it
shall be understood that the words “or approved equal by” are implied to precede each of the other manufacturer’s names.

B. The manufacturers other than the “basis of design” may be furnished at the contractor’s option in lieu of the “basis of design” product, provided that the selected manufacturer’s product is equal in all material and functional respects. Additional work required for equipment that is other than the “basis of design”, shall be at the expense of the contractor. In addition to submittal requirements that may be specified in this section, submit a line-by-line written verification of the applicable specification section(s) identifying compliance with or variations from the specified features, materials, performance, capacities, weight, size, durability, energy consumption and efficiency, warranty, and visual impact (if exposed to view by other than maintenance persons). The burden of proof of manufacturer/product equality is on the contractor.

C. Where a product is not scheduled on the drawings and, therefore, where no “basis of design” is indicated, the first listed manufacturer in the specifications shall be deemed as “basis of design”.

D. Products of manufacturers not listed in the Contract Documents are considered Substitutions and are not permitted, except as provided under the General and Supplementary Conditions and Division 1 Specifications. Full compliance with Division 1 section “Product Substitutions” is mandatory for acceptance of products or manufacturers not listed.

E. Listing of a manufacturer does not imply approval of that manufacturer’s standard product or products. Rather, listing of a manufacturer indicates only a general acceptance of that manufacturer’s name and reputation. Final approval is subject to full compliance with these Contract Documents.

F. Model numbers identified on the Drawings notwithstanding, all equipment must comply with the requirements of these Contract Documents. Do not assume that a manufacturer’s standard product is acceptable as is. For example, one or more custom modifications, custom colors or finishes, manufacturer’s options, and/or accessories may be required to meet the specified requirements.

G. Where drawings indicate sizes, profiles, connections, and dimensional requirements of material and equipment, these are based on the “basis of design” manufacturer, type and model indicated. In the event that equipment of power, dimensions, capacities, layout, connections, and/or ratings differing from the “basis of design” are selected by the contractor and approved by the Owner’s representative, any necessary adjustments are the contractor’s responsibility. All connecting mechanical and electrical services, circuit breakers, conduit, motors, bases, pipe and duct sizes, pipe and duct layout, and the like shall be adjusted by the contractor to suit the equipment provided. No additional costs will be approved for these changes. Should revisions to the design because of contractor’s selection of manufacturer, type, or model other than the “basis of design” require additional review and/or redesign by an Architect or Engineer, the contractor shall reimburse the Owner for Owner’s added professional fee expenses.

H. Where two or more materials are listed in the “Part 2 – Products” subsection of any Division 22 section, do not assume that the selection of materials is the contractor’s option. Refer to “Part 3 – Execution” subsection of that same Division 22 section for an explanation of which specific material(s) shall be used for which specific application(s). For example, Part 2 may list several types and grades of piping, and Part 3 will describe which type and grade of pipe to use for a given application.

I. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping
systems, and have been coordinated, as much as possible, based on available information and field observations. Deviations to layout that may require additional fittings, and are within 6’-0” of design document layout, shall be at the expense of the contractor. Deviations to layout shall be documented on the coordination drawings. 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.

1.5 COORDINATION DRAWINGS

A. Prepare project coordination drawings to a scale of ¼” = 1’0” or larger. Detail major elements, components, and systems of mechanical equipment and materials in relationship with other systems, installations, and building components. Show space requirements for installation and access. Indicate if sequence and coordination of installations are important to efficient flow of the Work.

1.6 RECORD DOCUMENTS

A. Prepare record documents in accordance with the requirements in Division 1. In addition to the requirements specified in Division 1, indicate the following installed conditions:

1. Mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located (i.e., traps, strainers, expansion compensators, tanks, etc.). Indicate actual inverts and horizontal locations of all underground piping.
2. Valve location diagrams, complete with valve tag chart. Refer to Section 220523.
3. Equipment locations (exposed and concealed), dimensioned from prominent building lines.
5. Contract Modifications, actual equipment and materials installed.

1.7 MAINTENANCE MANUALS

A. Prepare maintenance manuals in accordance with Division 1. In addition to the requirements specified in Division 1, include the following information for equipment items:

1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.
2. Manufacturer’s printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.
3. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
4. Servicing instructions and lubrication charts and schedules.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION (NOT APPLICABLE)

END OF SECTION 220510

BASIC PLUMBING REQUIREMENTS 220510-3
SECTION 220511 - 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 1 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.
7. Grout.
8. Equipment installation requirements common to equipment sections.
10. Concrete bases.
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:

2. CPVC: Chlorinated polyvinyl chloride plastic.
3. PVC: Polyvinyl chloride plastic.
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 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

B. 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.

1.6 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 plumbing 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 plumbing items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 8 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. The specification of each item of major equipment required for the project may include a list of manufacturers, with one “basis of design” manufacturer, type, and model identified by virtue of their being the first listed manufacturer in the specifications.

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-inch maximum 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. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

E. 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.

F. 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. 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:
   b. Dresser Industries, Inc.; DMD Div.
   c. Ford Meter Box Company, Incorporated (The); Pipe Products Div.
   d. JCM Industries.
   e. Smith-Blair, Inc.
   f. Viking Johnson.

2. Underground Piping NPS 1-1/2 and Smaller: Manufactured fitting or coupling.
4. Aboveground Pressure Piping: Pipe fitting.

B. Flexible Transition Couplings for Underground Nonpressure 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:
   b. Fernco, Inc.

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. Manufacturers:
   a. Capitol Manufacturing Co.
   b. Eclipse, Inc.
   e. Zurn Industries, Inc.; Wilkins Div.

D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 220- or 300-psig minimum working pressure as required to suit system pressures.

1. Manufacturers:
   a. Capitol Manufacturing Co.
   b. Epco Sales, Inc.

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.
2. Separate companion flanges and steel bolts and nuts shall have 220- or 300-psig minimum working pressure where required to suit system pressures.

F. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.
   1. Manufacturers:
      a. Calpico, Inc.
      b. Lochinvar Corp.
      c. Watts.

G. 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. 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: Carbon steel with corrosion-resistant coating 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.

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 set screw or spring clips and chrome-plated finish.

E. One-Piece, Floor-Plate Type: Cast-iron floor plate.

F. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

2.9 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
   2. Design Mix: 5000-psi, 28-day compressive strength.

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, 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. Coordinate piping location and installation with all trades involved in work.

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. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.
   b. Insulated Piping: One-piece, stamped-steel type with spring clips.
   c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
   d. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
   e. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.

2. Existing Piping: Use the following:
   a. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-casting, cast-brass type with chrome-plated finish.
   b. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-casting, cast-brass type with chrome-plated finish.

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 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.
   b. Steel Sheet Sleeves: For pipes NPS 6 and larger, penetrating gypsum-board partitions.

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.

Q. 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.

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-inch annular 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.

T. Verify final equipment locations for roughing-in.

U. 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.


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.

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. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
   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 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.

3.5 PAINTING

A. Painting of plumbing systems, equipment, and components is specified in Division 9 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.

3.6 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
   1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
   2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
   3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.
6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
7. Use 3000-psi, 28-day compressive-strength concrete and reinforcement as specified in Division 3 Section "Cast-in-Place Concrete."

3.7 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor plumbing materials and equipment.

B. Field Welding: Comply with AWS D1.1.

3.8 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 220511
SECTION 220512 - PLUMBING EXCAVATION AND BACKFILLING

PART 1 - GENERAL

1.1 GENERAL

A. The Contractor shall make all excavations required for constructing all sewers, water main, drains, and appurtenant structures as required by the Project Plans and Specifications. Except where otherwise required by the Project Plans and Specifications, or ordered by the Engineer, all excavations shall be in open cut to the specified widths and depths.

B. The Contractor shall be responsible for the conditions of all excavations made by him and shall properly and adequately protect the excavation from caving or sliding. All slides and cave-ins shall be handled, removed, or corrected by the Contractor without extra compensation at whatever time and under whatever circumstances they may occur.

1.2 CLASSIFICATION

A. There shall be three classes of excavation:

B. Class A: Any material such as solid limestone or hard sandstone in original beds or well-defined ledges; detached pieces of limestone or hard sandstone or mass concrete, any of which cannot be removed by heavy equipment without drilling and blasting or wedging.

C. Class B: Dense materials such as hard shales, soft sandstone, or broken rock or concrete in detached pieces more than one cubic foot in volume, removable by heavy equipment without drilling and blasting or wedging. If the Contractor chooses and is permitted to use drilling, blasting, or wedging for removal of Class B material, such material will be measured or classified as Class B, and not as Class A.

D. Class C: All materials not included in Class A and Class B excavation.

PART 2 - EXCAVATION

2.1 GENERAL

A. The Plumbing Contractor shall make all excavations required for construction of all underground sewers, water piping, drains, and all else required to make a complete and sanitary plumbing and storm drainage system.

B. This Contractor shall be responsible for the conditions of all excavations made by him and shall properly and adequately protect the excavation from caving or sliding.

C. All excavation shall be made in open cut from the surface.

D. All surplus material that is not necessary for backfilling purposes shall be hauled from the site and
E. The bottom of the trench shall be over-excavated a minimum of 4 inches below the bottom of the pipe and shall be shaped for the bell at each joint of pipe to ensure uniform bearing for the entire length of the pipe.

F. All excavation shall be dewatered before any construction is undertaken therein.

PART 3 - BACKFILL

3.1 GENERAL

A. The Plumbing Contractor shall backfill all trenches, restore all property damaged by this construction to as good condition as existed prior to excavation.

B. Cast Iron Installation:
   1. All cast iron piping shall be bedded in 3/4 inch minus crushed limestone and screenings. The bedding shall not be less than 4 inches thick below the bottom of the pipe.
   2. All backfill below slab on ground, pavement, walks, etc. shall be performed using 3/4 inch minus crushed limestone and screenings. This material shall be placed in 6 inch layers and compacted with mechanical tampers to a minimum 95 percent maximum dry density when tested in accordance with ASTM D-698.

C. PVC Installation:
   1. All PVC Piping shall be bedded in Class IA or IB materials. Bedding shall not be less than 4” thick below the bottom of the pipe.
   2. All backfill for PVC piping below grade shall be performed using Class IA or IB materials. This material shall be placed in 6” layers and compacted with mechanical tampers to a minimum 95% maximum dry density.
   3. Install below grade PVC piping in accordance with ASTM D 2321.

PART 4 - EXECUTION

4.1 ACCESS AND RIGHTS-OF-WAY

A. All construction shall be confined to the public rights-of-way and to the areas designated on the Owner's property. Should the Contractor damage any shrubbery or facilities besides those necessary in the immediate area of the new work, it shall be his responsibility to settle the damages with the appropriate Owner. Every precaution possible shall be taken to protect shrubbery, trees, fences, walks, structures, lawns, etc. near the areas of construction.

4.2 PROTECTION

A. This Contractor shall provide and maintain suitable guard rails, barricades and warning lights for the safety of the public as required by law or as ordered by the Construction Manager, and shall take all necessary precautions to prevent accidents. He shall make suitable and adequate provisions for the convenience and safety of the public and of the residents along the route of construction. He shall
give adequate notice in writing to all Owners or occupants of property, buildings, structures, or utilities that may be affected by this work and which may require protection or adjustment. He shall not hinder their protective measures but shall exercise due care to protect all property. The Contractor shall not obstruct access to fire hydrants and service valves, nor to U.S. mailboxes. He shall restore, without delay to service, any utility service facilities damaged by his operations, and shall cooperate with utility companies in the restoration of their services.

4.3 REMOVAL AND REPLACEMENT OF PAVEMENTS AND ROADWAY WEARING SURFACES

A. Existing paving or roadway surfacing, curb and gutter, streets, driveways, sidewalks, paved areas, parking areas, either removed or else damaged by the Plumbing Subcontractor in his operations, and not scheduled to be replaced by the General Contractor, shall be replaced by this Contractor to a condition at least equal to the condition before removal, and in conformance with the regulations of the agency of jurisdiction, and as required by the Engineer. Reasonable efforts shall be made to avoid contrast, clash, or lack of harmony in the color and texture of the restored surfaces.

B. The edges of all areas to be paved shall be saw cut to provide a straight joint.

C. All broken and removed pavement shall be removed from the site and shall not be used in the backfill material.

4.4 DISPOSITION OF UTILITIES

A. Rules and regulations governing the respective utilities shall be observed in executing all work under this section.

B. The drawings indicate the readily available record of locations of existing structures and facilities; both above and below the ground, but the Engineer assumes no responsibility for the accuracy or completeness of this information.

C. This Contractor shall proceed with caution in any excavation and shall use every means to determine the exact location of underground structures, pipelines, conduits, etc., prior to excavation in the immediate vicinity thereof. He shall be solely responsible for the costs of protection, or repair, or replacement of any structure, pipe lines, conduit, service connections, etc., above or below ground which may be broken or otherwise damaged by his operations. All water, sewer and gas pipes and other conduits adjacent to or crossing the trench must be properly supported or protected.

D. Overhead Wires and Poles - If the method of operation for the construction of sewers and water mains requires the removal and replacement or protection of any overhead wires or poles, this Contractor shall make satisfactory arrangements for such work with the Owners of such wires and poles.

E. Underground Utilities - Wherever it becomes necessary to move or perform any work on gas or water mains, or any other privately or publicly owned conduits encountered in or across the trenches, the Contractor shall make satisfactory arrangements for such work with the owners of such mains or conduits. All existing water mains, sewers, etc. must be protected from freezing by the Contractor.

F. All costs associated with the removal and replacement of existing utilities shall be included in the
price bid.

4.5 RESTORATION OF SITE

A. This Contractor shall protect and avoid damage to all public and private property along the line of work. Damage due to the carelessness of the Contractor shall be repaired or restored at his expense. Particular attention shall be paid to avoid damage to trees, shrubs, bushes, and private property located in and adjacent to easements on private property. No trees may be removed without the permission of the property owner.

B. All areas not scheduled to be replaced or restored by the General Work Contractor shall be restored as nearly as practicable to their original condition by this Contractor. Damaged shrubbery or trees shall be replaced with new plants of equal type and quality. Finished lawn areas upon which earth has been deposited shall be cleared to the level of the existing sod, raked and watered. Areas where sod has been damaged, destroyed or ruts have been filled in, shall be re-sodded. Areas where sod is only slightly damaged may be lightly reseeded, if so permitted by the Engineer. After final restoration of the settled trench surfaces, trench areas shall be re-sodded, unless otherwise required in the Project Plans and Specifications.

C. Debris and unused materials shall be removed from the working areas without unreasonable or unnecessary delay, and the working areas restored as nearly as practicable to their original conditions as soon as possible, in order to minimize damage, hazard, and inconvenience to the public and to the concerned property owners.
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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes general duty valves common to plumbing piping systems. Related Sections: The following Sections contain requirements that relate to this Section:

1. Special purpose valves are specified in Division 22 piping system Sections.
2. Valve tags and charts are specified in Division 22 Section "IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT."
3. Section 220511 “COMMON WORK RESULTS FOR PLUMBING”.

1.3 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Section 22 Specification Sections.

B. Product Data for each valve type. Include body material, valve design, pressure and temperature classification, end connection details, seating materials, trim material and arrangement, dimensions and required clearances, and installation instructions. Include list indicating valve and its application.

C. Maintenance data for valves to include in the operation and maintenance manual specified in Division 1. Include detailed manufacturer's instructions on adjusting, servicing, disassembling, and repairing.

1.4 QUALITY ASSURANCE


B. ASME Compliance: Comply with ASME B31.9 for building services piping and ASME B31.1 for power piping.

C. ASME Compliance for Ferrous Valves: ASME B16.10 and ASME B16.34 for dimension and design criteria.

D. MSS Compliance: Comply with the various MSS Standard Practice documents referenced.
E. NSF Compliance: NSF 61 for valve materials for potable water.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:
   1. Protect internal parts against rust and corrosion.
   2. Protect threads, flange faces, and grooves.
   4. Set butterfly valves closed or slightly open.
   5. Block check valves in either closed or open position.

B. Use the following precautions during storage:
   1. Maintain valve end protection. Store indoors and maintain valve temperature higher than ambient dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use a sling to handle large valves. Rig to avoid damage to exposed parts. Do not use handwheels and stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   1. Ball Valves:
      a. Conbraco Industries, Inc.; Apollo Division.
      b. Hammond Valve Corporation.
      c. NIBCO Inc.
      d. Stockham Valves & Fittings, Inc.
      e. Watts

   2. Butterfly Valves:
      a. General Signal; DeZurik Unit.
      b. Grinnell Corp.
      c. Hammond Valve Corporation.
      d. Keystone Valve USA, Inc.
      e. NIBCO Inc.
      f. Stockham Valves & Fittings, Inc.
      g. Watts

   3. Swing Check Valves:
      a. Cla-Val Co.
      b. Hammond Valve Corporation.
      c. NIBCO Inc.
      d. Powell: Wm. Powell Company (The).
      e. Stockham Valves & Fittings, Inc.
      f. Watts
4. Wafer Check Valves:
   a. Hammond Valve Corporation.
   b. NIBCO Inc.
   c. Stockham Valves & Fittings, Inc.
   d. Watts

5. Calibrated Balancing Valves:
   a. Armstrong Pumps, Inc.
   b. ITT Fluid Technology Corp.; ITT Bell & Gossett Div.
   c. Taco, Inc.

2.2 BASIC, COMMON FEATURES

A. Pressure and Temperature Ratings: As indicated in the "Application Schedule" of Part 3 of this Section and as required to suit system pressures and temperatures.

B. Sizes: Same size as upstream pipe, unless otherwise indicated.

C. Operators: Use specified operators and handwheels, except provide the following special operator features:
   1. Handwheels: For valves other than quarter turn.
   2. Lever Handles: For quarter-turn valves 4 inches and smaller.
   3. Gear-Drive Operators: For quarter-turn valves 6 inches and larger.

D. Extended Stems: Where insulation is indicated or specified, provide extended stems arranged to receive insulation.
   1. Bypass and Drain Connections: Comply with MSS SP-45 bypass and drain connections.

E. BALL VALVES
   1. Ball Valves, 4 Inches and Smaller: MSS SP-110, Class 150, 600-psi CWP, ASTM B 584 bronze body and bonnet, 2-piece construction; chrome-plated brass ball, full port for 1-inch valves and smaller and conventional port for 1-1/4-inch valves and larger; blowout proof; bronze or brass stem; teflon seats and seals; threaded or soldered end connections:
      b. Lever operators with lock where called for on the drawings.
      c. Stem Extension: For valves installed in insulated piping.
      d. Memory Stop: For operator handles.

F. BUTTERFLY VALVES
   1. Butterfly Valves: MSS SP-67, 200-psi CWP, 150-psi maximum pressure differential, ASTM A 126 cast-iron body and bonnet, extended neck, stainless-steel stem, field-replaceable EPDM or Buna N sleeve and stem seals, wafer, lug, or grooved style:
a. Disc Type: Nickel-plated ductile iron.
b. Disc Type: Epoxy-coated ductile iron.
c. Operator for Sizes 2-1/2 Inches to 4 Inches: Lever handle with latch lock.
d. Operator for Sizes 6 Inches and larger: Gear operator with position indicator.
e. Operator for Sizes 6 Inches and Larger, 96 Inches or Higher above Floor: Chain-wheel operator.

G. CHECK VALVES

1. Swing Check Valves, 2-1/2 Inches and Smaller: MSS SP-80; Class 125, 200-psi CWP, or Class 150, 300-psi CWP; horizontal swing, Y-pattern, ASTM B 62 cast-bronze body and cap, rotating bronze disc with rubber seat or composition seat, threaded or soldered end connections.
2. Swing Check Valves, 3 Inches and Larger: MSS SP-71, Class 125, 200-psi CWP, ASTM A 126 cast-iron body and bolted cap, horizontal-swing bronze disc, flanged or grooved end connections.
3. Wafer Check Valves: Class 125, 200-psi CWP, ASTM A 126 cast-iron body, bronze disc/plates, stainless-steel pins and springs, Buna N seals, installed between flanges.
4. Check Valves-Vertical Position: Check Valves used in vertical position shall be Mueller Steam Specialty Co., Figure 105-BP glove type, bronze body, flanged ends, 175# W.W.P., seats and disc of composition bronze, guide pins and bushings of silicon bronze, phosphor bronze springs. The units shall be designed for quiet action and positive protection against water hammer.

H. BALANCING VALVES

1. Furnish and install in the hot water recirculating branches a Bell and Gossett Bronze Circuit Setter with provisions for connecting portable differential pressure meter. An integral pointer shall be installed to provide degree of valve opening. A calibrated chart shall accompany the Circuit Setter and may be used to determine flow rate. Each Circuit Setter shall be constructed for 125 lbs. working pressure at 250°F, and supplied with a preformed polyurethane package that can be reused for insulation on the piping system. Before the job is turned over to the owner the Circuit Setters shall be adjusted to balance the circulation of hot water in all branches.
2. Similar valves by Armstrong will be acceptable. NOTE: If Armstrong balancing valves are used the Plumbing Contractor may eliminate the shut-off valve at each balancing valve as shown on the drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine piping system for compliance with requirements for installation tolerances and other conditions affecting performance of valves. Do not proceed with installation until unsatisfactory conditions have been corrected.

B. 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.
C. Operate valves from fully open to fully closed positions. Examine guides and seats made accessible by such operation.

D. Examine threads on valve and mating pipe for form and cleanliness.

E. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Check gasket material for proper size, material composition suitable for service, and freedom from defects and damage.

F. Do not attempt to repair defective valves; replace with new valves.

3.2 INSTALLATION

A. Install valves as indicated, according to manufacturer's written instructions.

B. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate the general arrangement of piping, fittings, and specialties.

C. Install valves with unions or flanges at each piece of equipment arranged to allow servicing, maintenance, and equipment removal without system shutdown.

D. Locate valves for easy access and provide separate support where necessary.

E. Install valves in horizontal piping with stem at or above the center of the pipe.

F. Install valves in a position to allow full stem movement.

G. For chain-wheel operators, extend chains to 60 inches above finished floor elevation.

H. Installation of Check Valves: Install for proper direction of flow as follows:

1. Swing Check Valves: Horizontal position with hinge pin level.
2. Wafer Check Valves: Horizontal or vertical position, between flanges.

3.3 THREADED CONNECTIONS

A. Note the internal length of threads in valve ends and proximity of valve internal seat or wall to determine how far pipe should be threaded into valve.

B. Align threads at point of assembly.

C. Apply appropriate tape or thread compound to the external pipe threads, except where dry seal threading is specified.

D. Assemble joint, wrench tight. Wrench on valve shall be on the valve end into which the pipe is being threaded.

3.4 FLANDED CONNECTIONS

A. Align flange surfaces parallel.
B. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly with a torque wrench.

C. For dead-end service, butterfly valves require flanges both upstream and downstream for proper shutoff and retention.

3.5 VALVE END SELECTION

A. Select valves with the following ends or types of pipe/tube connections:
   1. Copper Tube Size, 2 Inches and Smaller: Threaded ends.
   2. Copper Tube Size 2-1/2 Inches and Larger: Flanged ends.

3.6 APPLICATION SCHEDULE

A. General Application: Use gate, ball, and butterfly valves for shutoff duty; globe, ball, and butterfly for throttling duty. Refer to piping system Specification Sections for specific valve applications and arrangements.

B. Domestic Water Systems: Use the following valve types:
   1. Ball Valves: Class 150, 600-psi CWP, with stem extension.
   2. Butterfly Valves: Nickel-plated ductile iron or elastomer-coated ductile iron disc; EPDM or Buna N sleeve and stem seals.
   3. Bronze Swing Check: Class 125, with rubber seat.
   4. Check Valves: Class 125, swing or wafer type as indicated.

3.7 DOMESTIC HOT WATER RETURN SYSTEM BALANCING

A. This Contractor shall obtain the services of an independent firm to perform the hot water return system balancing. A Professional Engineer shall supervise all work and certify the balance report.

B. The Plumbing Contractor shall:
   1. Install all domestic hot water recirculating balancing valves indicated to be installed under this contract in a manner that will leave them accessible and readily adjustable. All hose connections and dial face shall be turned down or horizontal for ease of attachments and reading.
   2. He shall pre-set all balancing valves installed by him as directed by the Engineer.
   3. Provide the balance firm with one copy of the plumbing plans indicating the exact location of all devices.
   4. Place the plumbing equipment into full operation, domestic hot water heaters and hot water recirculating pumps and continue operating the equipment during the balancing.
   5. Open all valves throughout the domestic hot water system.
   6. Aid the balancing firm in locating and adjusting all balancing valves.
      a. The balance firm shall adjust the flow through all balancing elements to within 5% of design conditions.
      b. The balance firm shall prepare and submit to the Engineer four copies of the test and balance report.
c. The balance firm shall provide a one year warranty during which time additional adjustments may be required.

3.8 ADJUSTING

A. Adjust or replace packing after piping systems have been tested and put into service, but before final adjusting and balancing. Replace valves if leak persists.

END OF SECTION 220523
SECTION 220529 - HANGERS AND SUPPORTS 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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following hangers and supports for plumbing system piping and equipment:

1. Steel pipe hangers and supports.
2. Trapeze pipe hangers.
3. Thermal-hanger shield inserts.
4. Fastener systems.
5. Pipe stands.
6. Pipe positioning systems.
7. Equipment supports.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society for The Valve and Fittings Industry Inc.

B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.4 PERFORMANCE REQUIREMENTS

A. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.

B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

C. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

1.5 SUBMITTALS

A. Product Data: For the following:

1. Steel pipe hangers and supports.
2. Thermal-hanger shield inserts.
3. Powder-actuated fastener systems.
4. Pipe positioning systems.

B. Shop Drawings: Show fabrication and installation details and include calculations for the following:
1. Trapeze pipe hangers. Include Product Data for components.
2. Metal framing systems. Include Product Data for components.
3. Pipe stands. Include Product Data for components.
4. Equipment supports.

C. Welding certificates.

1.6 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel."

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.

2.2 STEEL PIPE HANGERS AND SUPPORTS

A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.

B. Manufacturers:
2. Empire Industries, Inc.
4. Grinnell Corp.
5. GS Metals Corp.
7. Piping Technology & Products, Inc.
8. Tolco Inc.

C. Galvanized, Metallic Coatings: Pregalvanized or hot dipped.

D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

E. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.
2.3 TRAPEZE PIPE HANGERS
   A. Description: 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.

2.4 METAL FRAMING SYSTEMS
   A. Description: MFMA-3, Shop or field fabricated pipe support assembly made of steel channels and other components.
   B. Manufacturers:
      1. B-Line Systems, Inc.; A Division of Cooper Industries.
      2. Erico/Michigan Hanger Co.; Eristrut Division.
      3. GS Metals Corporation.
      4. Tolco, Inc.
      5. Unistrut Corp.; Tyco International, Ltd.
   C. Nonmetallic Coatings: Plastic coating, jacket or liner.

2.5 THERMAL-HANGER SHIELD INSERTS
   A. Description: 100-psig-minimum, compressive-strength insulation insert encased in sheet metal shield.
   B. Manufacturers:
      1. Carpenter & Paterson, Inc.
      2. ERICO/Michigan Hanger Co.
      3. PHS Industries, Inc.
      4. Pipe Shields, Inc.
      5. Rilco Manufacturing Company, Inc.
   C. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with vapor barrier.
   D. Insulation-Insert Material for Hot Piping: ASTM C 552, Type II cellular glass, with vapor barrier.
   E. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
   F. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
   G. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.
2.6 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.
   1. Manufacturers:
      a. Hilti, Inc.
      b. ITW Ramset/Red Head.
      c. Masterset Fastening Systems, Inc.
      d. MKT Fastening, LLC.
      e. Powers Fasteners.

B. Mechanical-Expansion Anchors: Insert-wedge-type zinc-coated steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
   1. Manufacturers:
      b. Empire Industries, Inc.
      c. Hilti, Inc.
      d. ITW Ramset/Red Head.
      e. MKT Fastening, LLC.
      f. Powers Fasteners.

2.7 PIPE STAND FABRICATION

A. Pipe Stands, General: Shop or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.

2.8 PIPE POSITIONING SYSTEMS

A. Description: IAPMO PS 42, system of metal brackets, clips, and straps for positioning piping in pipe spaces for plumbing fixtures for commercial applications.

B. Manufacturers:
   2. HOLDRITE Corp.; Hubbard Enterprises.
   3. Samco Stamping, Inc.

2.9 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

2.10 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, 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.
   2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

A. Specific hanger and support requirements are specified 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 padded hangers for piping that is subject to scratching.

F. 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. 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.
   3. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated stationary pipes, NPS 3/4 to NPS 8.
   4. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.
   5. Split Pipe-Ring with or without Turnbuckle-Adjustment Hangers (MSS Type 11): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 8.
   6. U-Bolts (MSS Type 24): For support of heavy pipes, NPS 1/2 to NPS 30.
   7. 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.
   8. 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.
   9. 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.

G. 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 20.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20, if longer ends are required for riser clamps.

H. 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. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
4. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

I. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction to attach to top flange of structural shape.
2. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
3. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
4. C-Clamps (MSS Type 23): For structural shapes.
5. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
6. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
7. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.

J. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
2. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

K. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.

L. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.

M. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

3.2 HANGER AND SUPPORT INSTALLATION

A. Steel 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 building structure.
B. 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 above for individual pipe hangers.
   2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.

C. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

D. Pipe Stand Installation:
   1. Pipe Stand Types: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.

E. Pipe Positioning System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture. Refer to Division 22 Section "Plumbing Fixtures" for plumbing fixtures. Support devices shall be such that applied insulation undisturbed within supporting system.

F. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.


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 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 so maximum pipe deflections allowed by ASME B31.9 (for building services piping) are not exceeded.

M. Insulated Piping: Comply with the following:
   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 according to ASME B31.9 for building services piping.
2. 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.
3. 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.
4. Insert Material: Length at least as long as protective shield.
5. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.3 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to support equipment above floor.
B. Grouting: Place grout under supports for equipment and make smooth bearing surface.
C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.4 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
C. Field Welding: Comply with AWS D1.1 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.

3.5 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.6 PAINTING

A. Touch 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.
1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Touch Up: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 9 painting Sections.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 220529
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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Equipment labels.
   2. Warning signs and labels.
   3. Pipe labels.
   4. Stencils.
   5. Valve tags.
   6. 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 with the proposed content for each label.
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: Brass, 0.032-inch, Aluminum, 0.032-inch or anodized aluminum, 0.032-inch minimum 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 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.
   5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

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.

C. 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.

2.2 WARNING SIGNS AND 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: Black.

C. Background Color: Yellow.

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 inch by 5 inch.

F. 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.

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.

B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to partially cover circumference of pipe and to attach to pipe without fasteners or adhesive.


D. 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 high.

2.4 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.
   1. Tag Material: 1½" Diameter, Brass, 0.032-inch, minimum thickness, and having predrilled or stamped holes for attachment hardware.
   2. Fasteners: Brass #6 bead chain or #16 brass jack 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: 2 by 5 inches minimum.
   2. Fasteners: Brass grommet and wire.
   3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
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

A. Piping Color-Coding: Painting of piping is specified in Division 9 Section "High-Performance Coatings."

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.

C. Pipe Label Color Schedule:
   1. Domestic Water Piping:
      b. Letter Color: Green.
   2. Sanitary Waste, Vent and Storm Drainage Piping:
      b. Letter Color: Red.

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.

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:
2. Chains shall be attached to valve lever handle or around valve system.
3. Valve tags located above lay-in ceiling shall be hung where tag hangs below the level of the piping.

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 220719 - PLUMBING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Insulation Materials:
      a. Flexible elastomeric.
      b. Mineral fiber.
      c. Cellular glass.
   2. Insulating cements.
   3. Adhesives.
   5. Lagging adhesives.
   7. Factory-applied jackets.
   10. Field-applied jackets.
   11. Tapes.
   12. Securements.
   13. Corner angles.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, thickness, and jackets (both factory and field applied, if any).

B. Shop Drawings:
   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.

C. Samples: For each type of insulation and jacket indicated. Identify each Sample, describing product and intended use. Sample sizes are as follows:
   1. Sample Sizes:
c. Sheet Jacket Materials: 12 inches square.
d. Manufacturer's Color Charts: For products where color is specified, show the full range of colors available for each type of finish material.

D. Qualification Data: For qualified Installer.

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, and jackets, with requirements indicated. Include dates of tests and test methods employed.

F. Field quality-control reports.

1.4 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, tapes, and cement material containers, with appropriate markings of applicable testing and inspecting agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

1.5 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.

1.6 COORDINATION

A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 15 Section "Hangers and Supports."

B. Coordinate clearance requirements with piping Installer for piping 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.

1.7 SCHEDULING

A. Schedule insulation application after pressure testing systems. Insulation application may begin on segments that have satisfactory test results.
PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in Part 3 schedule articles for 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. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

E. Flexible Elastomeric: Closed cell or expanded rubber materials comply with ASTM C534, Type I for tubular materials and Type II for sheet materials.
   1. Products: Subject to compliance with requirements, provide the following:
      a. Aeroflex USA, Inc.; Aerocel.
      b. Armacell, LLP; Armaflex.
      c. RBX Corp.; Insul-Sheet 1800 and Insul Tube 180.

F. Mineral-Fiber, Preformed Pipe Insulation:
   1. Products: Subject to compliance with requirements, provide the following:
      a. Fibrex Insulations Inc.; Coreplus 1200.
      b. Johns Manville; Micro-Lok.
      c. Knauf Insulation; 1000(Pipe Insulation.
      d. Manson Insulation Inc.; Alley-K.
      e. Owens Corning; Fiberglas Pipe Insulation.
   2. Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

G. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in “Factory-Applied Jackets” article.
   1. Products: Subject to compliance with requirements, provide the following:
      a. Cell-U-Foam Corp.; Ultra-CUF.
      b. Pittsburgh Corning Corp.; FoamGlas Super K.
   2. Special Shaped Insulation: ASTM 552, Type III.
   3. Preformed Pipe Insulation without Jacket: Comply with ASTM C552, Type II, Class 1.
   5. Factory fabricate shades according to ASTM C450 and ASTM C585.

2.2 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.
   1. Products: Subject to compliance with requirements, provide the following:
      a. Aeroflex USA, Inc.; Aeroseal.
      b. Armacell, LLC; 520 Adhesive.
      c. RBX Corp.; Rubatex Contact Adhesive.

C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
   1. Products: Subject to compliance with requirements, provide the following:
      a. Childers Products, Division of ITW; CP-82.
      c. ITW TACC, Division of Illinois Tool Works; S-90/80.
      d. Marathon Industries, Inc.; 225.
      e. Mon-Eco Industries, Inc.; 22-25.

D. Cellular Glass Adhesive: Solvent-based resin adhesive, with a service temperature range of minus 75 to plus 300 degrees F.
   1. Products: Subject to compliance with requirements, provide the following:
      a. Childers Products, Division of ITW; CP-96.
      b. Foster Products Corp.; H.B. Fuller Co.; 81-33.

2.3 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.

B. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below ambient services.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Childers Products, Division of ITW; CP-30.
      b. Foster Products Corporation, H. B. Fuller Company; 30-35.
      c. ITW TACC, Division of Illinois Tool Works; CB-25.
      e. Mon-Eco Industries, Inc.; 55-10.

   2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 35-mil dry film thickness.
   3. Service Temperature Range: 0 to 180 deg F.

2.4 LAGGING ADHESIVES

A. Description: Comply with MIL-A-3316C Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Childers Products, Division of ITW; CP-52.
      b. Foster Products Corporation, H. B. Fuller Company; 81-42.
      c. Marathon Industries, Inc.; 130.
      d. Mon-Eco Industries, Inc.; 11-30.
      e. Vimasco Corporation; 136.
2. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over equipment and pipe insulation.
3. Service Temperature Range: Minus 50 to plus 180 deg F.

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 300 deg F.

2.6 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
   1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
   2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
   3. PVDC Jacket for Indoor Applications: 4-mil- thick, white PVDC biaxially oriented barrier film with a permeance at 0.02 perms when tested according to ASTM E 96 and with a flame-spread index of 5 and a smoke-developed index of 20 when tested according to ASTM E 84.
      a. Products: Subject to compliance with requirements, provide the following:
         1) Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film.
      a. Products: Subject to compliance with requirements, provide the following:
         1) Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film.

2.7 FIELD-APPLIED FABRIC-REINFORCING MESH

A. Woven Glass-Fiber Fabric for Pipe Insulation: Approximately 2 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. inch for covering pipe and pipe fittings.
   1. Products: Subject to compliance with requirements, provide the following:
      a. Vimasco Corporation; Elastafab 894.

   1. Products: Subject to compliance with requirements, provide the following:
      a. Childers Products, Division of ITW; Chil-Glas No. 5.
2.8 FIELD-APPLIED CLOTHS

A. Woven Glass-Fiber Fabric: Comply with MIL-C-20079H, Type I, plain weave, and presized a minimum of 8 oz./sq. yd.
   1. Products: Subject to compliance with requirements, provide the following:

2.9 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Johns Manville; Zeston.
      c. Proto PVC Corporation; LoSmoke.
      d. Speedline Corporation; SmokeSafe.
   2. Adhesive: As recommended by jacket material manufacturer.
   3. Color: White Color-code jackets based on system or Color as selected by Architect.
   4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
      a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.
   5. Factory-fabricated tank heads and tank side panels.

C. Metal Jacket:
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Childers Products, Division of ITW; Metal Jacketing Systems.
      b. PABCO Metals Corporation; Surefit.
      c. RPR Products, Inc.; Insul-Mate.
      a. Factory cut and rolled to size.
      b. Finish and thickness are indicated in field-applied jacket schedules.
      c. Moisture Barrier for Indoor Applications: 3-mil-thick, heat-bonded polyethylene and kraft paper.
      d. Factory-Fabricated Fitting Covers:
         1) Same material, finish, and thickness as jacket.
         2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
         3) Tee covers.
         4) Flange and union covers.
         5) End caps.
         6) Beveled collars.
         7) Valve covers.
         8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.
2.10 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0835.
      b. Compac Corp.; 104 and 105.
      c. Ideal Tape Co., Inc., an American Biltrite Company; 428 AWF ASJ.
      d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.
   2. Width: 3 inches.
   3. Thickness: 11.5 mils.
   5. Elongation: 2 percent.
   6. Tensile Strength: 40 lbf/inch in width.
   7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive. Suitable for indoor and outdoor applications.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0555.
      b. Compac Corp.; 130.
      c. Ideal Tape Co., Inc., an American Biltrite Company; 370 White PVC tape.
      d. Venture Tape; 1506 CW NS.
   2. Width: 2 inches.
   3. Thickness: 6 mils.
   5. Elongation: 500 percent.
   6. Tensile Strength: 18 lbf/inch in width.

C. PVDC Tape: White vapor-retarder PVDC tape with acrylic adhesive.
   1. Products: Subject to compliance with requirements, provide the following:
      a. Dow Chemical Company (The); Saran 540 Vapor Retarder Tape.
   2. Width: 3 inches.
   3. Film Thickness: 4 mils.
   4. Adhesive Thickness: 1.5 mils.
   5. Elongation at Break: 145 percent.
   6. Tensile Strength: 55 lbf/inch in width.

2.11 SECUREMENTS

A. Bands:
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Childers Products; Bands.
      b. PABCO Metals Corporation; Bands.
      c. RPR Products, Inc.; Bands.
   2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316; 0.015 inch thick, 1/2 inch wide with wing or closed seal.
   3. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 3/4 inch wide with wing or closed seal.

B. Insulation Pins and Hangers:

1. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
   a. Products: Subject to compliance with requirements, provide one of the following:
      1) AGM Industries, Inc.; Tactoo Insul-Hangers, Series T.
      2) GEMCO; Perforated Base.
      3) Midwest Fasteners, Inc.; Spindle.
   b. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
   c. Spindle: Copper- or zinc-coated, low carbon steel, fully annealed, 0.106-inch-diameter shank, length to suit depth of insulation indicated.
   d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick, galvanized-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
   a. Products: Subject to compliance with requirements, provide one of the following:
      1) AGM Industries, Inc.; RC-150.
      2) GEMCO; R-150.
      3) Midwest Fasteners, Inc.; WA-150.
      4) Nelson Stud Welding; Speed Clips.
   b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.

3. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
   a. Products: Subject to compliance with requirements, provide one of the following:
      1) GEMCO.
      2) Midwest Fasteners, Inc.

2.12 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 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment 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.

4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:
   1. Draw jacket tight and smooth.
   2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
   3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches o.c.
      a. For below ambient services, apply vapor-barrier mastic over staples.
   4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
   5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

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. For above ambient services, do not install insulation to the following:
   1. Vibration-control devices.
   2. Testing agency labels and stamps.
   3. Nameplates and data plates.
   5. Handholes.
   6. Cleanouts.

3.4 PENETRATIONS

A. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
B. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

1. Comply with requirements in Division 7 Section "Through-Penetration Firestop Systems" for firestopping and fire-resistive joint sealers.

C. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 7 Section "Through-Penetration Firestop Systems."

3.5 GENERAL 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 Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.

2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.

3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.

4. 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.

5. 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.

6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.

7. 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.
8. 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.

9. Stencil or label the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.

C. 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.

D. 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.

3.6 CELLULAR-GLASS INSULATION INSTALLATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.

2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.

3. For insulation with factory-applied jackets on above ambient services, secure laps with outward clinched staples at 6 inches o.c.

4. For insulation with factory-applied jackets on below ambient services, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on 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.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of same thickness as pipe insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. 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 sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:
1. Install preformed sections of cellular-glass insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

3.7 MINERAL-FIBER INSULATION INSTALLATION

A. Insulation Installation on Straight Pipes and Tubes:
1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Fittings and Elbows:
1. Install preformed sections of same material as straight segments of pipe insulation when available.
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.

C. Insulation Installation on Valves and Pipe Specialties:
1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.
3.8 FLEXIBLE ELASTOMERIC INSULATION INSTALLATION

A. Seal longitudinal seams and end joints with manufacturers recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:
   1. Install 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.
   3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
   4. Secure insulation to flanges and seal seams with manufacturers recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:
   1. Install mitered sections of pipe insulation.
   2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:
   1. Install preformed valve covers manufactured of same material as pipe insulation when available.
   2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
   3. Install insulation to flanges as specified for flange insulation application.
   4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.9 FIELD-APPLIED JACKET INSTALLATION

A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.
   1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
   2. Embed glass cloth between two 0.062-inch- thick coats of lagging adhesive.
   3. Completely encapsulate insulation with coating, leaving no exposed insulation.

B. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive.
   1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

C. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.
D. Where PVDC jackets are indicated, install as follows:

1. Apply three separate wraps of filament tape per insulation section to secure pipe insulation to pipe prior to installation of PVDC jacket.
2. Wrap factory-presized jackets around individual pipe insulation sections with one end overlapping the previously installed sheet. Install presized jacket with an approximate overlap at butt joint of 2 inches over the previous section. Adhere lap seal using adhesive or SSL, and then apply 1-1/4 circumferences of appropriate PVDC tape around overlapped butt joint.
3. Continuous jacket can be spiral wrapped around a length of pipe insulation. Apply adhesive or PVDC tape at overlapped spiral edge. When electing to use adhesives, refer to manufacturer's written instructions for application of adhesives along this spiral edge to maintain a permanent bond.
4. Jacket can be wrapped in cigarette fashion along length of roll for insulation systems with an outer circumference of 33-1/2 inches or less. The 33-1/2-inch-circumference limit allows for 2-inch-overlap seal. Using the length of roll allows for longer sections of jacket to be installed at one time. Use adhesive on the lap seal. Visually inspect lap seal for "fishmouthing," and use PVDC tape along lap seal to secure joint.
5. Repair holes or tears in PVDC jacket by placing PVDC tape over the hole or tear and wrapping a minimum of 1-1/4 circumferences to avoid damage to tape edges.

3.10 FINISHES

A. Equipment and Pipe Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Division 9 painting Sections.

1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

B. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

C. Do not field paint aluminum or stainless-steel jackets.

3.11 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. Inspect field-insulated equipment, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location(s) for each type of equipment defined in the "Equipment Insulation Schedule" Article. For large equipment, remove only a portion adequate to determine compliance.
2. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of...
threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.12 EQUIPMENT INSULATION SCHEDULE

A. Insulation materials and thicknesses identified below shall comply with the latest edition of The Washington State Energy Code and the Washington State Plumbing Code. If more than one material is listed for a type of equipment, selection from materials listed is Contractor's option.

B. Insulate indoor equipment in paragraphs below that is not factory insulated.

C. Domestic hot-water storage tank insulation shall be one of the following:

3.13 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
   1. Drainage piping located in crawl spaces.
   2. Underground piping.
   3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.14 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Cold Water:
   1. NPS 2 and Smaller: Insulation shall be the following:
      a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
   2. NPS 2-1/2 and Larger: Insulation shall be the following:
      a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1½ inch thick.

B. Domestic Hot and Recirculated Hot Water:
   1. NPS 2 and Smaller: Insulation shall be the following:
      a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
   2. NPS 2-1/2 and Larger: Insulation shall be the following:
      a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1½ inch thick.

C. Domestic Chilled Water (Potable):
   1. NPS 2 and Smaller: Insulation shall be the following:
      a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

D. Stormwater and Overflow (all horizontal and vertical piping):
1. All Pipe Sizes: Insulation shall be the following:
   a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

E. Roof Drain and Overflow Drain Bodies:
   1. All Pipe Sizes: Insulation shall be the following:
      a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

F. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities:
   1. All Pipe Sizes: Insulation shall be the following:
      a. Flexible Elastomeric: 3/4 inch thick.
      b. Polyolefin: 3/4 inch thick.

3.15 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. If more than one material is listed, selection from materials listed is Contractor's option.

C. Equipment, Concealed:
   1. None.

D. Piping, Exposed:
   1. PVC: 30 mils thick.
   2. Aluminum, Smooth: 0.032 inch thick.
   3. Painted Aluminum, Smooth: 0.032 inch thick.

END OF SECTION 220719
PART 1 - GENERAL

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

1.2 SUMMARY
   A. This Section includes the following domestic water piping specialties:
      1. Vacuum breakers.
      2. Temperature-actuated water mixing valves.
      3. Strainers.
      4. Hose bibbs.
      5. Wall hydrants.
      6. Drain valves.
      7. Water hammer arresters.
      8. Air vents.

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 61, "Drinking Water System Components - Health Effects; Sections 1 through 9."

PART 2 - PRODUCTS

2.1 VACUUM BREAKERS

A. Pipe-Applied, Atmospheric-Type Vacuum Breakers:
   
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Ames Co.
   b. Conbraco Industries, Inc.
   d. Zurn Plumbing Products Group; Wilkins Div.
   
   
3. Size: NPS 1/4 to NPS 3, as required to match connected piping.
   
   
5. Inlet and Outlet Connections: Threaded.
   
6. Finish: Chrome plated.

B. Hose-Connection Vacuum Breakers:
   
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Conbraco Industries, Inc.
   c. Woodford Manufacturing Company.
   d. Zurn Plumbing Products Group; Light Commercial Operation.
   
   
   
   
5. Finish: Chrome or nickel plated.

2.2 BACKFLOW PREVENTERS

A. Reduced-Pressure-Principle Backflow Preventers:
   
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Watts Industries, Inc.; Water Products Div
   b. Conbraco Industries, Inc.
   c. Ames
   d. Zurn Plumbing Products Group; Wilkins Div.
   
   
3. Operation: Continuous-pressure applications.
   
4. Pressure Loss: 12 psig maximum, through middle 1/3 of flow range.
   
5. Size: See plans.
   
6. Pressure Loss at Design Flow Rate: 10 psig for sizes NPS 2 and smaller.
   
   
8. End Connections: Solder or flanged.
9. Configuration: Designed for horizontal, straight through flow.
10. Accessories:
    a. Valves: Ball type with threaded ends on inlet and outlet of NPS 3 and smaller.

2.3 STRAINERS FOR DOMESTIC WATER PIPING

A. Y-Pattern Strainers:
   1. Pressure Rating: 125 psig minimum, unless otherwise indicated.
   2. Body: Bronze for NPS 2 and smaller.
   3. End Connections: Threaded for NPS 2 and smaller.
   4. Screen: Stainless steel with round perforations, unless otherwise indicated.
   5. Perforation Size:
      a. Strainers NPS 3 and Smaller: 0.020 inch.

2.4 WALL HYDRANTS

A. Nonfreeze Wall Hydrants/Hose Bibbs:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      b. Chicago Faucets
      c. Watts Industries.
      d. Woodford Manufacturing Company.
      e. Zurn Plumbing Products Group; Specification Drainage Operation.
   4. Operation: Loose key.
   5. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
   7. Outlet: Concealed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
   8. Box: Deep, flush mounting with cover.
   11. Operating Keys(s): One with each wall hydrant.

2.5 DRAIN VALVES

A. Ball-Valve-Type, Hose-End Drain Valves:
   2. Pressure Rating: 400-psig minimum CWP.
   4. Body: Copper alloy.
   5. Ball: Chrome-plated brass.
8. Inlet: Threaded or solder joint.

2.6 WATER HAMMER ARRESTERS

A. Water Hammer Arresters:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Sioux Chief Manufacturing Company, Inc.
      b. PPP Inc.
      c. Zurn Plumbing Products Group; Specification Drainage Operation.
   3. Type: Copper tube with piston.
   4. Size: ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.

B. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.
   1. Locate backflow preventers in same room as connected equipment or system.
   2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, 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 temperature-actuated water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.
   1. Install thermometers and water regulators if specified.

D. Install water hammer arresters in water piping according to PDI-WH 201 above ceiling with access panel in ceiling.

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 16 Section "Grounding and Bonding."

C. Connect wiring according to Division 16 Section "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. Pressure vacuum breakers.
   2. Reduced-pressure-principle backflow preventers.
   3. Primary water tempering 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 pressure vacuum breaker and reduced-pressure-principle backflow preventer 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 temperature set points of temperature-actuated water mixing valves.

END OF SECTION 221119
SECTION 224000 - PLUMBING FIXTURES

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.

B. Specification sections for all Division 22 work.

1.2 SUMMARY

A. This Section includes the following conventional plumbing fixtures and related components:
   1. Faucets for lavatories and sinks.
   2. Laminar-flow faucet-spout outlets.
   3. Toilet seats.
   4. Protective shielding guards.
   5. Fixture supports.
   7. Lavatories.
   8. Service sinks.
   9. Owner-furnished fixtures.

B. Related Sections include the following:
   1. Division 2 Section "Water Distribution" for exterior plumbing fixtures and hydrants.
   2. Division 10 Section "Toilet and Bath Accessories."
   3. Division 15 Section "Plumbing Specialties" for backflow preventers, floor drains, and specialty fixtures not included in this Section.

1.3 DEFINITIONS


B. 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 and 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.

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 plumbing fixtures to include in emergency, operation, and maintenance manuals.
D. Warranty: Special warranty specified in this Section.

1.5 QUALITY ASSURANCE
A. Source Limitations: Obtain plumbing fixtures, faucets, and other components of each category through one source from a single manufacturer.
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.
E. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.
G. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.
H. Comply with the following applicable standards and other requirements specified for plumbing fixtures:
   2. Vitreous-China Fixtures: ASME A112.19.2M.

I. Comply with the following applicable standards and other requirements specified for lavatory and sink faucets:
   1. Faucets: ASME A112.18.1.

J. Comply with the following applicable standards and other requirements specified for bathtub, bathtub/shower and shower faucets:

K. Comply with the following applicable standards and other requirements specified for miscellaneous fittings:
   2. Brass and Copper Supplies: ASME A112.18.1.

L. Comply with the following applicable standards and other requirements specified for miscellaneous components:
   2. Floor Drains: ASME A112.6.3.
   4. Off-Floor Fixture Supports: ASME A112.6.1M.

1.6 WARRANTY

A. Warranty Period for Commercial Applications: One year from date of Substantial Completion.
1.7 COORDINATION

A. Coordinate rough-in and final fixture locations, and verify that fixtures can be installed to comply with original design and referenced standards.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. For fixture descriptions in other Part 2 articles where the subparagraph titles “Products” and “Manufactures” introduce a list of manufacturers and their products or manufacturers only, the following requirements apply for product selection:

1. Products: Subject to compliance with requirements, provide one of the products specified in other Part 2 articles.
2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified in other Part 2 articles.

B. Listed Manufacturers

1. Vitreous China Water Closets:
   a. Toto
   b. American Standard
   c. Kohler
   d. Zurn

2. Vitreous China Lavatory:
   a. Toto
   b. American Standard, Inc.
   c. Kohler
   d. Zurn

3. Stainless Steel Sink:
   a. Elkay Manufacturing Co.
   b. Advance Tabco
   c. Just Manufacturing Co.

4. Manual Faucet:
   a. Chicago Faucet Co.
   b. Toto
   c. T & S Brass Mfg.
   d. Moen Commercial

5. Water Coolers/Drinking Fountains
   a. Elkay
   b. Oasis
   c. Halsey Taylor

6. Fixture Supports
   a. Zurn
   b. Watts
   c. J.R. Smith

7. Fitting Insulation Kits
   a. TRUEBRO, Inc.
   b. Dearborn Brass
   c. McGuire Manufacturing Co. Inc
8. Stop Valves  
   a. Dearborn Brass  
   b. Chicago  
   c. Watts  
9. P-Traps  
   a. Dearborn Brass Co.  
   b. Cambridge Brass; Delta Faucets  
   c. Watts  
10. Hydrants and Hose Bibs  
   a. J.R. Smith  
   b. Chicago  
   c. Zurn

2.2 FIXTURES  
   A. Refer to Schedule on drawings

PART 3 - EXECUTION

3.1 EXAMINATION  
   A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before 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.

3.2 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 chair-type carrier supports with rectangular steel uprights for accessible fixtures.  
   C. Install floor-mounting fixtures on closet flanges or other attachments to piping or building substrate.  
   D. Install wall-mounting fixtures with tubular waste piping attached to supports.  
   E. First paragraph below applies to counter-mounting fixtures such as lavatories and sinks.  
   F. Install counter-mounting fixtures in and attached to casework.  
   G. Install fixtures level and plumb according to roughing-in drawings.
H. 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 ball or globe valves if supply stops are not specified with fixture. Valves are specified in Division 15 Section "Plumbing Valves."

I. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.

J. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.

K. Install tanks for accessible, tank-type water closets with lever handle mounted on wide side of compartment.

L. Install toilet seats on water closets.

M. Install faucet-spout fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.

N. Install faucet flow-control fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.

O. Install shower flow-control fittings with specified maximum flow rates in shower arms.

P. Install traps on fixture outlets.

1. Exception: Omit trap on fixtures with integral traps.

2. Exception: Omit trap on indirect wastes, unless otherwise indicated.

Q. 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 15 Section "Basic Mechanical Materials and Methods."

R. Set shower receptors and service basins in leveling bed of cement grout. Grout is specified in Division 15 Section "Basic Mechanical Materials and Methods."

S. 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 7 Section "Joint Sealants."

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 15 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. Ground equipment according to Division 16 Section "Grounding and Bonding."

D. Connect wiring according to Division 16 Section "Conductors and Cables."
3.4 FIELD QUALITY CONTROL
   A. Verify that installed plumbing fixtures are categories and types specified for locations where installed.
   B. Check that plumbing 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.

3.5 ADJUSTING
   A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.
   B. Adjust water pressure at faucets to produce proper flow and stream.
   C. Replace washers and seals of leaking and dripping faucets and stops.

3.6 CLEANING
   A. Clean fixtures, faucets, 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.
   B. After completing installation of exposed, factory-finished fixtures, faucets, and fittings, inspect exposed finishes and repair damaged finishes.

3.7 PROTECTION
   A. Provide protective covering for installed fixtures and fittings.
   B. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 15410
SECTION 224110 - WATER DISTRIBUTION PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes water distribution piping from locations indicated to fixtures and equipment inside building.

B. Related Sections include the following:

1. Division 221119 Section "Domestic Water Piping Specialties" for water distribution piping specialties.
2. Section 220529 “Hangers and Supports for Plumbing Piping and Equipment”.
3. Section 220511 “Common Work Results for Plumbing”.

1.3 DEFINITIONS

A. Water Service Piping: Water piping outside building that conveys water to building.

B. Service Entrance Piping: Water piping at entry into building between water service piping and water distribution piping.

C. Water Distribution Piping: Water piping inside building that conveys water to fixtures and equipment throughout the building.

D. The following are industry abbreviations for plastic piping materials:

1. CPVC: Chlorinated polyvinyl chloride.
2. PVC: Polyvinyl chloride.

1.4 SYSTEM PERFORMANCE REQUIREMENTS

A. Provide components and installation capable of producing piping systems with the following minimum working-pressure ratings, unless otherwise indicated:

1.5 QUALITY ASSURANCE

A. Provide listing/approval stamp, label, or other marking on piping made to specified standards.

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

A. Hard Copper Tube: ASTM B 88, Type L and [ASTM B 88, Type M water tube, drawn temper.

B. Soft Copper Tube: ASTM B 88, Type K water tube, annealed temper.

C. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.


E. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.

F. 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.

G. Copper Pressure-Seal-Joint Fittings:
   1) Fittings for NPS 2 (DN 50) and Smaller: Wrought-copper fitting with EPDM-rubber, O-ring seal in each end.
   2) Fittings for NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Cast-bronze or wrought-copper fitting with EPDM-rubber, O-ring seal in each end.

H. Copper Push-on-Joint Fittings:
   1) Description:
      a) Cast-copper fitting complying with ASME B16.18 or wrought-copper fitting complying with ASME B 16.22.
      b) Stainless-steel teeth and EPDM-rubber, O-ring seal in each end instead of solder-joint ends.

I. Appurtenances for Grooved-End Copper Tubing:
1) Bronze Fittings for Grooved-End, Copper Tubing: ASTM B 75 (ASTM B 75M)
copper tube or ASTM B 584 bronze castings.
2) Mechanical Couplings for Grooved-End Copper Tubing:
   a) Copper-tube dimensions and design similar to AWWA C606.
   b) Ferrous housing sections.
   c) EPDM-rubber gaskets suitable for hot and cold water.
   d) Bolts and nuts.
   e) Minimum Pressure Rating: 300 psig (2070 kPa).

2.2 CPVC PIPING
A. CPVC Pipe: ASTM F 441/F 441M, Schedule 80.
   1) CPVC Socket Fittings: ASTM F 439 for Schedule 80.
   2) CPVC Threaded Fittings: ASTM F 437, Schedule 80.

2.3 PEX TUBE AND FITTINGS (Non Barrier, Flexible)
A. PEX Distribution System: ASTM F 877, SDR 9 tubing.
B. Fittings for PEX Tube: ASTM F 1807, metal-insert type with copper or stainless-steel
crimp rings and matching PEX tube dimensions.
C. Manifold: Multiple-outlet, plastic or corrosion-resistant-metal assembly complying with
   ASTM F 877; with plastic or corrosion-resistant-metal valve for each outlet.

2.4 PEX-AL-PEX TUBE AND FITTINGS (Non Barrier, Flexible, Holds Shape)
B. Fittings for PEX-AL-PEX Tube: ASTM F 1281, metal-insert type with copper or
   stainless-steel crimp rings and matching PEX-AL-PEX tube dimensions.

2.5 JOINING MATERIALS
A. General: Applications of the following piping joining materials are indicated in Part 3
   "Piping Applications" Article.
B. Solder: ASTM B 32, Alloy Sn95; lead free.
C. Ductile-Iron, Keyed Couplings: AWWA C606 for ductile-iron-pipe dimensions.
Include ferrous housing sections, gasket suitable for hot water, and bolts and nuts.

D. Transition Couplings: Coupling or other manufactured fitting same size as, with pressure rating at least equal to, and with ends compatible with piping to be joined.

2.6 POLYETHYLENE ENCASEMENT

A. Polyethylene Encasement for Ductile-Iron Piping: ASTM A 674 or AWWA C105 polyethylene film, 0.008-inch minimum thickness, tube or sheet.

PART 3 - EXECUTION

3.1 EXCAVATION

A. Refer to Division 31 Earth Moving for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

A. Transition and special fittings with pressure ratings at least equal to piping pressure rating may be used in applications below, unless otherwise indicated.

B. Flanges may be used on aboveground piping, unless otherwise indicated.

C. Underground, Service Entrance Piping: Do not use flanges or valves underground. Use the following:

1. 1-1/4-Inch NPS and Smaller: Soft copper tube, Type K; copper, solder-joint pressure fittings; and soldered joints.
2. 1-1/2- to 3-Inch NPS: Hard copper tube, Type K; copper, solder-joint pressure fittings; and soldered joints.
3. 4-inch and Larger NPS ductile-iron pipe and fittings, and mechanical joints.

D. Aboveground, Water Distribution Piping Mains: Use the following:

1. 2-1/2-Inch NPS and Smaller: Hard copper tube, Type L; copper, solder-joint fittings; and soldered joints.
2. 3 to 4-Inch NPS: Hard copper tube, Type L; copper, solder-joint fittings; and soldered joints.
3. 6-Inch and Larger NPS: Hard copper tube, Type L with grooved ends; copper, grooved-end fittings; and copper, keyed couplings. Couplings must be Victaulic.

E. Aboveground, Water Distribution Piping Branches (downstream of shut-off valves): Use the following:

1. 2-1/2-Inch NPS and Smaller: Hard copper tube, Type L; copper, solder-joint fittings; and soldered joints.
3.2 WATER DISTRIBUTION PIPING

224110 - 5 fittings; and soldered joints.

2. 3 to 4-Inch NPS: Hard copper tube, Type L; copper, solder-joint fittings; and soldered joints.

3. 6-Inch and Larger NPS: Hard copper tube, Type L with grooved ends; copper, grooved-end fittings; and copper, keyed couplings. Couplings must be Victaulic.

5. 3-inch NPS and Smaller: PEX or PEX-AL Tubing and fittings

E. Underground, Water Distribution Piping: Do not use flanges or valves underground. Use the following:

1. 2-Inch NPS and Smaller: Soft copper tube, Type K; wrought-copper, solder-joint pressure fittings; and soldered joints.

2. 2-1/2- to 4-Inch NPS: Hard copper tube, Type K; wrought-copper, solder-joint pressure fittings; and soldered joints.

3. 3-inch NPS and Smaller: PEX-AL tubing and fittings.

3.3 VALVE APPLICATIONS

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Shutoff Duty: Use ball, or butterfly valves.

B. Grooved-end butterfly valves may be used with grooved-end piping.

3.4 PIPING INSTALLATION, GENERAL

A. Refer to Division 22 Section "Basic Mechanical Materials and Methods" for basic piping installation.

3.5 SERVICE ENTRANCE PIPING INSTALLATION

A. Extend service entrance piping to exterior water service piping in sizes and locations indicated for service entrances into building. Refer to Division 2 Section "Water Systems" for water service piping.

B. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve, inside building at each service entrance pipe.

C. Ductile-Iron, Service Entrance Piping: Comply with AWWA C600. Install buried piping between shutoff valve and connection to water service piping with restrained joints. Anchor pipe to wall or floor at entrance. Include thrust-block supports at vertical and horizontal offsets.

1. Encase piping with polyethylene film according to ASTM A 674 or
AWWA C105.

D. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service entrance pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Refer to Division 22 Section "Basic Mechanical Materials and Methods" for sleeves and mechanical sleeve seals.

E. Install wall penetration system at each service entrance pipe penetration through foundation wall. Make installation watertight. Refer to Division 22 Section "Basic Mechanical Materials and Methods" for wall penetration systems.

3.6 WATER DISTRIBUTION PIPING INSTALLATION

A. Install piping with 0.25 percent slope downward toward drain.

3.7 JOINT CONSTRUCTION

A. Refer to Division 22 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.

B. Grooved Joints: Assemble joints with coupling, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.

C. Solvent-Cemented, Thermoplastic Pipe and Fitting Joints: Handle cleaners, primers, and solvent cements according to ASTM F 402.

3.8 VALVE INSTALLATION

A. Sectional Valves: Install sectional valves close to main on each branch and riser serving plumbing fixtures or equipment, and where indicated. Use ball valves for piping 2-inch NPS and smaller. Use butterfly valves for piping 2-1/2-inch NPS and larger.

B. Shutoff Valves: Install shutoff valve on each water supply to equipment, on each supply to plumbing fixtures without supply stops, and where indicated. Use ball valves for piping 2-inch NPS and smaller. Use butterfly valves for piping 2-1/2-inch NPS and larger.

C. Drain Valves: Install drain valves for equipment, at base of each water riser, at low points in horizontal piping, and where required to drain water piping.

   1. Install hose-end drain valves at low points in water mains, risers, and branches.

D. Balancing Valves: Install in each hot-water circulation return branch, discharge side of each pump and circulator, and where indicated. Refer to Division 22110 Section "Plumbing Valves" for balancing valves.
3.9  **HANGER AND SUPPORT INSTALATION**

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 (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.
   b) Longer Than 100 Feet (30 m): MSS Type 43, adjustable roller hangers.
   c) Longer Than 100 Feet (30 m) If Indicated: MSS Type 49, spring cushion rolls.

3) Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) 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 (10 mm).

E.  Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

   1) NPS 3/4 (DN 20) and Smaller: 60 inches (1500 mm) with 3/8-inch (10-mm) rod.
   2) NPS 1 and NPS 1-1/4 (DN 25 and DN 32): 72 inches (1800 mm) with 3/8-inch (10-mm) rod.
   3) NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 96 inches (2400 mm) with 3/8-inch (10-mm) rod.
   4) NPS 2-1/2 (DN 65): 108 inches (2700 mm) with 1/2-inch (13-mm) rod.
   5) NPS 3 to NPS 5 (DN 80 to DN 125): 10 feet (3 m) with 1/2-inch (13-mm) rod.
   6) NPS 6 (DN 150): 10 feet (3 m) with 5/8-inch (16-mm) rod.
   7) NPS 8 (DN 200): 10 feet (3 m) with 3/4-inch (19-mm) rod.

F.  Install supports for vertical copper tubing every 10 feet (3 m).

G.  Install hangers for PEX or PEX-AL piping every 48-inches.

H.  Install hangers for galvanized steel piping with the following maximum horizontal spacing and minimum rod diameters:

   1) NPS 8 to NPS 12 (DN 200 to DN 300): 12 feet (3.7 m) with 7/8-inch (22-mm) rod.

I.  Install supports for vertical steel piping every 15 feet (4.5 m).
J. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

3.10 CONNECTIONS

A. Connect service entrance piping to exterior water service piping. Use transition fitting to join dissimilar piping materials.

B. Connect water distribution piping to service entrance piping at shutoff valve, and extend to and connect to the following:

1. Booster Systems: Connect cold-water suction and discharge piping.
2. Water Heaters: Connect cold-water supply and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
3. Plumbing Fixtures: Connect hot- and cold-water supply piping in sizes indicated, but not smaller than required by plumbing code. Refer to Division 22 Section "Plumbing Fixtures."
4. Equipment: Connect hot- and cold-water supply piping as indicated. Provide shutoff valve and union for each connection. Use flanges instead of unions for connections 2-1/2-inch NPS and larger.

3.11 FIELD QUALITY CONTROL

A. Inspect water distribution piping as follows:

B. Inspect service entrance piping and water distribution piping as follows:

1. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
2. 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.

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 for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

3. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

C. Test service entrance piping and water distribution piping 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
2. Leave uncovered and unconcealed new, altered, extended, or replaced water piping until it has been tested and approved. Expose work that has been covered or concealed before it has been tested and approved.

3. Cap and subject piping to static water pressure of 150 psig. Isolate test source and allow to stand for 4 hours. Leaks and loss in test pressure constitute defects that must be repaired.

4. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.

5. Prepare reports for tests and required corrective action.

3.12 CLEANING

A. Clean and disinfect service entrance piping and water distribution piping as follows:

1. Purge new piping and parts of existing water piping that have been altered, extended, or repaired before using.

2. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed, procedure described in either AWWA C651 or AWWA C652 or as 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 3 hours.

   C. Flush system with clean, potable water until chlorine is no longer in water coming from system after the standing time.

   D. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination shows contamination.

B. Prepare and submit reports for purging and disinfecting activities.

C. Clean interior of piping system. Remove dirt and debris as work progresses.

3.13 COMMISSIONING

A. Fill water piping. Check components to determine that they are not air bound and that piping is full of water.

B. Perform the following steps before putting into operation:
1. Close drain valves, hydrants, and hose bibbs.
2. Open shutoff valves to fully open position.
3. Set ballancing valves to proper setting.
4. Remove plugs used during testing of piping and plugs used for temporary sealing of piping during installation.
5. Remove and clean strainer screens. Close drain valves and replace drain plugs.
6. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and that cartridges are clean and ready for use.

C. Check plumbing equipment and verify proper settings, adjustments, and operation. Do not operate water heaters before filling with water.

D. Check plumbing specialties and verify proper settings, adjustments, and operation.
   1. Water-Pressure Regulators: Set outlet pressure at 80 psig maximum, unless otherwise indicated.

E. Energize pumps and verify proper operation.

END OF SECTION 224110
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

1.4 QUALIFICATIONS
   A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years documented experience.

1.5 SUBMITTALS
   A. Submit shop drawings and product data.
   B. Indicate material specifications, dimensions, capacities, and color coding.
   C. Provide product data for all wire and cable.
   D. Submit manufacturer's installation instructions.

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.


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.; a Leviton Company.
D. Senator Wire & Cable Company.

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 be 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 used 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.
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.

1.3 QUALITY ASSURANCE

A. Regulatory Requirements:

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.


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. Insulation shall be 600 volt, same type as phase conductors, green in color.

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.

END OF SECTION 260526
SECTION 260529 - SUPPORTING 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 conduit and equipment supports and anchors and fasteners.

1.3 REFERENCES
   A. NECA - National Contractors Association.

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.
5. Solid Masonry Walls: Use expansion anchors and preset inserts.

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.
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 DESIGN REQUIREMENTS

A. Conduit Size: ANSI/NFPA 70.
1.5 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.

1.6 PROJECT RECORD DOCUMENTS

A. Accurately record actual routing of conduits larger than 2".

1.7 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.

1.8 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.

1.9 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 intermediate metal conduit.

D. Wet and Damp Locations: Use rigid aluminum.

E. 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.

F. 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.

   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.

   1. Connections; steel or malleable iron compression type with insulated throat and "O" ring assembly for liquidtight 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.
   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.

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. Arrange supports to prevent misalignment during wiring installation.

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 pipe cutter; 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.

2.12 UNDERGROUND CONDUIT INSTALLATION

A. Provide barriers to protect open excavation.

B. Install top of conduit minimum 24 inches below finished grade.

C. Excavating and backfilling shall be in accordance with section 312000.
D. Adjust the elevation of the conduit as necessary to allow for the crossing of the other underground utilities.

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.
D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

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.

PART 2 - PRODUCTS

BOXES
2.1 Boxes, enclosures, and cabinets installed in wet locations shall be cast boxes for use in wet locations.

2.2 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.

2.3 PULL AND JUNCTION BOXES
   A. Sheet Metal Boxes: NEMA OS 1, galvanized steel.
   B. Use Surface-Mounted Cast Metal Box in Wet Locations: NEMA 250, Type 4 flat-flanged, surface-mounted junction box.
      1. Material: Galvanized cast iron.
      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
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: III.
      a. Life Safety Component Importance Factor: 1.5.
      b. Regular Component Importance Factor: 1.0

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.


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.
   4. Isolation Technology, Inc.
7. Vibration Eliminator Co., Inc.
8. Vibration Isolation.
10. Amber/Booth
11. 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.
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 FIELD QUALITY CONTROL

A. Testing Agency: A/E may hire an independent testing company to test anchorage devices to restrained components. If tests fail components will be replaced by Electrical Contractor and additional components will be tested.

2.6 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:
   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.
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:
<table>
<thead>
<tr>
<th>Service</th>
<th>Background</th>
<th>Stripes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) 277/480 V, 3 Phase</td>
<td>Orange</td>
<td>Single Red Stripe</td>
</tr>
<tr>
<td>2) 120/208V, Three Phase</td>
<td>Orange</td>
<td>Red-Yellow-Red</td>
</tr>
<tr>
<td>3) 120 volt controls</td>
<td>Orange</td>
<td>Green-White-Green</td>
</tr>
<tr>
<td>4) Fire Alarm</td>
<td>Red</td>
<td>Single Orange Stripe</td>
</tr>
<tr>
<td>5) Emergency power &amp; Exit</td>
<td>Red</td>
<td>Single Green Stripe</td>
</tr>
<tr>
<td>6) Telephone</td>
<td>White</td>
<td>Single Orange Stripe</td>
</tr>
<tr>
<td>7) Intercom</td>
<td>White</td>
<td>Single Black Stripe</td>
</tr>
<tr>
<td>8) Program Systems</td>
<td>White</td>
<td>Single Green Stripe</td>
</tr>
<tr>
<td>9) Television</td>
<td>White</td>
<td>Single Red Stripe</td>
</tr>
<tr>
<td>10) Low Voltage Controls</td>
<td>White</td>
<td>Yellow-Green-Yellow</td>
</tr>
<tr>
<td>11) Data/Computer</td>
<td>White</td>
<td>Black-Yellow-Black</td>
</tr>
</tbody>
</table>

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:

<table>
<thead>
<tr>
<th>120/208V 3 Phase</th>
<th>277/480V 3 Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase A Black</td>
<td>Phase A Brown</td>
</tr>
<tr>
<td>Phase B Red</td>
<td>Phase B Orange</td>
</tr>
<tr>
<td>Phase C Blue</td>
<td>Phase C Yellow</td>
</tr>
<tr>
<td>Neutral White</td>
<td>Neutral Gray</td>
</tr>
<tr>
<td>Equipment Ground Green</td>
<td>Equipment Ground Green</td>
</tr>
<tr>
<td>Isolated Ground w/ Yellow Tracer</td>
<td>Isolated Ground Green w/ Yellow Tracer</td>
</tr>
</tbody>
</table>

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 26 09 23 - 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. Outdoor and indoor photoelectric switches.
2. Indoor occupancy sensors.
3. Lighting contactors.
4. Emergency shunt relays.

B. Related Sections include the following:

1. Division 26 Section "Wiring Devices" for wall-box dimmers, wall-switch occupancy sensors, 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 OUTDOOR PHOTOELECTRIC SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Intermatic, Inc., K4100 Series
2. Paragon Electric Co.; Invensys Climate Controls.
3. TORK.

B. Description: Solid state, with SPST dry contacts rated for 1800-VA tungsten or 1000-VA ballast, to operate connected relay, contactor coils, or microprocessor input; complying with UL 773A.

1. Light-Level Monitoring Range: 1.5 to 10 fc, with an adjustment for turn-on and turn-off levels within that range.
2. Time Delay: 15-second minimum, to prevent false operation.
4. Mounting: Stem mounting, with base-and-stem mounting or stem-and-swivel mounting accessories as required to direct sensor to the north sky exposure.

2.2 INDOOR OCCUPANCY SENSORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Hubbell Lighting.
3. Lithonia Lighting; Acuity Lighting Group, Inc.
4. Novitas, Inc.
5. RAB Lighting, Inc.
6. Sensor Switch, Inc.
7. TORK.
8. Watt Stopper (The).

B. General Description: Wall mounted, solid-state units with a separate relay unit.

1. Wall Mounted 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.
2. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor shall be powered from the relay unit.
3. 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.
4. Mounting:
   a. Sensor: Suitable for mounting in any position on a standard outlet box.
   b. Relay: Externally mounted through a 1/2-inch knockout in a standard electrical enclosure.
   c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
5. Indicator: LED, to show when motion is being detected during testing and normal operation of the sensor.
6. Bypass Switch: Override the on function in case of sensor failure.
7. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc; keep lighting off when selected lighting level is present.

C. Dual-Technology Type: 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.

2.3 LIGHTING CONTROL PANELS

A. Provide lighting control panels in the locations and capacities as indicated on the plans and schedules. Each panel shall be of modular construction and consist of the following components:

1. Enclosure/Tub shall be NEMA 1, sized to accept an interior with 1 – 8 relays, 1 – 24 relays and 6 four-pole contactors, or 1 – 48 relays and 6 four-pole contactors.
2. Cover shall be configured for surface or flush wall mounting of the panel as indicated on the plans. The panel cover shall have a hinged and lockable door with restricted access to line voltage section of the panel.
3. Interior assembly shall be supplied as a factory assembled component specifically designed and listed for field installation. The interior construction shall provide total isolation of high voltage (Class 1) wiring from low voltage (Class 2) wiring within the
assembled panel. The interior assembly shall include intelligence boards, power supply, DIN rails for mounting optional Class 2 control devices, and individually replaceable latching type relays. The panel interiors shall include the following features:

4. Removable, plug-in terminal blocks with screwless connections for all low voltage terminations.
5. Individual terminal block, override pushbutton, and LED status light for each relay.
6. Direct wired switch inputs associated with each relay and group channel shall support two-wire, momentary or maintained contact switches.
7. Digital inputs (four RJ-45 jacks) shall support 1-, 2-, 3-, 4-, and 8-button digital switches, digital IO modules capable of receiving 0-5V or 0-10V analog photocell inputs, digital IO modules capable of receiving momentary or maintained contact closure inputs, digital photocell modules, and digital occupancy sensors.
8. Dimming modules on each circuit controlled by 0-10V signal.
9. True relay state shall be indicated by the on-board LED and shall be available to external control devices and systems via BACnet.
10. Automatically sequenced operation of relays to reduce impact on the electrical distribution system when large loads are controlled simultaneously.
11. Group, channel, and pattern control of relays shall be provided through a simple keypad interface from a handheld IR programmer. Any group of relays can be associated with a channel for direct on/off control or pattern (scene) control via a simple programming sequence using the relay and channel override pushbuttons and LED displays for channels 1-9 or a handheld IR programmer for channels 1-99.
12. Relay group status for each channel shall be provided through red LED indicators for groups 1-9 and via BACnet for groups 1-99. Solid red indicates that the last group action called for an ON state and relays in the group are on or in a mixed state.
13. Single-pole latching relays with modular plug-in design. Relays shall provide the following ratings and features:

   a. Electrical:

   1) 30 amp ballast at 277V
   2) 20 amp ballast at 347V
   3) 20 amp tungsten at 120V
   4) 30 amp resistive at 347V
   5) 1.5 HP motor at 120V
   6) 14,000 amp short circuit current rating (SCCR) at 347V
   7) Relays shall be specifically UL listed for control of plug loads

   b. Mechanical:

   1) Individually replaceable, ⅜” KO mounting with removable Class 2 wire harness.
   2) Actuator on relay housing provides manual override and visual status indication, accessible from Class 2 section of panel.
   3) Dual line and load terminals each support two #14 – #12 solid or stranded conductors.
   4) Tested to 300,000 mechanical on/off cycles.

   c. Isolated low voltage contacts provide for true relay status feedback and pilot light indication.
14. Power supply shall be a multi-voltage transformer assembly with rated power to supply all electronics, occupancy sensors, switches, pilot lights, and photocells as necessary to meet the project requirements. Power supply to have internal over-current protection with automatic reset and metal oxide varistor protection.

15. Lighting control panels shall be WattStopper model LMCP24 or as shown on the plans or equal by Leviton and Lithonia

2.4 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 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.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance and staff personnel to adjust, operate, and maintain lighting control devices. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 26 09 23
SECTION 262416 – PANELBOARDS

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. Distribution panelboards.
   2. Lighting and appliance branch-circuit panelboards.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of panelboard, switching and overcurrent protective device, transient voltage suppression device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each panelboard and related equipment.
   1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
   2. Detail enclosure types and details for types other than NEMA 250, Type 1.
   3. Detail bus configuration, current, and voltage ratings.
   4. Short-circuit current rating of panelboards and overcurrent protective devices.
   5. Include evidence of NRTL listing for series rating of installed devices.
   6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
   7. Include wiring diagrams for power, signal, and control wiring.
   8. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards. Submit on translucent log-log graph paper; include selectable ranges for each type of overcurrent protective device.

1.4 INFORMATIONAL SUBMITTALS

A. Panelboard Schedules: For installation in panelboards.

1.5 CLOSEOUT SUBMITTALS
A. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01, include the following:

1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

1.6 QUALITY ASSURANCE

A. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

C. 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.

D. Comply with NEMA PB 1.

E. Comply with NFPA 70.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.

B. Handle and prepare panelboards for installation according to NEMA PB 1.

1.8 PROJECT CONDITIONS

A. Environmental Limitations:

1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:

   a. Ambient Temperature: Not exceeding 23 deg F (minus 5 deg C) to plus 104 deg F (plus 40 deg C).
B. Service Conditions: NEMA PB 1, usual service conditions, as follows:

1. Ambient temperatures within limits specified.
2. Altitude not exceeding 6600 feet (2000 m).

1.9 COORDINATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

A. Enclosures: Flush- and surface-mounted cabinets.

1. Rated for environmental conditions at installed location.
   a. Indoor Dry and Clean Locations: NEMA 250, Type 1.

2. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.

3. Finishes:
   a. Panels and Trim: galvanized steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.


B. Incoming Mains Location: Top or bottom.

C. Phase, Neutral, and Ground Buses:

1. Material: Copper.

2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.

D. Conductor Connectors: Suitable for use with conductor material and sizes.
2. Main and Neutral Lugs: Mechanical lugs.
3. Ground Lugs and Bus-Configured Terminators: Mechanical lugs.

E. Service Equipment Label: NRTL labeled for use as service equipment for panelboards or load centers with one or more main service disconnecting and overcurrent protective devices.

F. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.


2.2 DISTRIBUTION PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Square D; a brand of Schneider Electric. (Basis of Design)
2. Eaton Electrical Inc.; Cutler-Hammer Business Unit.

B. Panelboards: NEMA PB 1, power and feeder distribution type.

C. Doors: Secured with vault-type latch with tumbler lock; keyed alike.

1. For doors more than 36 inches (914 mm) high, provide two latches, keyed alike.

D. Mains: Circuit breaker or main lugs.


F. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger than 125 A: Bolt-on circuit breakers.

G. Contactors can be incorporated to switch the entire panelboard or only a portion of the circuits. Coordinate with Drawings and schedules to indicate contactor connections, type, quantity of circuits controlled, current ratings, external control circuits, and number of poles. Consult manufacturers for their respective limitations on and availability of short-circuit ratings and electrically held contactors, which may not be available from all manufacturers.

2.3 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Square D; a brand of Schneider Electric. (Basis of Design)
2. Eaton Electrical Inc.; Cutler-Hammer Business Unit.

B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

C. Mains: Circuit breaker or lugs only.

D. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

E. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

F. Column-Type Panelboards: Narrow gutter extension, with cover, to overhead junction box equipped with ground and neutral terminal buses.

2.4 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Square D; a brand of Schneider Electric. (Basis of Design)
2. Eaton Electrical Inc.; Cutler-Hammer Business Unit.

B. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with to meet available fault currents.

3. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:
   a. Standard frame sizes, trip ratings, and number of poles.
   b. Lugs: Suitable for number, size, trip ratings, and conductor materials.
   c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Receive, inspect, handle, and store panelboards according to NEMA PB 1.1.

B. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.
C. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.

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

3.2 INSTALLATION

A. Install panelboards and accessories according to NEMA PB 1.1.

B. Equipment Mounting: Install floor mounted panelboards on concrete bases, 4-inch (100-mm) nominal thickness. Comply with requirements for concrete base specified in Division 03 Section “Miscellaneous Cast-in-Place Concrete.”

1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around full perimeter of base.
2. For panelboards, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
4. Install anchor bolts to elevations required for proper attachment to panelboards.
5. Attach panelboard to the vertical finished or structural surface behind the panelboard.

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.

D. Mount top of trim 90 inches (2286 mm) above finished floor unless otherwise indicated.

E. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.

F. Install overcurrent protective devices and controllers not already factory installed.

1. Set field-adjustable, circuit-breaker trip ranges.

G. Install filler plates in unused spaces.

H. Stub four 1-inch (27-GRC) empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch (27-GRC) empty conduits into raised floor space or below slab not on grade.

I. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.

J. Comply with NECA 1.

3.3 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Division 26 Section "Identification for Electrical Systems."
B. Create a directory to indicate installed circuit loads; incorporate Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.

C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

D. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

3.4 PROTECTION

A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions.

END OF SECTION 262416
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.
      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 265600 – EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Exterior luminaires with lamps and ballasts.
2. Poles and accessories.

B. Related Sections:

1. Division 26 Section "Interior Lighting" for exterior luminaires normally mounted on exterior surfaces of buildings.

1.3 DEFINITIONS

A. CCT: Correlated color temperature.
B. CRI: Color-rendering index.
C. HID: High-intensity discharge.
D. LER: Luminaire efficacy rating.
E. Luminaire: Complete lighting fixture, including ballast housing if provided.
F. Pole: Luminaire support structure, including tower used for large area illumination.
G. Standard: Same definition as "Pole" above.

1.4 STRUCTURAL ANALYSIS CRITERIA FOR POLE SELECTION

A. Dead Load: Weight of luminaire and its horizontal and vertical supports, lowering devices, and supporting structure, applied as stated in AASHTO LTS-4-M.
B. Live Load: Single load of 500 lbf (2224 N), distributed as stated in AASHTO LTS-4-M.
C. Ice Load: Load of 3 lbf/sq. ft. (145 Pa), applied as stated in AASHTO LTS-4-M Ice Load Map.
D. Wind Load: Pressure of wind on pole and luminaire and banners and banner arms, calculated and applied as stated in AASHTO LTS-4-M.

1. Basic wind speed for calculating wind load for poles 50 feet (15 m) high or less is 100 mph (45 m/s).
   a. Wind Importance Factor: 1.0.
   c. Velocity Conversion Factors: 1.0.

1.5 ACTION SUBMITTALS

A. 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. Anchor-bolt templates keyed to specific poles and certified by manufacturer.
3. Design calculations, certified by a qualified professional engineer, indicating strength of screw foundations and soil conditions on which they are based.
4. Wiring Diagrams: For power, signal, and control wiring.

1.6 INFORMATIONAL SUBMITTALS

A. Pole and Support Component Certificates: Signed by manufacturers of poles, certifying that products are designed for indicated load requirements in AASHTO LTS-4-M and that load imposed by luminaire and attachments has been included in design. The certification shall be based on design calculations by a professional engineer.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For luminaires and poles to include in emergency, operation, and maintenance manuals.

1.8 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. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by 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.

C. 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.

E. Comply with NFPA 70.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Package aluminum poles for shipping according to ASTM B 660.

B. Store poles on decay-resistant-treated skids at least 12 inches (300 mm) above grade and vegetation. Support poles to prevent distortion and arrange to provide free air circulation.

C. Handle wood poles so they will not be damaged. Do not use pointed tools that can indent pole surface more than 1/4 inch (6 mm) deep. Do not apply tools to section of pole to be installed below ground line.

D. Retain factory-applied pole wrappings on fiberglass and laminated wood poles until right before pole installation. Handle poles with web fabric straps.

E. Retain factory-applied pole wrappings on metal poles until right before pole installation. For poles with nonmetallic finishes, handle with web fabric straps.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace products that fail in materials or workmanship; that corrode; or that fade, stain, perforate, erode, or chalk due to effects of weather or solar radiation within specified warranty period. Manufacturer may exclude lightning damage, hail damage, vandalism, abuse, or unauthorized repairs or alterations from special warranty coverage.

1. Warranty Period for Luminaires: Five years from date of Substantial Completion.
2. Warranty Period for Metal Corrosion: Five years from date of Substantial Completion.
3. Warranty Period for Color Retention: Five years from date of Substantial Completion.
4. Warranty Period for Poles: Repair or replace lighting poles and standards that fail in finish, materials, and workmanship within manufacturer's standard warranty period, but not less than three years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide product indicated on Drawings.

2.2 GENERAL REQUIREMENTS FOR LUMINAIRES

A. Luminaires shall comply with UL 1598 and be listed and labeled for installation in wet locations by an NRTL acceptable to authorities having jurisdiction.
B. Lateral Light Distribution Patterns: Comply with IESNA RP-8 for parameters of lateral light distribution patterns indicated for luminaires.

C. Metal Parts: Free of burrs and sharp corners and edges.

D. Sheet Metal Components: Corrosion-resistant aluminum unless otherwise indicated. Form and support to prevent warping and sagging.

E. Housings: Rigidly formed, weather- and light-tight enclosures that will not warp, sag, or deform in use. Provide filter/breather for enclosed luminaires.

F. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses. Designed to disconnect ballast when door opens.

G. Exposed Hardware Material: Stainless steel.

H. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

I. Light Shields: Metal baffles, factory installed and field adjustable, arranged to block light distribution to indicated portion of normally illuminated area or field.

J. Reflecting surfaces shall have minimum reflectance as follows unless otherwise indicated:

1. White Surfaces: 85 percent.
2. Specular Surfaces: 83 percent.
3. Diffusing Specular Surfaces: 75 percent.

K. Lenses and Refractors Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.

L. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.

M. Factory-Applied Finish for Steel Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or SSPC-SP 8, "Pickling."
2. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.

   a. Color: As selected by Architect from manufacturer's full range.
N. Factory-Applied Finish for Aluminum Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
2. Natural Satin Finish: Provide fine, directional, medium satin polish (AA-M32); buff complying with AA-M20; and seal aluminum surfaces with clear, hard-coat wax.
3. Class I, Clear Anodic Finish: AA-M32C22A41 (Mechanical Finish: medium satin; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.
4. Class I, Color Anodic Finish: AA-M32C22A42/A44 (Mechanical Finish: medium satin; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA 611.

   a. Color: As selected by Architect from manufacturer's full range.

O. Factory-Applied Labels: Comply with UL 1598. 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 AND DRIVERS

A. Drivers for Low-Temperature Environments:

1. Temperatures 0 Deg F (Minus 17 Deg C) and Higher: Electronic type rated for 0 deg F (minus 17 deg C) operating temperature.

B. Driver Characteristics:

1. Power Factor: 90 percent, minimum.
2. Sound Rating: Class A.
3. Total Harmonic Distortion Rating: Less than 10 percent.
4. Transient-Voltage Protection: Comply with IEEE C62.41.1 and IEEE C62.41.2, Category A or better.

C. High-Temperature LED Capability: Rated for reliable operation with driver and lamp at temperatures 120 deg F (50 deg C) and higher.

2.4 GENERAL REQUIREMENTS FOR POLES AND SUPPORT COMPONENTS

A. Structural Characteristics: Comply with AASHTO LTS-4-M.

1. Wind-Load Strength of Poles: Adequate at indicated heights above grade without failure, permanent deflection, or whipping in steady winds of speed indicated in "Structural Analysis Criteria for Pole Selection" Article.
2. Strength Analysis: For each pole, multiply the actual equivalent projected area of luminaires and brackets by a factor of 1.1 to obtain the equivalent projected area to be
used in pole selection strength analysis.

B. Luminaire Attachment Provisions: Comply with luminaire manufacturers' mounting requirements. Use stainless-steel fasteners and mounting bolts unless otherwise indicated.

C. Mountings, Fasteners, and Appurtenances: Corrosion-resistant items compatible with support components.
   1. Materials: Shall not cause galvanic action at contact points.
   3. Anchor-Bolt Template: Plywood or steel.

D. Handhole: Oval-shaped, with minimum clear opening of 2-1/2 by 5 inches (65 by 130 mm), with cover secured by stainless-steel captive screws.

E. Concrete Pole Foundations: Cast in place, with anchor bolts to match pole-base flange. Concrete, reinforcement, and formwork are specified in Division 03 Section "Cast-in-Place Concrete."

F. Power-Installed Screw Foundations: Factory fabricated by pole manufacturer, with structural steel complying with ASTM A 36/A 36M and hot-dip galvanized according to ASTM A 123/A 123M; and with top-plate and mounting bolts to match pole base flange and strength required to support pole, luminaire, and accessories.

G. Breakaway Supports: Frangible breakaway supports, tested by an independent testing agency acceptable to authorities having jurisdiction, according to AASHTO LTS-4-M.

2.5 STEEL POLES

A. Poles: Comply with ASTM A 500, Grade B, carbon steel with a minimum yield of 46,000 psig (317 MPa); one-piece construction up to 40 feet (12 m) in height with access handhole in pole wall.
   1. Shape: Square, straight.
   2. Mounting Provisions: Butt flange for bolted mounting on foundation or breakaway support.

B. Brackets for Luminaires: Detachable, cantilever, without underbrace.
   1. Adapter fitting welded to pole, allowing the bracket to be bolted to the pole mounted adapter, then bolted together with stainless-steel bolts.
   2. Cross Section: Tapered oval, with straight tubular end section to accommodate luminaire.
   3. Match pole material and finish.

C. Pole-Top Tenons: Fabricated to support luminaire or luminaires and brackets indicated, and securely fastened to pole top.

D. Steps: Fixed steel, with nonslip treads, positioned for 15-inch (381-mm) vertical spacing,
alternating on opposite sides of pole; first step at elevation 10 feet (3 m) above finished grade.

E. Grounding and Bonding Lugs: Welded 1/2-inch (13-mm) threaded lug, complying with requirements in Division 26 Section "Grounding and Bonding for Electrical Systems," listed for attaching grounding and bonding conductors of type and size listed in that Section, and accessible through handhole.

F. Cable Support Grip: Wire-mesh type with rotating attachment eye, sized for diameter of cable and rated for a minimum load equal to weight of supported cable times a 5.0 safety factor.

G. Factory-Painted Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or with SSPC-SP 8, "Pickling."

2. Interior Surfaces of Pole: One coat of bituminous paint, or otherwise treat for equal corrosion protection.

3. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.

   a. Color: As selected by Architect from manufacturer's full range.

2.6 POLE ACCESSORIES

A. Duplex Receptacle: 120 V, 20 A in a weatherproof assembly complying with Division 26 Section "Wiring Devices" for ground-fault circuit-interrupter type.

   1. Recessed, 12 inches (300 mm) above finished grade.

   2. Nonmetallic polycarbonate plastic or reinforced fiberglass, weatherproof in use, cover, that when mounted results in NEMA 250, Type 3R enclosure.

   3. With cord opening.

   4. With lockable hasp and latch that complies with OSHA lockout and tag-out requirements.

PART 3 - EXECUTION

3.1 LUMINAIRE INSTALLATION

A. Install lamps in each luminaire.

B. Fasten luminaire to indicated structural supports.

C. Adjust luminaires that require field adjustment or aiming.

3.2 POLE INSTALLATION
A. Alignment: Align pole foundations and poles for optimum directional alignment of luminaires and their mounting provisions on the pole.

B. Clearances: Maintain the following minimum horizontal distances of poles from surface and underground features unless otherwise indicated on Drawings:

1. Fire Hydrants and Storm Drainage Piping: 60 inches (1520 mm).
2. Water, Gas, Electric, Communication, and Sewer Lines: 10 feet (3 m).
3. Trees: 15 feet (5 m) from tree trunk.

C. Concrete Pole Foundations: Set anchor bolts according to anchor-bolt templates furnished by pole manufacturer. Concrete materials, installation, and finishing requirements are specified in Division 03 Section "Cast-in-Place Concrete."

D. Raise and set poles using web fabric slings (not chain or cable).

3.3 CORROSION PREVENTION

A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.

B. Steel Conduits: Comply with Division 26 Section "Raceway and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch- (0.254-mm-) thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

3.4 GROUNDING

A. Ground metal poles and support structures according to Division 26 Section "Grounding and Bonding for Electrical Systems."

1. Install grounding electrode for each pole unless otherwise indicated.
2. Install grounding conductor pigtail in the base for connecting luminaire to grounding system.

B. Ground nonmetallic poles and support structures according to Division 26 Section "Grounding and Bonding for Electrical Systems."

1. Install grounding electrode for each pole.
2. Install grounding conductor and conductor protector.
3. Ground metallic components of pole accessories and foundations.

END OF SECTION 265600
SECTION 26 82 39 - UNIT HEATERS

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 propeller unit heaters with electric-resistance heating coils.

1.3 DEFINITIONS
A. BAS: Building automation system.
B. CWP: Cold working pressure.
C. PTFE: Polytetrafluoroethylene plastic.
D. TFE: Tetrafluoroethylene plastic.

1.4 ACTION SUBMITTALS
A. Product Data: For each type of product.
   1. Include rated capacities, operating characteristics, furnished specialties, and accessories.
B. Shop Drawings:
   1. Include location and size of each field connection.
   2. Include details of anchorages and attachments to structure and to supported equipment.
   3. Include equipment schedules to indicate rated capacities, operating characteristics, furnished specialties, and accessories.

1.5 INFORMATIONAL SUBMITTALS
A. Field quality-control reports.
1.6 CLOSEOUT SUBMITTALS
A. Operation and Maintenance Data: For propeller unit heaters to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 MANUFACTURERS
A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Trane Inc.
2. Qmark.
3. Indeeco.

2.2 DESCRIPTION
A. Assembly including casing, coil, fan, and motor in horizontal discharge configuration with adjustable discharge louvers.
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 UL 2021.
D. Comply with UL 823.

2.3 HOUSINGS
A. 304 stainless steel, factory-assembled and -tested unit heaters.
B. 304 stainless steel discharge grille.
C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
D. Discharge Louver: Adjustable fin diffuser for horizontal units.

2.4 COILS
A. Electric-Resistance Heating Coil: Nickel-chromium heating wire, free from expansion noise and 60-Hz hum, embedded in magnesium oxide refractory and sealed in steel or corrosion-resistant metallic sheath with fins no closer than 0.16 inch (4 mm). Element ends shall be
enclosed in terminal box. Fin surface temperature shall not exceed 550 deg F (288 deg C) at any point during normal operation.

2. Wiring Terminations: Stainless-steel or corrosion-resistant material.

2.5 FAN AND MOTOR
   A. Fan: Propeller type with aluminum wheel directly mounted on motor shaft.
   C. Auto reset thermal overloads shall shutdown unit if safe operating temperatures are not met.

2.6 CONTROLS
   A. 24V control transformer.
   B. NEMA 4x Non-metallic enclosure
   C. Door interlock disconnect switch.
   D. Control Devices:
      1. Wall-mounted thermostat.

PART 3 - EXECUTION

3.1 EXAMINATION
   A. Examine areas to receive unit heaters for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
   B. Examine roughing-in for electrical connections to verify actual locations before unit-heater installation.
   C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION
   A. Install unit heaters to comply with NFPA 90A.
   B. Install unit heaters level and plumb.
   C. Suspend unit heaters from structure with all-thread hanger rods.
D. Install wall-mounted thermostats and switch controls in electrical outlet boxes at heights to match lighting controls. Verify location of thermostats and other exposed control sensors with Drawings and room details before installation. Thermostats shall be rated for “wet” environments.

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, start units to confirm proper motor rotation and unit operation.
2. Operate electric heating elements through each stage to verify proper operation and electrical connections.
3. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

B. Units will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.5 ADJUSTING

A. Adjust initial temperature set points.

B. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.6 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain propeller unit heaters.

END OF SECTION 26 82 39
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 REFERENCES

A. References to standards of organizations are made herein in accordance with the following abbreviations:

- ADA: Americans with Disabilities Act
- ADAAG: Americans with Disabilities Act Accessibility Guidelines
- ANSI: American National Standards Institute Inc.
- ASA: American Standards Association
- ASTM: American Society for Testing and Materials
- CBEMA: Computer and Business Equipment Manufacturers Association
- EIA: Electronic Industries Association
- FAA: Federal Aviation Agency
- FCC: Federal Communications Commission
- ICEA: Insulated Cable Engineers Association
- IEC: International Electro-Technical Commission
- IEEE: Institute of Electrical and Electronics Engineers
- ISO: International Standard Organization
- NEC: National Electrical Code (NFPA 70)
- NEMA: National Electrical Manufacturer's Association
- NTSC: National Television Standards Committee
- OSHA: Occupational Safety and Health Administration
- TIA: Telecommunications Industry Association
- SBC: Standard Building Code
- UL: Underwriters Laboratories, Inc.

B. Work installed shall be in strict compliance with governing codes and regulations. Installation shall be in accordance with installation recommendations and details provided by product manufacturers unless exceeded in quality by these specifications.

C. Work called for in the specifications or shown on the drawings that is deemed contrary to the code by the local Authority Having Jurisdiction governing shall be brought to attention of Engineer prior to rough-in for clarification or revision.
1.3 DEFINITIONS AND ABBREVIATIONS

A. Abbreviations:

1. A.F.F: Above Finish Floor
2. AHJ: Authority Having Jurisdiction
3. AP: Wireless local area network Access Point
4. BC: Bonding Conductor
5. CATV: Community Antenna Television
6. CER: Communications Equipment Room
7. EMI: Electromagnetic Interference
8. HC: Horizontal Cross-Connect
9. IC: Intermediate Cross-Connect
10. IDC: Insulation Displacement Connector
11. IDF: Intermediate Distribution Frame
12. LAN: Local Area Network
13. MC: Main Cross-Connect
14. MDF: Main Distribution Frame
15. MUTOA: Multi-User Telecommunication Outlet Assembly
16. N/A: Not Applicable
17. PoE: Power over Ethernet
18. PVC: Polyvinyl Chloride
19. RFI: Radio Frequency Interference
20. SP: Wireless local area network Security Point
21. TBB: Telecommunications Bonding Backbone
22. TBC: Telecommunications Bonding Conductor
23. TBBIBC: Telecommunications Bonding Backbone Interconnecting Bonding Conductor
24. TBD: To Be Determined
25. TDC: Telecommunication Distribution Center
26. TGB: Telecommunications Grounding Bus Bar
27. TMGB: Telecommunications Main Grounding Bus Bar
28. TO: Telecommunication Outlet
29. TR: Telecommunication Room
30. UTP: Unshielded twisted pair
31. VoIP: Voice over Internet Protocol
32. WA: Work Area
33. WLAN: Wireless Local Area Network

B. AHJ: Authority Having Jurisdiction - the legally authorized agency empowered to review, inspect, and approve the design, installation procedures, and operational features and application of materials, systems, and practices.

C. As Directed: As directed by the Owner or approved Owner representative.

D. Backbone Distribution System: It consists of cable pathways, cables and all connecting hardware, and all miscellaneous support facilities. All cables and interconnecting components shall be electrically compatible with the horizontal cabling.

E. Cabling/Wiring: Includes the furnishing and installation of all fittings, conductors, connectors, grounding accessories, tape and all other items necessary for such work.
F. Communication Pathway: An established pathway between two endpoints. A critical component of the structured cabling system utilizing conduit, wiring hangers and cable trays. These pathways are to be utilized for Communication Systems only. Other trades shall not utilize these pathways.

G. Concealed: Embedded in masonry or other construction, installed behind wall furring or within double partitions, or installed within hung ceilings.

H. Conduit or Cable Support: Includes the furnishing and installation of all fittings, hangers, supports, sleeves, grounding, etc.

I. Contractor: The General Contractor or where prime contracts exist, the contracted licensed installer of all systems and product specified on the construction documents and in this Project Manual including, but not limited to, their vendors and suppliers, subcontractors, unions and/or administering their representatives, and administrative support.

J. Construction Document(s): The drawings, specifications, supplemental drawings and directives as defined, described, listed, and/or identified in the General Conditions and the sections, subsections, articles, and paragraphs contained therein.

K. Coordination (verification): The word “coordinate,” “verification,” or “coordination” as used in the Construction Documents, shall be understood to mean, unless specifically stated otherwise:

1. That the Contractor is responsible, and thus empowered, to insure all parties involved, directly or indirectly, including, but not limited to, Owner(s), Architect(s), Engineer(s), and other trades and services through respective agents of responsibility (i.e. superintendents, supervisors, project managers) are contacted for the distinct purpose of scheduling or arranging a mutual schedule for a needed event/action for the purpose of detailing and/or resolving potential areas of conflict or space restriction; notification of interruption of service, potential disruption of service, and/or objectionable, but required, environmental noise, dust, etc. conditions; informational research of existing systems; meetings; development of coordination drawings; and any other necessary action necessary for the execution of work specified herein.

2. That all coordination shall occur prior to commencing any work or portion thereof including, but not limited to, rough-in.

3. That a satisfactory and mutually agreed upon resolution has been achieved and documented in detail including, but not limited to, drawing plans and sections, correspondence, and minutes of meetings (documenting who, what, where, when, and how) with and to all parties, respectively.

4. That the lack or absence of executing this requirement does not release and relieve the Contractor from correcting any associated and/or resulting work; will not constitute additional compensation from the District/Owner or Owner/Engineer; and will not be reason for additional construction time regardless of timing, the work completed, the work to be completed, project schedule, and/or cost associated with, but not limited to, special/priority manufacturing duty, any special deliveries and transportation, premium time and materials, tools and equipment, and administration.

L. Exposed: Not installed underground or “Concealed” as defined above.
M. Outdoor: Where the term outdoor is used in this section of specifications it shall also be defined as indoor wet location. Devices or equipment specified as outdoor shall meet code requirements for wet locations and shall be applicable for use in indoor wet locations.

N. Provide: All administration, coordination, programming, labor (standard and/or premium), tools, materials, transportation, and equipment required for a complete and operable installation of the referenced/specified item, system, and/or product.

O. Service Provider: The operator of a service that provided telecommunications transmission delivered over access provider facilities.

P. Structured Cabling System (SCS)/Solution: The SCS includes all components, installation, and testing required for a complete and warranted (when applicable) system to achieve a specified level of performance.

Q. Substitutions: Changes in products, materials, equipment and methods of construction from those required by the Contract documents and proposed by the Contractor.

1. Substitutions for Cost Changes proposed by the Contractor that are required due to changed project conditions, such as unavailability of product, regulatory changes or unavailability for required warranty terms.

2. Substitutions for Convenience Changes proposed by the Contractor or Owner that are not required in order to meet other Project requirements but may offer advantages to Owner.

R. Supply: Purchase, procure, acquire, and deliver complete with related accessories.

S. System: A complete and operating building entity and/or infrastructure which shall include, but not limited to, material and equipment; supporting hardware; associated supplementary building features; and coordination with other trades, Owner, Owner/Engineer, AHJ, utilities, and other governing entities. For purposes of acceptance and/or guarantee, "system" shall be understood to mean all components and/or features operating and working as specified herein in whole and not in part regardless of importance, size, or function.

T. TMGB: Telecommunications Main Grounding Busbar.

1.4 GENERAL REQUIREMENTS

A. Drawings in Electronic Format:

1. Drawings in electronic format when provided under this contract shall be for the convenience of the recipient only. The Engineer makes no representation as to its completeness or accuracy.

2. The user is advised that any translation of the drawings from one computer system or environment to another can and often does result in the loss of important data. This loss can include but may not be limited to: portions of text and dimensions - the existence, location or scale of symbols or other elements of graphics - the internal structure of the data including layers and data attributes - the style or weight of lines.

3. The user is further warned that, while all digital data appears to be extremely accurate, this apparent accuracy is an artifact of the techniques used to generate it and is in no way intended to imply actual accuracy.
B. Equipment Storage and Protection: In general, equipment shall be stored in a sheltered clean, dry area.

1. If equipment must be stored in cool, damp areas, heaters shall be provided to keep equipment dry.
2. Contractor shall protect special system equipment from moisture until final acceptance by Owner. Rusted areas on equipment enclosure shall be cleaned, prime painted and receive appropriate finish coat.
3. Equipment or components of equipment receiving moisture or water damage shall be replaced with new equipment or components at Contractor's expense.
4. Until final observation equipment busbars, terminals and other internal components shall be protected by Contractor from paint, plaster, cleaners, abrasives, dust and spray by providing appropriate covers.

C. Basis of Design:

1. First-named manufacturer’s device, equipment or system has been used in specifications and drawings to meet the job requirements and to determine the space and dimensional requirements. Verify the devices, equipment, systems or product by other than first-named manufacturers will meet the job requirements and will fit in the allocated space.
2. Listing of a manufacturer as acceptable does not in any way relieve the Contractor from the responsibility for providing a device, equipment or system that meets the requirements of the specifications.
3. Where material, device, equipment, or system is specified by a manufacturer and model number, the current manufacturer’s specification for same shall be considered part of these specifications, as if completely included.
4. No extra cost will be allowed due to effect on other trades when bid is based on products other than basis of design manufacturer. Contractor shall be responsible for coordination required for the use of substituted devices, equipment, systems, or products by other than the basis of design manufacturer.

D. Drawing Details: Since the installation of devices, equipment and systems may vary by each manufacturer and the "approved manufacturer" for the job was unknown at the time the drawing details were made, the details shown on the drawings to be accepted by the Contractor as general in nature and are not to be used for the installation. Contractor shall obtain from the "approved manufacturer" of the devices, equipment or systems detailed installation drawings for their proper installation.

E. Deviations from Specified Devices, Equipment or System: While it is recognized that devices, equipment or systems by other than the first-named manufacturer may not be exactly identical, the Contractor shall verify and provide devices, equipment, systems, or products that meet the specified job requirements. All deviations of devices, equipment, systems, or products from the first-named manufacturer shall be clearly noted on shop drawing submittal or by cover letter. Engineer reserves the right to reject all devices, equipment or systems he feels does not meet the specified job requirements.

F. Submission of shop drawings will be considered as indicating that space requirements have been reviewed and that submitted equipment will fit space allocated with due concern given to access required for maintenance purposes.
**G.** Contract drawings and specifications are complementary and what is called for by one shall be as binding as if called for by both.

**H.** The word “provide” as used on the plans and in these specifications shall be understood to mean all administration, labor, materials, tools, equipment and components required for a complete and operable installation of the referenced item, system, and/or product.

**I.** Contractor shall furnish all labor and material required to complete installation including accessories, fittings, auxiliaries, and components required for proper performance of systems.

**J.** Location of Equipment and Devices:

1. Locations of the communication equipment and devices shown are approximate. Determine the exact location of the equipment and devices by checking the communication systems drawings, field measurements, or the approved shop drawings.
2. Relocate equipment or devices when directed by Engineer without cost, providing equipment has not been installed and the new location is not greater than 10 ft. (3 M) from the location shown.

**K.** Product Model/Part Numbers: Model and/or part numbers are given for reference purposes only. Where conflict arises between the written product specification and description and model/part numbers, the stricter of the two shall apply or, at the least, the description shall apply.

1. It is the Contractors responsibility to insure all model and part numbers are correct and accurate to meet the requirements of the construction documents.
2. Where model and/or part numbers specified become out-dated or are not longer in production, Contractor shall provide manufactures recommended replacement for same and insure that recommendation provides, as a minimum, all features and functions of that specified.
3. Final approval of any differences is at the discretion of the Engineer. Decision of Engineer is final.

**L.** Do not scale drawings. Refer to Architectural and communication system drawings for new and existing building construction, dimensions and finishes in order to provide proper rough-in and installation of work.

**M.** Quality Control:

1. Exposed Work in Finished Spaces: Install communication devices and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed.
2. Equipment Access: Install communication devices and equipment to facilitate servicing, maintenance and repair or replacement. As much as practical, connect equipment for ease of disconnecting with minimum of interference with other installations.
3. Cleanliness: Contractor shall keep debris and dirt from around, on top of and the inside of all communication equipment he provides during construction.

**N.** Final Clean-Up: On completion of system installation, including outlet fittings and devices, inspect exposed finish, remove dirt and construction debris and repair damaged finish, including chips, scratches and abrasions.
1.5 WORK INCLUDED

A. Provide labor, material, mounting hardware, terminations, tools, transportation, services, and equipment necessary for a complete and operating system for work specified in Division 27. See individual sections for scope of work for additional requirements.

B. The scope of this work includes, but is not limited to, providing the following:

1. All horizontal communications cabling between individual work area outlet locations and their associated patch panel in the communication rooms. Contractor shall be responsible for terminations and testing of cables to the patch panels and termination blocks in the communication closets.
2. Horizontal communication system shall include the following systems: data, voice, audio/visual, paging/intercom, video surveillance, and access control.
3. All termination blocks, equipment racks, cross connect supports and guide rings required to terminate or cross connect communications cables in communications closets and/or at designated equipment locations.
4. All connectors, terminating devices, faceplates, etc. required to terminate and mount communications cables.
5. All necessary plywood, backboards, wiring enclosures, cable supports, equipment frames and pathways hardware, except for those already provided for in other building contracts.
6. All conduit systems including all necessary drilling, placement of support rods, and placement of mounting hardware wherever cables are installed within the ceiling plenum outside of cable trays.
7. All cable supports, including ladder runway, within the communication rooms.
8. Labeling and documentation of installation of all cables, racks, frames, outlets and hardware installed under this contract.
9. Testing and test documentation for all cabling as described within these specifications.
10. All connections to the communications grounding system.
11. Preparation and submission of shop drawings, as-built drawings, reports, documentation, and submittals as described within these specifications.
12. Fire-stopping of all openings in fire rated walls and floors created by or on behalf of the Contractor.
13. Raceways and conduits specified under Division 26 Electrical Specifications.

C. Service-entrance and Service-entrance Facilities: Coordinate service provider’s service-entrance requirements and final pathway location.

1.6 DESCRIPTION OF SYSTEMS

A. See individual sections of Division 27 and Division 28 for general description of required communication systems, equipment, devices and products.

B. Conditions:

1. The Contract Documents may not necessarily describe all the required work to satisfy their intention. On the basis of work described herein, and or indicated in the drawings, the Contractor shall furnish all items and provide all labor required providing a complete, standards based structured cabling system.
2. It is the Contractor’s responsibilities to field verify all pathways, routes and dimensions necessary for the cabling system. The Contractor shall verify that all pathways and spaces are installed prior to cable installation. Commencement of work implies acceptance of the pathways by Contractor.

C. Inspection of work provided by other trades is required by Contractor. Commencement of work described herein will serve as evidence that the Contractor has accepted all prior and or ongoing work performed by other trades for the cabling system. All necessary changes done without prior written authorization shall be done at the Contractors own risk and expense.

1.7 SUBSTITUTIONS

A. Substitutions for Cause: Submit requests for substitution immediately on discover of need for change, but no later than 15 days prior to time required for preparation and review of the related submittals.

1. Conditions: Architect/Engineer will consider Contractor’s request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect/Engineer will return requests without action, except to record non-compliance with these requirements.

a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
b. Substitution request is fully documents and properly submitted.
c. Requested substitution will not adversely affect Contractor’s’ construction schedule.
d. Requested substitution has received necessary approvals of AHJ.
e. Requested substitution is compatible with other portions of work.
f. Requested substitution had been coordinated with other portions of the Work.
g. Requested substitution provides specified warranty.
h. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portion of the work, is uniform and consistent, is compatible with other products and is acceptable to all contractors involved.
i. If requested substitution requires additional equipment, components, mounting, power, etc., the contractor shall coordinate with other trades and shall be no additional cost to Owner.

B. Substitutions for Convenience: Engineer will consider requests for substitution if received within 30 days after the Notice of Award. Requests received after that time may be considered or rejected at the discretion of the Engineer.

1. Conditions: Architect/Engineer will consider Contractor’s request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect/Engineer will return requests without action, except to record non-compliance with these requirements.
a. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation or other consideration, after deducting additional responsibilities Owner must assume. Owner’s additional responsibilities may include compensation to Architect/Engineer for redesign and evaluation of services, increased cost of other construction and similar considerations.
b. Requested substitution does not require extensive revisions to the Contract Documents.
c. Requested substitution is consistent with the Contract Documents and will produce indicated results.
d. Substitution request is fully documents and properly submitted.
e. Requested substitution will not adversely affect Contractor’s’ construction schedule.
f. Requested substitution has received necessary approvals of AHJ.
g. Requested substitution is compatible with other portions of work.
h. Requested substitution had been coordinated with other portions of the Work.
i. Requested substitution provides specified warranty.
j. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portion of the work, is uniform and consistent, is compatible with other products and is acceptable to all contractors involved.
k. If requested substitution requires additional equipment, components, mounting, power, etc., the contractor shall coordinate with other trades and shall be no additional cost to Owner.

C. Installer Qualifications: Cabling Installer shall have personnel certified by BICSI on staff.

1. Installation Supervision: Installation shall be under the direct supervision of ITS Technician, who shall be present at all times when Work of this Section is performed at Project site.
2. Field Inspector: currently registered by BICSI as a designer RCDD to perform the on-site inspection.

1.8 SHOP DRAWINGS AND SUBMITTAL REQUIREMENTS

A. See detailed shop drawing requirements in other sections of Division 27 and Division 28. Submittal transmittal shall reference specification section and description of equipment. Submittals shall be clearly scheduled and marked as to which model number, quantity and type is being submitted. Copies of catalog cut sheets are not sufficient unless clearly defined project specific information is marked. All shop drawings submitted shall include the Project name and number that is given in the drawing title block. Shop drawing shall include the specification section that the submittal item is referencing. Each specification section shall be submitted as a single submittal, otherwise will be rejected.

B. Submittal Schedule: Submit, as an action submittal, a list of submittals, arranged in chronological order by dates required by the construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revision to submittals noted by Engineer and additional time for handling and reviewing submittal required by those corrections.

1. Coordinate submittal schedule with list of subcontracts, the schedule of values and Contractor’s construction schedule.
2. Initial Submittal: Submit concurrently with startup construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrications.

3. Final Submittal: Submit concurrently with the first complete submittal of Contractor’s construction schedule. Submit revised submittal schedule to reflect changes in current status and timing for submittals.

4. Format: Arrange the following information in a tabular format:

   a. Schedule date for first submittal.
   b. Specification Section number and title.
   c. Submittal Category: Action; Informational
   d. Name of subcontractor.
   e. Description of work covered.
   f. Scheduled date for Engineer’s final release or approval.
   g. Scheduled dates for installation.

5. Submittal Information: Include the following information in each submittal:

   a. Project Name.
   b. Date.
   c. Name of Architect.
   d. Name of Construction Manager.
   e. Name of Contractor.
   f. Name of firm or entity that prepared submittal.
   g. Name of subcontractor, manufacturer, and supplier.
   h. Unique submittal number, including revision identifier. Include specification section number with sequential alphanumeric identifier and alphanumeric suffix for resubmittals.
   i. Category and type of submittal.
   j. Submittal purpose and description.
   k. Number and title of Specification Section with paragraph number and generic name for each of multiple items.
   l. Drawing number and detail references, if applicable
   m. Indication of full or partial submittal.
   n. Location(s) where product is to be installed, as appropriate.
   o. Other necessary identification.
   q. Signature of transmitter.

C. Options: Clearly identify options requiring selection by Engineer.

D. Deviations and Additional Information: On each submittal, clearly indicate deviations from requirements in the Contract Documents, including minor variations and limitations. Include relevant additional information and revisions, other than those requested by Architect/Engineer on previous submittals. Indicate by highlighting on each submittal or noting on attached separate sheet.
E. Contractor must allow a minimum of 2 weeks for Engineers to review and process the shop drawings. Detailed shop drawing items shall require 4 week review and process time. Shop drawings shall be phased and submitted in a sequence, which allows adequate time for Engineer review. Submittal of large numbers of shop drawings simultaneously is discouraged and may result in time for review, which exceeds the normal 2 week commitment for return. Any effect on construction schedule due to untimely submittal of shop drawings shall be the responsibility of the Contractor. Contractor shall submit Mechanical Submittal Summary within 2 weeks of being awarded the contract.

F. All shop drawings shall be submitted in a legible manner. Submittals shall be original or first generation. Any submittals that have been recopied to the point of illegible status will be rejected.

G. PDF Submittals: Prepare submittals as a PDF package, incorporating complete information into each PDF file. Name PDF file with submittal number.

H. Submittals for Web-Based Project Software: Prepare submittals as PDF files or in other format indicated by Project Software website.

I. Shop drawings of related equipment, devices, and material shall be submitted at same time so Architect/Engineer can coordinate the related components.

J. Incomplete submittals and submittals not in accordance with above paragraphs will be returned without action, and resubmittal will be required.

   1. Burden of timely submittals and approval of same is the Contractors.
   2. All resulting risks and liabilities are the responsibility of the Contractor.

1.9 QUALITY ASSURANCE

A. Comply with NFPA 70. Comply with applicable local code requirements of the Authority Having Jurisdiction.

B. Electrical Components, Devices and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to AHJ and marked for intended use.

C. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.

   1. Company specializing in installing products specified in this section with minimum 3 years documented experience, and with service facilities within 120 miles of project. The Electrical/Communications Contractor must be approved and certified for the installation of the selected cabling and fiber solutions. A copy of certification documents for each must be submitted with the quote in order for such quote to be valid.
   2. Layout Responsibility: Preparation of Shop Drawings shall be under the direct supervision of an RCDD.
   3. Installation Supervision: Installation shall be under the direct supervision of Registered Technician who shall be present at all times when Work of this Section is performed at Project site.
4. Field Inspector: Currently registered by BICSI as RCDD to perform the on-site inspection.
5. Experience in performing work of this section that is qualified by the manufacturer as having been provided the necessary training to install products in accordance with specified requirements.

1.10 MATERIALS AND WORKMANSHIP

A. Material and equipment required under this contract shall be new unless otherwise specified. Workmanship shall be first class and be performed by persons qualified in respective trades.

B. Material shall meet requirements of governing codes and regulations.

C. UL Listing: Communication material, equipment and systems, where applicable, shall be UL listed.

1.11 CONTRACTOR'S SUPERVISION AND SUBCONTRACT WORK

A. Work shall be under constant supervision of qualified superintendent or foreman as specified above.

B. Submit name of major subcontractors to Architect/Engineer for approval prior to award of subcontract work. Architect/Engineer reserves the right to approve or disapprove subcontractors.

C. Job superintendents or foremen shall not be changed without prior notice to and approval of Architect/Engineer in order to maintain proper coordination and continuity of branches of work.

1.12 COORDINATION

A. Coordinate work with other Contractors and/or building elements to eliminate interferences. Interferences due to lack of coordination shall be corrected to provide proper clearance and access without additional compensation. Communication equipment shall not be hung from piping or ductwork or from hangers supporting piping or ductwork. Install cable tray, conduit and boxes giving right-of-way where space is available to systems such as plumbing, drain and fire protection lines required to be installed at a specified slope.

B. Adequate clearance shall be maintained to allow for access, repairs and removal of equipment and devices. Protect installation of equipment or devices from being obstructed by other Contractors.

C. Permanent openings or knockout panels shall be provided to permit future service or replacement of system components, but not necessarily for entry or exit of entire assembled units.

D. Contractor shall provide arrangements for hoisting equipment and assume related cost.
E. Building structure is designed for supporting equipment at its permanent location. Provide necessary shoring or other protection necessary for moving heavy equipment to permanent location.

F. Contractor shall coordinate his equipment delivery with construction progress in order that installation may be made in an orderly and safe manner.

1.13 SITE OBSERVATION

A. Visiting existing and new site conditions and review base building construction procedures and documents prior to preparation of bid and determine conditions that affect execution of work. This includes but is not limited to exact locations of existing equipment, type of supports, conduit lengths, ceiling access and sleeves through existing smoke and fire partitions.

B. Failure to be acquainted with job site construction conditions under which work is to be performed will not be justification for additional compensation.

1.14 PERMITS AND INSPECTIONS

A. Obtain required permits governing the contract work from Authorities Having Jurisdiction and assume cost of permits and inspections.

B. Furnish to Owner certificates of observation or approval from Authorities Having Jurisdiction, if certificates of observation or approval are required by law or regulations, upon completion of work.

C. Contractor shall assume the cost of labor and materials to conduct all required acceptance tests required by Local Code Enforcing Authority.

1.15 TRADE AND LOCAL PRACTICES

A. Comply with local customs and labor trade agreements regarding trade or trades that shall be employed for installation of work.

1.16 MOUNTING AND LOCATIONS

A. Location of Equipment and Devices:

1. Location of communication equipment and devices shown are approximate. Determine exact location by checking Architectural drawings, field conditions and approved shop drawings.

2. Telephone outlets, data network outlets or other system outlets within room shall be located at same height and of same vertical configuration unless noted otherwise.

3. Wire, signal and control devices, where provided, shall be flush mounted in finished areas.
B. Mounting Heights: Mounting heights shall be to center of device’s outlet box unless otherwise indicated by existing conditions or details. Mounting height of devices and equipment shall comply with the following, unless noted otherwise on drawings:

1. Communication Devices:
   a. Telephone Outlets (desk Phones) ......................... 1' - 6" (457.2 mm) above floor
   b. Telephone Outlets (wall Phones) ......................... 4' - 0" (1.22 M) above floor
   c. Network Data Outlet .................................... 1' - 6" (457.2 mm) above floor
   d. Cable Television Outlets (floor units) .............. 1' - 6" (457.2 mm) above floor
   e. Cable Television Outlets (wall units) .............. 1' - 6" (457.2 mm) below ceiling
   f. Paging/Intercom Pushbutton Stations ............... 4' - 0" (1.22 M) above floor
   g. Paging/Intercom Amplifiers (shelf mounted) .... 5' - 0" (1.5 M) above floor
   h. Speakers (wall mounted) .................................. 1' - 0" (304.8 mm) below ceiling
   i. Volume Control .............................................. 4' - 0" (1.22 M) below ceiling
   j. Security Intercom Pushbutton Station ............. 4' - 0" (1.22 M) above floor
   k. Clock (wall mounted) ..................................... 8' - 0" (2.44 M) above floor

1.17 CUTTING AND PATCHING

A. General: Structural members, load bearing walls or footings shall not be cut without first obtaining written permission from Architect/Engineer. Openings shall be core drilled or cut as applicable.

B. Cutting:
   1. Openings for conduit and cable trays in masonry materials shall be core drilled. Other openings shall be cut as necessary.
   2. Make thorough investigation and field measurement by use of magnetic detection instruments or other approved means to detect concealed ferrous metal piping or conduit prior to cutting. Active piping, conduit or wire damaged due to this work shall be restored immediately. Restoration costs shall be at the expense of the Contractor.
   3. Cutting shall be limited to size necessary for working conditions.

C. Patching and Finishing:
   1. Patching:
      a. Concrete or Concrete Block Surfaces: Patch opening with grout finished smooth with adjacent surface prior to applying final finish.
      b. Gypsum Board or Plastered Surfaces: Patch opening with filler compound finished smooth with adjacent surface prior to applying final finish.
      c. Special Finished Surfaces: Patch openings with appropriate material where surfaces are to have finishes such as glazed tile, paneling, stone or marble finish.
      d. Painted Surfaces: Patch opening smooth with adjacent surfaces.
2. Finishing:
   a. Where surfaces have received their final finish prior to being cut or where the surface of an existing finish is cut, Contractor shall refinish surfaces to match the adjacent surfaces.
   b. Contractor requiring the cutting shall be responsible for the quality of the finish work and make corrections to the refinished surfaces to maintain the quality of the finish to match the existing finish.
   c. Maintain the watertight integrity of all penetrations of roofs or exterior walls and floors on or below grade.

PART 2 - PRODUCTS

2.1 NOT APPLICABLE

PART 3 - EXECUTION

3.1 RECORD DRAWINGS

A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.

1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally.

   a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
   b. Accurately record information in an acceptable drawing technique.
   c. Record data as soon as possible after obtaining it.
   d. Record and check the markup before enclosing concealed installations.
   e. Cross-reference record prints to corresponding

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

   a. Dimensional changes.
   b. Revisions to details shown on drawings.
   c. Depths of foundations.
   d. Location and depths of underground utilities.
   e. Revisions to routing of pathways.
   f. Equipment locations
   g. Locations of concealed internal utilities.
   h. Changes made by change order or change directive.
   i. Changes made by Architect/Engineer written directive.
   j. Details not on the original Contract Drawings.
   k. Field records for variable and concealed conditions.
   l. Record information on the Work that is shown only schematically.
3. Mark the drawings completely and accurately. Use personnel proficient at recording graphic information in product of marked up record prints.
4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of work at the same location.
5. Note construction change directive numbers, alternate numbers, change order number and similar identification where applicable.
6. Adhere to Architectural/Engineering specified Record drawing requirements.

3.2 FINAL OBSERVATION
A. Contractor shall review requirements of the Contract Documents, observe work and inform parties involved of work to be corrected or completed before project can be deemed substantially complete.
B. Notify Architect/Engineer in writing when project is substantially complete listing those items of work remaining incomplete and anticipate date of completion. Final observation of project will be scheduled by Architect/Engineer.
C. Architect/Engineer reserves the right to cancel and re-schedule observation in event considerable work remains to be completed or corrected than indicated in written request for observation.
D. Items not completed or found not complying with drawings or specifications by Architect/Engineer will be identified in observation report by Architect/Engineer.
E. Copy of final observation report will be given to Contractor. Deficient items on observation report shall be corrected. Contractor shall initial and date items on report after corrections have been completed.

3.3 GUARANTEE
A. General Guarantee:
   1. Guarantee work against defects in labor and material for a period of one year from date of Owner acceptance and takeover of equipment for use and maintenance.
   2. Starting date of guarantee for defective or incomplete system or equipment shall become effective only after correction of defects and completion of systems or equipment.
   3. Guarantee period for systems or equipment will begin from date of correction and completion. Submit written certificate in triplicate listing such systems and equipment to Architect/Engineer for signature of Owner for record purposes.
   4. Guarantee is not intended to cover damage resulting from Owner’s misuse or to cover normal maintenance.
B. Specific Warranty: See specific system/equipment specification for warranties extended beyond one year. Provide manufacturer's warranty of subject system and/or equipment to Owner prior to receiving final payment where warranties are specified. Warranties shall cover labor, material and travel expenses to repair and place equipment back in operation.
3.4 MAINTENANCE MANUALS

A. General: Contractor shall provide three (3) hard copy volumes of Maintenance Manuals and a CD of all material submitted at completion of project. Manuals shall be provided two weeks prior to Contractor's request for final observation. Manuals that include information on multiple systems are acceptable only when items not applicable to the system installed are crossed out.

2. Equipment List: Provide list of major equipment as installed. Communication equipment, security equipment, UPS, and termination kits shall include manufacturer, model number, and nameplate data.
3. Service Instructions: Provide following information:
   a. Recommended spare parts including catalog number and name, address and telephone number of local suppliers or factory representatives.
   b. Preventative maintenance and operation instructions for systems and/or equipment requiring routine attention.
4. Include in manuals, parts catalogs for items of equipment furnished with components identified by number for replacement ordering.
5. Include in manuals, manufacturers’ representatives name and contact number, manufacturers name and factory contact numbers, and any other pertinent names, numbers, and/or contacts that may be required from time-to-time.

B. Submission:

1. Manuals shall be in triplicate, and materials shall be neatly bound into volumes of standard 8-1/2 inch by 11 inch (215.9 mm x 279.4 mm) hard binders. Large drawings too bulky to be folded into 8-1/2 inch by 11 inch (215.9 mm x 279.4 mm) size shall be separately bound or folded into brown envelopes, cross-referenced and indexed with manuals. A CD shall be included with all material submitted.
2. Manuals shall include name of Architect/Engineer and all Contractors.

3.5 CLEANING

A. During construction keep the job site clean and remove all rubbish.

B. Upon completion of work leave the premises and work in a clean and acceptable condition. Remove all tools, scaffolding, materials and rubbish from the building and site, clean all panels and equipment.

END OF SECTION 270100
SECTION 270528 – PATHWAYS FOR COMMUNICATION 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. This section includes the minimum requirements to complete the installation required for the items specified under this Section, including but not limited to:

1. Metal conduits and fittings.
2. Outlet Box.
4. Fire Rated Devices

B. Comply fully with the manufacturer’s instructions and with all applicable codes.

C. Provide all raceway, conduit, sleeves, cable tray, supporting hardware, etc. required for a complete pathway installation. Coordinate the pathways with the Building Contractor and all other trades.

D. Where Standards conflict with manufacturer’s recommendations, the more restrictive shall be applied. Perform work in accordance with the latest revision and addenda of applicable standards.

8. Underwriters Laboratories Inc. (UL) - Fire Resistance Directory

E. The Contractor shall provide all cable tray and accessories required for a complete installation. cable tray shall be down main cable run pathways. Coordinate these pathways with the Building Contractor and coordinate all other raceway, sleeves, supporting devices and other equipment for internal pathways as specified or required.

PATHWAYS FOR COMMUNICATION SYSTEMS 270528 - 1
1.3 SUBMITTALS

A. Product Data: Provide catalog cut sheets, construction details, material descriptions, dimensions of individual components, and rated capacities for the following:

2. Fire Rated Devices

B. Shop Drawings:

1. Submit schedule of opening locations and sizes, penetrating items, and required listed design numbers to seal openings to maintain fire resistance ratings.
2. Show fabrication and installation details of cable trays, including plans, elevations, and sections of components and attachments to other construction elements. Designate components and accessories, including clamps, brackets, hanger rods, splice-plate connectors, expansion-joint assemblies, straight lengths, and fittings.

C. Certificates: Product certificates signed by firestop system manufacturer certifying material compliance with applicable code and specified performance characteristics.

D. Coordination Drawings: Floor plans and sections, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Include scaled cable tray layout and relationships between components and adjacent structural, electrical, and mechanical elements.
2. Vertical and horizontal offsets and transitions.
3. Clearances for access above and to side of cable trays.
4. Vertical elevation of cable trays above the floor or below bottom of ceiling structure.

E. Field quality control reports.

1.4 QUALITY ASSURANCE

A. Strictly adhere to industry standard installation practices when installing raceways and pathways.

B. Raceway Systems installation and components shall comply with UL Standard 5A and separate UL listing for non-metallic surface raceway: UL-E143298, E143309, and CSA Certified LR87514.

C. Products/Systems: Provide firestopping systems that comply with the following requirements:

1. Firestopping tests are performed by a qualified, testing and inspection agency. A qualified testing and inspection agency is UL, or another agency performing testing and follow-up inspection services for firestop system acceptable to Authorities Having Jurisdiction.
2. Firestopping products bear the classification marking of qualified testing and inspection agency.

1.5 PROJECT CONDITIONS

A. Do not install until enclosed and weathertight, wet work in spaces is complete and dry, and work above ceilings is complete.

B. Do not install firestopping products when ambient or substrate temperatures are outside limitations recommended by manufacturer.

C. Do not install firestopping products when substrates are wet due to rain, frost, condensation, or other causes.

D. Maintain minimum temperature before, during, and for a minimum 3 days after installation of materials.

E. Do not use materials that contain flammable solvents.

F. Coordinate construction of openings and penetrating items to ensure that through-penetration firestop systems are installed according to specified requirements.

G. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration firestop systems.

H. Schedule installation of firestopping after completion of penetrating item installation but prior to covering or concealing of openings.

1.6 COORDINATION

A. Coordinate layout and installation of communications raceways with Owner's communications and LAN equipment and service suppliers.

1. Meet jointly with communications and LAN equipment suppliers, local exchange carrier representatives, and Owner to exchange information and agree on details of equipment arrangements and installation interfaces.

2. Record agreements reached in meetings and distribute them to other participants.

3. Adjust arrangements and locations of raceways with distribution frames, cross-connects, and patch panels of cabling systems of other communications, electronic safety and security, and related systems.

4. Coordinate location of communications equipment, requiring electrical power, with power raceways and receptacles.
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.

2.2 METAL CONDUIT AND FITTINGS

A. Description: Metal raceway of circular cross section with manufacturer-fabricated fittings.

B. General Requirements for Metal Conduits and Fittings:

1. Listed and labeled as defined in NFPA 70, by a nationally recognized testing laboratory, and marked for intended location and application.

2. Comply with TIA-569-D.

C. GRC: Comply with ANSI C80.1 and UL 6.

D. IMC: Comply with ANSI C80.6 and UL 1242.

E. EMT: Comply with ANSI C80.3 and UL 797.

F. Conduit Requirements:

1. Only electrical metal tubing (EMT) shall be used for all conduits.

2. Fittings shall be formed steel compression ring type. Die-cast fittings shall not be allowed.

3. All conduits shall have a plastic or nylon bushing installed.

4. Flexible or BX type conduits shall not be acceptable unless it is approved prior to installation by the Engineer and is the only practical solution. When used in such an application, the conduit size shall be increased by a minimum of one trade size and be approved by Engineer prior to installation.

2.3 BACKBOXES AND OUTLET BOXES

A. Only metallic, double gang size outlet boxes shall be used for all outlet box installations unless noted otherwise in Construction Documents.

B. New construction communication outlet boxes shall have following:

1. The outlet box will be a minimum 4-11/16 inch x 4-11/16 inch box, 2-7/8 inch deep with 3/4 inch through 2 inch knockouts.

2. A two-gang opening plaster ring shall be required for a total assembled depth of 3-3/4 inch minimum.
3. Communication outlet boxes will have an attached extension ring recessed 1/8 inch from the finished drywall surface.
4. Provide knockout closures for unused openings

C. Floor mounted junction boxes shall have the following characteristics:
   1. The communication floor outlet box shall be sized similarly to new construction communication outlet boxes or have similar capacity unless noted otherwise on drawings.
   2. The communicating floor outlet box not share space with any other service including electrical.
   3. The pathway to the floor outlet box shall not share space with any other service unless specifically approved by the Owner’s designated Network Engineer.

D. Existing outlet boxes shall have a quad/double gang size outlet box and mud ring and meet the minimum outlet box depth requirement.

2.4 J-HOOKS

A. Description: Prefabricated cable supports for telecommunications cable.

B. Basis of Design Product: Provide product indicated on Drawings for comparable product by one of the following:
   1. Legrand J-Hooks
   2. MonoSystems The Hook
   3. Panduit, J-Mod Cable Support System
   4. Pentair CADDY CAT HP J-hook System

C. Open top J-hook cable support shall be used in suspended ceiling and raised floor areas where duct, cable tray or conduit is not available.
   1. Shall support horizontal cabling in bundles of fifty (50) cables or less.
   2. Support system shall have the ability to retain the cable bundle utilizing Velcro straps or the manufacturer’s retaining device.
   3. System pathway shall be suitable for use in the air handling space in which it is installed. Provide an accordance to UL 2043 where applicable.

D. Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.

E. Comply with TIA-569-D.

F. Galvanized steel.

G. J-hooks shall be sized to accommodate cables in which it is supporting and an addition 25% spare capacity for future growth.
H. Multi-Tiered Non-Continuous Cable Support Assemblies:

1. Multi-tiered non-continuous cable support assemblies shall be used where separate cabling compartments are required. Assemblies may be factory assembled or assembled from pre-packaged kits. Assemblies shall consist of a steel angled hanger bracket holding up to six (6) non-continuous cable supports, rated for indoor use in non-corrosive environments.

2. Assemble using manufacturer recommended specialty fasteners including beam clips, flange clips, C and Z purlin clips, as required

2.5 GENERAL REQUIREMENTS FOR CABLE TRAYS

A. Cable Trays and Accessories: Identified as defined in NFPA 70 and marked for intended location, application, and grounding.

1. Source Limitations: Obtain cable trays and components from single manufacturer.

B. Sizes and Configurations: See the Cable Tray Schedule on Drawings for specific requirements for types, materials, sizes, and configurations.

C. Structural Performance: See articles for individual cable tray types for specific values for the following parameters:

1. Uniform Load Distribution: Capable of supporting a uniformly distributed load on the indicated support span when supported as a simple span and tested according to NEMA VE 1.

2. Concentrated Load: A load applied at midpoint of span and centerline of tray.

3. Load and Safety Factors: Applicable to both side rails and rung capacities.

2.6 SLEEVES

A. Conduit Sleeves/Slots:

1. Provide size and quantity as indicated on drawings and sketches.

2. EMT

3. PVC - Schedule 40

B. Sleeves: Provide sleeves where required for cable pass-thru. Provide core drilling where required for sleeve installation.

1. Where not noted, sleeve sizing shall be determined by the type and quantity of cable to be routed through the sleeve in accordance with TIA/EIA-569-A cable capacity standards, plus an additional 100 percent for future expansion.

2. The minimum installed sleeve size for any penetration shall be 2 inch (50.8 mm).
3. Where sleeves penetrate a fire wall, all sleeves shall have or be UL listed to meet wall or floor rating. For higher capacity, provide STI EZ-Path communication sleeves (fire/smoke rated) for these locations in quantities and configurations as indicated on plans and/or specified herein.
4. Sleeves shall be EMT conduit and shall be provided with insulated throat bushings for each end. Sleeve sizing shall be as noted on the Drawings.

2.7 CABLE MANAGEMENT WRAPS

A. Description: Management wraps used to bundle and manage multiple cables occupying a common space, plenum rated.

B. Basis of Design: Subject to compliance with requirements, provide products by one of the following or an approved equal:

1. 3M Company
2. Avery Dennison
3. Panduit Corporation
4. Richco, Inc.
5. Velcro Industries B.V.

C. General:

1. Provide sufficient quantities to wrap all cables at the MC and IC.
2. Plenum rated, UL Listed 94-V2, comply with FAR 2.5 853 A/B, NEC 300.22.
3. UVB Stabilized for outdoor applications.
4. Low temperature conditions down to -40 deg. F. (-40 deg. C.).
5. Heat Stabilized for extreme temperature conditions up to 221 deg. F. (105 deg. C.).

D. Nylon Tie Straps:

1. The use of nylon tie straps is strictly prohibited on this project without the written pre-authorization for specific purposes.
2. Use re-usable nylon straps for securing and managing backbone, riser and horizontal cabling. Straps shall be loose fitting and shall not cinch cables too tight.

2.8 MEASURING TAPE AND PULL LINES

A. Manufacturers: Provide pull tape from one of the following or an approved equal.

1. ARNCO, Pull-Tape
2. NEPTCO Inc., MULETAPE
3. Southwire, Pull tape.

2.9 CABLE PULLING LUBRICATION AND LUBRICANT

A. The cable jacket and/or conduit innerduct walls shall be completely lubricated when cable is pulled into conduit. The lubricant shall be applied immediately before or during the pull.
B. Minimum quantities of lubricant are as follows:

1. Quart of Lubricant Per 30,480 mm of 25 mm Conduit
2. Quarts of Lubricant Per 30,480 mm of 50 mm Conduit
3. Quarts of Lubricant Per 30,480 mm of 75 mm Conduit
4. Gallon of Lubricant Per 30,480 mm of 100 mm Conduit
5. This quantity shall be increased as needed for difficult pulling situations (high temperatures, multiple bends, poor conduit condition, etc.).

C. The cable lubricant shall meet the following performance specifications:

1. When subjected to a 444 N/300 mm normal force, between cable and conduit, the lubricated cable system shall have a coefficient of kinetic friction less than 0.25 (pulling force greater than 111 N/300 mm).
2. The lubricant shall be UL or CSA listed.
3. 150 mm of a 25 mm diameter cable will hold at least 75 grams of the lubricant for 1 minute when held vertically at 68 deg. F. (20 deg. C.).
4. The lubricant shall wet out evenly on all surfaces. It will not bead up or rub off of the cable jacket.
5. The lubricant shall produce no deleterious effects on physical or electrical properties of cable jackets.
6. The lubricant shall produce no stress cracking on LDPE cable jackets when tested in accordance with IEEE Standard 1210, Standard Tests for Determining Compatibility of Cable-Pulling Lubricants with Wire and Cable.
7. Cable jacket materials LLDPE, XLPE, CPE, and PVC heat aged in lubricant shall pass tensile and elongation compatibility requirements from IEEE Standard 1210, Standard Tests for Determining Compatibility of Cable-Pulling Lubricants with Wire and Cable.
8. When used on high voltage cable, the lubricant shall not affect the volume resistivity of any semi-conducting jacket or insulation shield present. The volume resistivity of the semi-conducting material shall at no time increase more than 100 percent when tested via the ICEA T-25-425 method, 194 deg. F. (90 deg. C.) exposure, 7 day test, reading made at 73.4 deg. F. (23 deg. C.) daily.
9. The lubricant shall experience no more than a 10 percent change in Brookfield viscosity from 41 deg. F. to 104 deg. F. (5 deg. C. to 40 deg. C.).
10. The lubricant shall contain no waxes, greases, silicones, or polyalkylene glycol oils or waxes.
11. The lubricant shall have less than a 6.0 percent solids residue after drying for 24 hours at 221 deg. F. (105 deg. C.).
12. The lubricant shall not separate into phases after exposure to 194 deg. F. (90 deg. C.) for 24 hours.
13. The lubricant shall not phase-out after five (5) freeze/thaw cycles or 5 day exposure at 140 deg. F. (60 deg. C.).
14. A coating of 3 mils of the lubricant fully dried for 24 hours at 73.4 deg. F. (23 deg. C.) shall show a coefficient of friction, greater than 0.25 when tested as described in above.
15. A 200 gram sample of the lubricant, when fully dried for 24 hours at 221 deg. F. (105 deg. C.), shall not melt, liquefy, or flow at temperatures below 392 deg. F. (200 deg. C.).
16. A 200 gram sample of the lubricant, when placed in a 1 ft. (304.8 mm), split metal conduit and fully dried for 24 hours at 221 deg. F. (105 deg. C.), shall not ignite with a pilot flame and continuously burn for more than one minute at a continued heat flux of (40 kW/m²). Total time of test shall be one-half hour.

17. A 200 gram sample of the lubricant, when placed in a 1 ft. (304.8 mm), split metal conduit and fully dried for 24 hours at 221 deg. F. (105 deg. C.), shall not spread a flame more than 3 inch (76.2 mm) beyond a point of ignition at a continued heat flux of (40 kW/m²). Total time of test shall be one-half hour.

D. Flexible Fabric Raceway (Innerduct): flexible, multi-celled, fabric raceway for use in interior (plenum and riser) and exterior applications.
   1. Refer to drawings for sizes and additional requirements.

2.10 FIRE RATED DEVICES

A. Description: Firestopping products tested for specific fire resistance rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements, and fire rating involved for each separate instance.

B. Sealants: STI SpecSeal® Brand single component latex formulations that upon cure do not re-emulsify during exposure to moisture.

C. Putty: STI SpecSeal® Brand intumescent, non-hardening, water resistant putties containing no solvents, inorganic fibers or silicone compounds.

D. Pillows: STI SpecSeal® Brand re-enterable, non-curing, mineral fiber core encapsulated on six sides with intumescent coating contained in a flame retardant poly bag.

E. Fire Rated Cable Pathways: Cable pass through for fire rated floor or wall containing an intumescent insert material adjusting automatically to cable additions or subtractions. Device shall be capable of allowing a 0 to 100 percent fill capacity.

PART 3 - EXECUTION

3.1 GENERAL

A. Routing: The Contractor shall determine the exact routing of pathways and cables in the field.
   1. Routing shall be laid out in advance of actual installation.
   2. Routing shall not interfere with nor affect structural sections.
   3. Routing shall be coordinated with architecture, structure and other trades.
B. Penetrations: Where conduits, wire-ways, and other raceways pass through fire partitions, fire walls or walls and floors, install a firestop that provides an effective barrier against the spread of fire, smoke and gases. Where called for on Drawing or where large bundles of cables pass through fire partitions, utilize EZ-Path fire rated pathway sleeves.

1. Firestop material shall be packed tight and completely fill clearances between raceways and openings.
2. Firestop material shall be in accordance with reference codes standards, regulations, and contract documents.

C. Floor, exterior wall, and roof seals shall be watertight.

D. Horizontal pathways shall follow building lines as much as possible. Pathways shall be parallel and perpendicular to building lines.

3.2 CONDUIT SIZING, ARRANGEMENT AND SUPPORT REQUIREMENTS

A. Bends:

1. There shall be no more than two (2) 90 degree bend (or combination of bends totaling 180 degrees) between junction boxes.
2. Recommended 90 degree bend radius for a conduit 2 inch (50.8 mm) (or less is 6 times the internal diameter of the conduit.
3. Recommended 90 degree bend radius for conduit larger than 2 inch (50.8 mm) is 10 times the internal diameter of the conduit.
4. Contractor shall not use 90 degree condulets (LBs).
5. and/or pull boxes.

B. A typical conduit stub-up at a wall outlet shall be a minimum of 1 inch (25.4 mm) ID. Each 1 inch (25.4 mm) conduit shall service only one wall outlet location. The conduit shall be terminated in a 4 inch x 4 inch x 2-3/4 inch (101.6 mm x 101.6 mm x 69.85 mm) deep box with a pull string. The box shall be fitted with either a single or double gang extension ring.

1. Typical outlet heights to center:
   a. Desks 18 inch (457.2 mm) A.F.F.
   b. Wall Phones 48 inch (1.22 mm) A.F.F.
   c. Pay Phones 48 inch (1.22 mm) A.F.F.

2. A conduit run to the cable tray shall end approximately 4 inch to 6 inch (101.6 mm to 152.4 mm) from the top or bottom edge of the cable tray to maintain a proper bend radius.

C. Conduit and tubing shall extend 1 inch (25.4 mm) minimum above the finished floor.

D. Arrange conduit supports to prevent alignment distortion by wire pulling operations. Fasten conduit using galvanized straps, lay in adjustable hangers, clevis hangers, or bolted split stamped galvanized hangers.
E. Group conduit in parallel runs where practical and use conduit rack constructed of steel channel with conduit straps or clamps. Provide space for 30 percent additional conduits whenever possible.

F. Maintain minimum 6 inch (152.4 mm) clearance between conduit and piping. Maintain 12 inch (304.8 mm) clearance between conduit and heat sources such as flues, steam pipes, and heating appliances whenever possible.

G. Do not fasten conduit with wire or perforated pipe straps. Remove all wire used for temporary conduit support during construction, before conductors are pulled.

H. Support conduit in accordance with NEC and local requirements for the conduit size but in no case exceed 10 ft. (3.05 M) center-to-center spacing.

I. Conduit shall be supported at least every 10 ft. (3.05 M), and within 3 ft. (914.4 M) of an outlet or junction box. All junction boxes shall be independently supported.

J. Follow the NEC and local specifications for the spacing from electrical wiring.

3.3 CONDUIT INSTALLATION

A. Arrange conduit to maintain headroom and present a neat appearance.

B. Conduits shall be racked or follow other conduits to its destination.

C. Conduit and joints must be aligned and properly joined. Joints shall not be used in lieu of a bend.

D. Cut conduit square and true using a saw or pipe cutter and de-burr ends.

E. Bring conduit to the shoulder of fittings and couplings and fasten securely.

F. Use suitable conduit caps to protect installed conduit against entrance of dirt and moisture.

G. All conduit installations shall have a suitable plastic or nylon pull string installed.

H. Install expansion joints where conduit crosses building expansion joints.

I. All conduit penetrations in fire rated walls or floors shall be sealed and fire proofed to at least the rating of the penetration area.

J. All conduit runs shall be properly grounded.

K. All conduit runs shall be terminated with a plastic or phenolic bushing.

L. Conduit connectors shall be tightened with a wrench.

M. For all bends, only large radius sweeps shall be used.
N. Flexible Conduit:
   1. When the use of steel clad flex has been approved by the Engineer for a particular wall box installation, the flexible conduit may only be used for straight-in wall sections.
   2. The use of flexible conduit will only be allowed where the Engineer has determined that EMT conduit cannot be installed.
   3. The transition from flexible conduit to EMT conduit shall be through the use of a junction box directly over the wall box.
   4. The flexible conduit shall not have any slack between its termination points.
   5. Only steel straight connector style fittings may be used.
   6. If flexible conduit must be used, the conduit size shall be increased by one trade size.

O. Where existing conduit is to be reused, the subcontractor shall be responsible for meeting the NEC and local codes for proper support of the entire conduit run.

P. No conduit bends shall exist inside an interior or exterior wall.

Q. If any item has not been specified with this section, all standards bodies outlined in the communications division shall apply.

3.4 COORDINATION OF BOX LOCATIONS

A. Provide communication outlet boxes as shown on drawings and as required for wire pulling, equipment connections, and code compliance.

B. Communication Outlet box locations shown on drawings are approximate. Any deviation from the dimensioned locations shall be coordinated with Architect/Engineer prior to rough-in.

C. Locate and install pull boxes to allow access.
   1. Pull boxes shall be sized per TIA/EIA standards.
   2. Pull or junction boxes shall not be installed over walls or any other mechanical devices.
   3. Do not use a pull or junction box in lieu of a bend. Align conduits that enter the pull box from opposite ends.
   4. Place pull boxes in sections of conduit that are 100 ft. or more in length.

D. Locate and install to maintain headroom and to present a neat appearance.

E. Support boxes independently of conduit.

F. Boxes shall be installed solid, plumb, square, and use a four-point hang to other mechanical items.

G. If any item has not been specified with this section, all standards bodies outlined in the communications division shall apply.
3.5 OUTLET BOX INSTALLATION

A. Do not install boxes back to back in walls.

B. Communication outlet box height shall match electrical outlet standard heights but in no case shall the height be less than 15 inch A.F.F. and a minimum of 18 inch from corners or other building structures. A minimum of 12 inch clearance is required in all directions from the center point of the box to any other utility or obstruction. All ADA requirements for the installation of the outlet box shall be followed.

C. Locate boxes in masonry walls to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat openings for boxes.

D. Provide knockout closures for unused openings.

E. Install boxes in walls without damaging wall insulation.

F. Coordinate mounting heights and locations of outlets mounted above counters, benches, and backsplashes.

G. Provide recessed outlet boxes in finished areas; secure boxes to interior wall and partition studs, accurately positioning to allow for surface finish thickness. Use stamped steel stud bridges for flush outlets in hollow stud walls and adjustable steel channel fasteners for flush ceiling outlet boxes.

H. To install cut-in boxes, plaster shall be surface shaved so box does not protrude from the surface of the wall.

I. Boxes with mud rings installed shall not have the mud ring or finish plaster protrude from the finished wall plane. The mud ring shall not be more than 1/8 inch below the wall surface before the finish plaster is applied.

J. Assembled cut-in boxes shall have all four (4) screw holes aligned to standard dimensions.

3.6 CABLE TRAY INSTALLATION

A. Install cable trays according to NEMA VE 2.

B. Install cable trays as a complete system, including fasteners, hold-down clips, support systems, barrier strips, adjustable horizontal and vertical splice plates, elbows, reducers, tees, crosses, cable dropouts, adapters, covers, and bonding.

C. Install cable trays so that the tray is accessible for cable installation and all splices are accessible for inspection and adjustment.

D. Remove burrs and sharp edges from cable trays.

E. Join aluminum cable tray with splice plates; use four square neck-carriage bolts and locknuts.

F. Fasten cable tray supports to building structure.
G. Design fasteners and supports to carry cable tray, the cables, and a concentrated load of 200 pounds (90 kg).

H. Place supports so that spans do not exceed maximum spans on schedules and provide clearances shown on Drawings. Install intermediate supports when cable weight exceeds the load-carrying capacity of the tray rungs.

I. Construct supports from channel members, threaded rods, and other appurtenances furnished by cable tray manufacturer. Arrange supports in trapeze or wall-bracket form as required by application.

J. Support bus assembly to prevent twisting from eccentric loading.

K. Locate and install supports according to NEMA VE 2. Do not install more than one cable tray splice between supports.

L. Support wire-basket cable trays with center support hangers, trapeze hangers, and wall brackets.

M. Support center support hangers and trapeze hangers for wire-basket trays with 3/8 inch (10 mm) diameter rods.

N. Make connections to equipment with flanged fittings fastened to cable trays and to equipment. Support cable trays independent of fittings. Do not carry weight of cable trays on equipment enclosure.

O. Install expansion connectors where cable trays cross building expansion joints and in cable tray runs that exceed dimensions recommended in NEMA VE 2. Space connectors and set gaps according to applicable standard.

P. Make changes in direction and elevation using manufacturer's recommended fittings.

Q. Make cable tray connections using manufacturer's recommended fittings.

R. Seal penetrations through fire and smoke barriers.

S. Install capped metal sleeves for future cables through firestop-sealed cable tray penetrations of fire and smoke barriers.

T. Install cable trays with enough workspace to permit access for installing cables.

U. Install barriers to separate cables of different systems, such as power, communications, and data processing; or of different insulation levels, such as 600, 5000, and 15 000 V.

V. Install permanent covers, if used, after installing cable. Install cover clamps according to NEMA VE 2.

W. Clamp covers on cable trays installed outdoors with heavy-duty clamps.

X. Install warning signs in visible locations on or near cable trays after cable tray installation.
3.7 PROTECTION

A. Protect coatings, finishes, and cabinets from damage or deterioration.
   1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.

B. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

3.8 SLEEVES

A. All penetrations through floors or walls shall be through sleeves, slots, or conduit.

B. All penetration of fire or smoke barriers shall be firestopped with appropriate compound or assemblies to match the rating of the barrier penetrated. Both sides of the pathway shall be properly sealed.

C. Sleeves shall extend 1 inch (25.4 mm) minimum above the finished floor.

3.9 CABLE HANGERS AND SUPPORT

A. J-Hook Cable Support Devices:
   1. The Contractor shall adhere to the manufacturers’ requirements for bending radius and pulling tension of all data and voice cables.
   2. Adhere to the manufacturer’s recommendations for allowable fill capacity for each size non-continuous cable support.
   3. Cable bundles supported via J-hooks attached to the existing building structure and framework shall be spaced at a maximum of 5 ft. (1.5 M) intervals.
      a. If an approved mounting surface is not available within the 5 ft. (1.5 M) maximum distance, a closer spacing of J-hooks shall be installed.
      b. Extra J-hooks shall be installed to properly cross hallways and to make turns or a change in direction.
   4. J-hooks installed above ceiling shall adhere to the following requirements:
      a. J-hooks shall not be attached or secured to, or be supported by, any portion of the ceiling grid system, including the “T” bar ceiling tile support rails or the “T” bar support rail wires.
      b. The J-hook pathway shall not be attached or secured to, or be supported by, any other above ceiling system or installation.
      c. The J-hook pathway shall not interfere with ceiling tile installation or removal.
5. The combined load of the J-hook and the additional imposed load of the cables installed with the J-hook shall not exceed the load bearing capacity of J-hook fasteners as specified by the J-hook manufacturer.

6. The use of toggle bolts or similar fasteners to secure J-hooks to field areas of sheet-rock or other finish material is not allowed.

### 3.10 FIRE RATED DEVICES

#### A. General:

1. Before beginning installation, verify that substrate conditions previously installed under other sections are acceptable for installation of firestopping in accordance with manufacturer’s installation instructions and technical information.

2. Surfaces shall be free of dirt, grease, oil, scale, laitance, rust, release agents, water repellants, and any other substances that may inhibit optimum adhesion.

3. Provide masking and temporary covering to protect adjacent surfaces.

#### B. Installation:

1. Install through-penetration firestop systems in accordance with Performance Criteria and in accordance with the conditions of testing and classification as specified in the published design.

2. Comply with manufacturer’s instructions for installation of firestopping products.

END OF SECTION 270528
SECTION 270553 – IDENTIFICATION FOR COMMUNICATION 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. Color and legend requirements for labels and signs.
   2. Labels.
   3. Tapes.

B. Work covered by this Section shall consist of furnishing labor, equipment, supplies, and materials, unless otherwise specified, in performing the following operations recognized as necessary for the labeling of the communication infrastructure as described on the Drawings and/or required by these specifications.

C. This Section identifies the administration method and numbering scheme utilized with this cabling system.

D. Related Documents:

1.3 PERFORMANCE REQUIREMENTS

A. The Contractor shall label and document all specified components of this cabling system.

1.4 SUBMITTALS

A. Submit product data under provisions of Division 01 GENERAL REQUIREMENTS, of the Contract.
1.5 QUALITY ASSURANCE

A. All work shall be performed in accordance with current industry standards and with the equipment manufacturer recommendations. All work shall be in accordance with the general principles outlined in the BICSI TDMM, latest edition.

B. Assure that the “finished installed” system is correctly and completely documented including engineering drawings, manuals, and operation procedures in such a manner as to support maintenance and future expansion of the system.

C. Standard Products:
   1. Equipment and materials shall be standard products of a manufacture regularly engaged in the manufacture of specified products and shall be the manufacturer’s latest standard design.
   2. Items of the same classification shall be identical. The requirement includes equipment, modules, assemblies, parts, and components.

1.6 COORDINATION

A. Identification of all cables, equipment, pathways, etc. shall be coordinated with Owner and Engineer.

B. All labeling schemes shall be coordinated with and approved by Owner prior to installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Comply with NFPA 70 and TIA 606-B.

B. Comply with ANSI Z535.4 for safety signs and labels.

C. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

2.2 COLOR AND LEGEND REQUIREMENTS

A. Equipment Identification Labels:
   1. Black letters on a white field.
2.3 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or an approved equal:

1. Brady
2. Dymo
3. Kroy
4. Panduit

2.4 GENERAL REQUIREMENTS

A. All communication components, areas, and cables shall be labeled, including but not limited to the following:

1. Fiber cables
2. Metallic cables (copper, coax)
3. Ground points
4. Exterior enclosures
5. Pull boxes and junction boxes
6. Equipment racks, cabinets and enclosures
7. Cables in maintenance holes and pull boxes
8. Patch cables/jumpers


2.5 LABELS

A. General Requirements:

1. The size, color, and contrast of all labels shall be selected to ensure that the identifiers are easily read. Labels shall conform to ANSI/TIA/EIA-606-A, "Labeling and Color Coding."
2. All labels shall be machine generated and permanent. Other forms shall not be allowed.
3. Labeling products shall be suitable for use with and/or recommended by the equipment manufacturer for use on the equipment to which it is applied.

B. Vinyl Wraparound Labels: Preprinted, flexible labels laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing label ends.

C. Self-Adhesive Wraparound Labels: Preprinted, 3-mil- (0.08-mm-) thick, vinyl flexible labels with acrylic pressure-sensitive adhesive.

1. Self-Lamination: Clear; UV-, weather- and chemical-resistant; self-laminating protective shields over the legend. Labels sized such that the clear shield overlaps the entire printed legend.
2. Marker for Labels: Machine-printed, permanent, waterproof black ink recommended by printer manufacturer.
D. Nameplates: Unless otherwise specified, provide engraved, three-layer laminated plastic or die-cut, foam backed polyester printable adhesive labels, minimum 3/16 inch (4.7625 mm) high black letters on a white background. Provide labels at top and bottom, front and back on all cabinets and Racks.

E. Wiring Block Labels: Cardboard-like strips or adhesive labels that slip inside or onto clear plastic designation strips or label holders located on protector panels and wiring blocks.

F. Telecommunications Outlet (TO) Labels: Use a label-making machine to construct label tabs from plastic or paper strips or adhesive labels. Handwritten labels are unacceptable.

2.6 LABELING EQUIPMENT

A. The labeling equipment shall be designed to generate the appropriate labels as defined within this specification.

B. Labeling equipment shall be compliant with TIA/EIA-606-A.

PART 3 - EXECUTION

3.1 GENERAL

A. Install all labels firmly as recommended by the label manufacturer.

B. Labels attached to data or communication patch panels and faceplates shall be installed plumb and neatly on all equipment.

C. Install nameplates or equipment labels parallel to equipment lines.

D. Labeling on cables shall be clearly marked and be readily visible, and shall be accessible to be read at both ends of each installed cable.

E. The designated identification numbering system shall be used to identify devices, components, and cables. Any deviation shall be coordinated with the Owner prior to final designation.

F. Replace labeling with new labels at any occurrence where a label has become distorted, cut off, or lost during the termination process.

G. System: Cables at wall outlets and terminations at the communication room shall use the Labeling Scheme as shown on drawings or as directed by Owner.

1. Communication cables to the desktop shall be labeled on both ends with the assigned cable designation.
2. Coax cable to the desktop shall be labeled on both ends with the assigned cable designation.
3. Fiber-optic cable to the desktop shall identify the transmit fiber by the markings on the fiber sheath and receive fiber with no markings on the sheath.
4. The outlet number assignment shall begin with the number one (1) and continue.
5. Verify with the Owner the proposed numbers prior to proceeding with final cable and device numbering.

3.2 PREPARATION

A. Clean all surfaces before attaching labels with the label manufacturer's recommended cleaning agent.

B. The Contractor shall coordinate and verify telecom identification schemes with the Owner prior to preparation and execution of the work. Contractor shall ensure that identification scheme is in agreement with the labeling methods of the products furnished, i.e., cable, wiring blocks, fiber optic shelves, other equipment room components, TOs, etc. This plan shall address proposals for implementation of the requirements included in this specification section for label placement, materials to be used, the printing methods and format.

C. The identification scheme in the IDF and Work Area spaces shall comply with TIA/EIA-606-A.

3.3 CABLE ADMINISTRATION

A. Cable Identification Schedule: Post at a prominent location in each Equipment Room and in each Communication Room. List incoming and outgoing cables and their designations, origins and destinations. Protect with a rigid frame and clear plastic cover. Provide a diskette copy of final comprehensive schedules for the project in the software and format selected by Owner.

B. Cable Administration Drawings: Show building floor plans with cable administration point labeling. Identify labeling convention and show labels for communication room, horizontal cables, and work areas. Follow the guidelines of ANSI/TIA/EIA-606-A. Furnish electronic record of all drawings, in software and format selected by Owner.

3.4 LABEL IDENTIFICATION

A. Panel, Rack and Cabinet Marking:

1. Equipment racks and cabinets shall be have engraved or printed labels on the front AND back, top and bottom that are approximately 2 inch x 4 inch (50.8 mm x 101.6) and at both ends of each row that are approximately 4 inch x 4 inch (101.6 mm x 101.6 mm).

2. Patch Panels in IDFs: Label patch panels with the floor, panel number and port.

B. Horizontal UTP Cable:

1. All horizontal cabling shall be identified with printed labels.

   a. At the Work Area, labels shall be placed on the cable within 4 inch (101.6 mm) of the end. At the TR, labels shall be placed on the cable within 12 inch (304.8 mm) of the end.

   b. Cable tags shall be permanent. Cable tags, which appear less than permanent, shall not be accepted.
c. The cable label shall be a self-laminating label with a character height suitable for the diameter of the cable to maintain legibility of the identification.
d. At the Work Area, the identification shall be visible when the outlet cover plate is removed.

2. Numbering Scheme: The following method shall be used for the labeling system.
   a. Coordinate the numbering scheme with Owner/Engineer.
   b. Utilize Owner approved labeling scheme for all horizontal cables distributed directly from a patch panel or wiring block. Label horizontal cables twice using a laminated preprinted adhesive label attached to the sheath. Place one label inside the communication outlet and the other at the wiring block or patch panel end.

C. Intrabuilding Backbone and Riser Cable:
   1. All intrabuilding riser and backbone cables shall be labeled.
   2. All intrabuilding backbone and riser cables shall be identified at both end and at 25 ft. intervals in a horizontal backbone installation.
      a. Cables shall be labeled on each end within 12 inch (304.8 mm) of the end of the cable or within 12 inch (304.8 mm) of where it terminates on the cross-connect or patch panel.

   3. All riser and backbone cables shall be labeled with self-laminating marking tape. Tags shall be pre-printed. Cable tags shall be permanent. Cable tags, which appear less than permanent, shall not be accepted.

   4. Numbering Scheme: The following method shall be used for the labeling system.
      a. At each MDF/IDF or TR, the riser and backbone cable shall be labeled with from/to, cable type (F for fiber, C for coax, U for UTP), cable number, and count information.

D. Work Area Termination Hardware:
   1. At the Work Area, jacks shall be identified on the faceplate using a printed identification tag.
   2. Labeling Techniques: Label each faceplate with a permanent label.
      a. Labels shall be placed behind the clear plastic shield in the upper and/or lower position of the faceplate.
      b. The label shall be black letters on white background.
      c. Labels may be typewritten, laser printed, or produced by label making equipment. Handwritten labels shall not be allowed.
      d. Printed information exceeding the length of the label shall be reformatted with smaller text or a narrower width to accommodate the available space.
      e. The blank white label tags which are included in the faceplate hardware shall be installed with clear plastic shields for any un-used position on the faceplate. No information is to be written on these tags.
3. Numbering Scheme:

a. Outlets are numbered sequentially for each BDF/IDF. Each outlet (faceplate) has one unique number. This one number represents all cables and jacks terminated at that outlet. Cables and jacks within an outlet do not have unique numbers. The format is as follows: BDF/IDF ROOM # - SEQUENTIAL OUTLET #. For example, Outlet Number "2011A-4" represents the fourth outlet originating from IDF Room Number 2011A.

b. Final numbering scheme shall be coordinated with and approved by Owner’s approved IT personnel.

E. Outlet/Connector Labeling:

1. Each outlet/connector shall be identified with adhesive label compatible with device.
2. Label each connector at each discrete unit of cable-terminating and connecting hardware.

F. Innerduct Labeling:

1. All innerduct containing fiber-optic cable shall be labeled where exposed. This includes areas where the innerduct is:
   a. Installed alone in risers, tunnels or trays.
   b. Where innerducts transit manholes and/or pull boxes.
   c. In equipment rooms.

2. The innerduct shall be labeled with a durable Yellow Polyethylene tag which reads “CAUTION Fiber-Optic Cable” and includes blank spaces for adding fiber count and destination information.
3. The destination of the cable(s) contained in the innerduct and the fiber count shall be marked on the tag. Hand lettering is acceptable on this tag, using indelible type ink.
   a. The tag shall be secured to the innerduct(s) using self-locking ties.
4. Innerduct shall be labeled on each floor in a riser installation, in each manhole and/or handhole or at 25 ft. intervals in a tunnel or tray installation.

G. Patch/Fiber Panel Labeling:

1. Labels shall be used on the face of the patch panel(s) to identify the port assignment and patch panel id.
2. The wiring identification of the patch panel in the TR shall identify each port on the patch panel with the Work Area station cable number.
3. Labels shall be placed on the patch panels such that patch cables running into the wire management will not obstruct them. Labels shall be clearly visible and not hidden by cross connect wiring. Labels shall be placed above the jack on patch panels fed from the wire management below the row of jacks. Labels shall be placed below the jack on patch panels fed from the wire management above the row of jacks.
4. Each fiber-optic termination panel shall be clearly labeled indicating the destination of the cable(s) and the fiber number of each fiber position. The cable identifiers are to be secured to the side and to the front cover of the panel enclosure.
H. Raceway Labeling: Cable tray and conduits shall be labeled with the Owner's identification scheme. Coordinate with Owner on the identification that shall be printed and attached to all raceways.

1. All raceway labeling shall be permanent, self-adhesive, self-laminated, black on white, machine printed labels of sufficient size to accommodate the designated identification number.
2. Cable trays and conduits shall be labeled at the beginning and end of run, at 50 ft. (15.24 M) intervals and on both sides of firewall penetrations.
3. Intermediate points where two (2) or more raceways intersect or join shall have each raceway labeled near its endpoint.
4. Labels are to be attached to the raceway in an easy to read location where damage to the label is least likely to occur.

I. J-Hook Labeling: J-hooks shall be labeled with the Owner's identification scheme. Coordinate with Owner on the identification that shall be printed and attached to all J-hooks.

1. All J-hook labeling shall be permanent, self-adhesive, self-laminated, black on white, machine printed labels of sufficient size to accommodate the designated identification number.
2. J-hooks shall be labeled at the beginning and end of run, at 50 ft. (15.24 M) intervals, on both sides of firewall penetrations and where the raceway changes direction.
3. All J-hook raceways shall be labeled where two (2) or more join or intersect and where raceway types change.
4. All J-hook labels shall be attached to the lower portion of the device.
5. Multiple hook raceways attached to a common anchor point shall be considered on device for labeling purposes.
6. Additional J-hooks added to an existing labeled raceway shall become part of the existing raceway for identification purposes.

3.5 CLEANING

A. Remove all unnecessary tools and equipment, unused materials, packing materials, and debris from each area where work has been completed unless designated for storage.

3.6 ACCEPTANCE

A. Once all work has been completed and the Owner is satisfied that all work has been completed in accordance with the contract documents. The Owner will notify the Contractor in writing of formal acceptance of the system.

B. Acceptance shall be subject to completion of all work and submittal and approval of full documentation as described above.

END OF SECTION 270553
SECTION 271100 – EQUIPMENT ROOM FITTINGS

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes the minimum requirements for the equipment and cable installations in communication equipment rooms.

B. Included in this section are the minimum composition requirements and installation methods for the following:

1. Cable Management
2. Patch Panels
3. Firestop

1.2 DEFINITIONS

A. Access Provider: An operator that provides a circuit path or facility between the service provider and user. An access provider can also be a service provider.


C. RCDD: Registered communications distribution designer.

D. Service Provider: The operator of a telecommunications transmission service delivered through access provider facilities.

E. TGB: Telecommunications grounding bus bar.

F. TMGB: Telecommunications main grounding bus bar.

1.3 SUBMITTALS

A. Product Data: For the following:

1. Cable Management
2. Patch Panels

B. Shop Drawings: For communications equipment room fittings. 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. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for equipment racks and cabinets.
3. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
4. Equipment Racks and Cabinets: Include workspace requirements and access for cable connections.
5. Grounding: Indicate location of grounding bus bar and its mounting detail showing standoff insulators and wall mounting brackets.

C. Qualification Data: For Installer, qualified layout technician, installation supervisor, and field inspector.

D. Seismic Qualification Certificates: For floor-mounted cabinets, accessories, and components, from manufacturer.
   1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
   2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions. Base certification on the maximum number of components capable of being mounted in each rack type. Identify components on which certification is based.
   3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Communications Pathways and Spaces: Comply with ANSI/IA-569-D Telecommunications Pathways and Spaces.


D. Installer Qualifications: Cabling installer must have personnel certified for installation by manufacturer or and RCDD by BICSI on staff.
   1. Layout Responsibility: Preparation of Shop Drawings shall be under direct supervision of of certified personnel or by RCDD.
   2. Installation Supervision: Installation shall be under direct supervision of Technician, who shall be present at all times when Work of this Section is performed at Project site.
   3. Field Inspector: Currently certified by manufacturer or registered by BICSI as RCDD to perform the on-site inspection.
1.5 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install equipment frames and cable trays until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and work above ceilings is complete.

1.6 COORDINATION

A. Coordinate layout and installation of communications equipment with Owner's communications and LAN equipment and service suppliers. Coordinate service entrance arrangement with local service provider as required.

1. Meet jointly with communications and LAN equipment suppliers, local exchange carrier representatives, and Owner to exchange information and agree on details of equipment arrangements and installation interfaces.
2. Record agreements reached in meetings and distribute them to other participants.
3. Adjust arrangements and locations of distribution frames, cross-connects, and patch panels in equipment rooms to accommodate and optimize arrangement and space requirements of telephone switch and LAN equipment.
4. Adjust arrangements and locations of equipment with distribution frames, cross-connects, and patch panels of cabling systems of other communications, electronic safety and security, and related systems that share space in the equipment room.

B. Coordinate location of power raceways and receptacles with locations of communications equipment requiring electrical power to operate.

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 or an approved equal.

   a. Chatsworth Products
   b. Chief Manufacturing
   c. Cooper B-Line
   d. Hoffman
   e. Hubbell
   f. Lowell Manufacturing Company
   g. Middle Atlantic
   h. Panduit
   i. Siemon Company
2. Substitutions: Provide all relevant data with substitution request for the Engineer to determine if the proposed substitution product meets or exceeds the quality and features of the specified product. Substitution requests without complete data will be rejected.

2.2 CABLE MANAGEMENT

A. All cable managers, vertical or horizontal, shall be secured to the equipment rack frame and shall provide a clear and unobstructed pathway to route cables.

B. Horizontal Management:

1. The horizontal managers shall range from one to two rack units in size and shall extend from side rail to side rail. Horizontal 19 inch (483 mm) cable management shall include components that aid in routing, managing and organizing cable to and from equipment within a rack. Manager shall be a universal design mounting to EIA 19 inch (483 mm) racks and constructed of steel bases with PVC duct attached. The duct fingers shall include retaining tabs to retain the cables in place during cover removal. The covers shall be able to hinge from either side yet still be easily removed to allow for quick moves, adds, and changes.

   a. The cable managers shall be provided with movable wire retainers to retain the cables during cover removal and #12-24 English mounting screws. An integral strain relief bracket shall be provided on either end of the duct to allow for easy cover placement.

   b. A one rack unit space manager (1U) shall be installed above the first patch panel or fiber housing at top of rack. A two rack unit space manager (2U) shall be installed between each patch panel and below the last patch panel.

2.3 UTP PATCH PANELS

A. Contractor shall provide a warranted cable and connectivity solution.

B. Manufacturer: Basis of design. Provide manufacturer for warranted solution in conjunction with cable manufacturer. Refer to Specification section 27 15 13 Horizontal Copper Cabling.

C. Modular Patch Panel: A modular patch panel with modular connectors to facilitate adds, moves and changes. All pairs of the network horizontal copper cables shall be terminated. Comply with ANSI/TIA/EIA-568-B.

1. Panel shall be fully populated with Category 6 connectors to match the cable to which it is connected. The patch panel shall include labeling, cable management and accessories for a complete installation. Refer to Section 27 16 00 for connector specification.

2. The patch panel shall be in either a 24 or 48 port configuration.

3. Ports: The maximum number of patch panel ports per rack shall not exceed the manufacturer's recommendations.

4. Mounting: Rack mount on EIA Standard 19 inch (483 mm) equipment rack or frame.

5. Quantity: Provide patch panels and accessories in quantity to accommodate the number of data/voice outlets shown on the drawing including a 20 percent spare capacity.
2.4 D-RINGS

A. D-rings shall be used to properly support horizontal and vertical cabling when cabling is installed or routed on plywood backboard

2.5 COPPER PATCH CORDS

A. Provide one (1) pre-manufactured 1-meter (3 ft.) CAT-6 patch cord for one-half of the terminated copper patch panel ports, and one 2m (6 ft.) for the other half.

B. Provide one (1) pre-manufactured 2-meter (6 ft.) CAT-6 patch cord for one-half of the terminated work area outlets, and one 3m (9 ft.) for the other half.

C. Patch Cords, shall be pre-manufactured by the same manufacturer of the terminating equipment and meet all conventions and specifications conforming to the structured wiring arrangement described above, except constructed using stranded wire. Patch cords made in the field are not acceptable.

2.6 FIRESTOP

A. Firestop Putty: STI SpecSeal® Brand intumescent, non-hardening, water resistant putties containing no solvents, inorganic fibers or silicone compounds, the following products are acceptable:


B. Fire-rated Cable Pathway: STI EZ-PATH™ Brand device modules comprised of steel raceway with intumescent foam pads allowing 0 to 100 percent cable fill, the following products are acceptable:

1. Specified Technologies Inc. (STI) EZ-PATH™ Fire-rated Pathway.

PART 3 - EXECUTION

3.1 GENERAL

A. The Contractor shall install all components strictly to manufacturer’s recommendations.

B. All work shall comply with the requirements and standards listed in PART 1 in this Section. Where questions arise regarding which standards apply, the more stringent specification or policy shall prevail.

C. Materials (ceiling tiles, cables, network equipment, etc.) inadvertently demolished or damaged by the Contractor during the course of construction shall be replaced and/or repaired by the Contractor at no additional cost to the Owner.
3.2 INSTALLATION

A. Comply with NECA 1.


D. Bundle, lace, and train conductors and cables to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

E. Coordinate layout and installation of communications equipment in racks and in room.

F. Coordinate location of power raceways and receptacles with locations of communications equipment requiring electrical power to operate.

G. Comply with requirements for backboard installation in BICSI's "Information Technology Systems Installation Methods Manual" and TIA-569-D

3.3 EQUIPMENT RACK AND ENCLOSURE INSTALLATION

A. Self Supporting 19 Inch (483 mm) Equipment Rack or Enclosure:

1. In the equipment room or communication room, equipment racks or cabinet enclosures shall be installed such that rear access is available for installation and maintenance.

2. Racks and cabinets shall be bolted to the floor using anchors in concrete floors and toggle bolts through raised flooring. Racks shall be mounted on isolation pads and shall utilize non-conductive washers to secure the rack to the floor.

   a. Perform installation in accordance with manufacturer's instructions.

3. The tops of floor-mounted racks shall be securely braced from the wall from behind or from structural steel from above. To prevent movement, brace racks with either:

   a. Cable ladder track style runway to allow a cable placement path.
   b. Approved manufacturer's bracing and support accessories.

3.4 CABLE MANAGEMENT INSTALLATION

A. Cable Management:

1. Provide 8 inch (203.2 mm) D-rings 2 ft. (609.6 mm) on center for all exposed wall mounted vertical cable runs.

2. Cable brackets for Category 6 cabling shall be on 3 ft. (1 M) center supported from building structure for all cable runs not supported by cable tray.
3.5 BACKBOARD

A. General:

1. The identification stamp bearing the classification mark of Underwriters Laboratories, Inc shall remain visible after installation.
2. Install from 6 inches (150 mm) to 8 feet, 6 inches (2588 mm) above finished floor. If plywood is fire rated, ensure that fire-rating stamp is visible after installation. Trim at ceiling as required.
3. Support for riser cables shall be installed vertically resting directly on the finished floor. Anchoring and mounting techniques of plywood used to support backbone riser cables shall be sufficient to support a minimum of 1500 pounds (680.39 kg) of weight.
4. Backboard shall allow a minimum of 4 inch (101.6 mm) clearance on either side of equipment to be supported and a minimum of 24 inch (609.6 mm) wide at 12 inch (304.8 mm) increments.
5. Mounting screw heads shall be flush with the face of the backboard.

B. Treated Plywood:

1. Mount plywood with the A side out and the C side to the wall.
2. Plywood shall be treated on all sides with at least two (2) coats of paint, color white.

3.6 FIBER AND PATCH PANEL INSTALLATION

A. UTP Patch Panels

1. Mount UTP patch panels and connecting hardware on equipment racks.
2. Use patch panels to terminate network cables entering the room, unless noted otherwise. Individual patch panels shall be utilized to separate horizontal and backbone data infrastructure.
3. Panels shall be labeled as specified in Section 27 17 00.
4. Install per manufacturer’s recommendations.

B. Optical Fiber Panels

1. Mount panels and connecting hardware on equipment racks.
2. Use fiber optic panel to terminate fiber optic cabling entering the room, unless noted otherwise.
3. Panels shall be labeled as specified in Section 27 17 00.
4. Install per manufacturer’s recommendations.

3.7 LADDER RUNWAY.

A. Ladder Runway shall be securely bolted and installed in accordance to manufacturer’s recommendations. All runway and brackets shall be cleanly cut with the appropriate cutting tool and be clean and free from burrs and sharp edges.

B. The system shall include aluminum, ladder-type runway, with straight sections, vertical bends, horizontal bends, crosses, tees, drop-outs, connectors, fittings, hangers, supports, hardware and
all necessary accessories required to provide a complete system as outlined in the Contract Documents for support of the cable and wire indicated. All items shall be provided as part of this Contract.

C. Attach ladder runway directly on top of the vertical racks utilizing required hardware in compliance with manufacturer’s recommendations. Runways will also be securely fastened to walls.

D. Installation shall comply with all applicable Code requirements.

E. Exact placement of ladder runway shall be coordinated with all field conditions. Runway shall not obstruct access to any equipment or components, or infringe on any code-required clearances.

F. Runway shall not penetrate any fire-rated walls or floors.

3.8 FIRESTOPPING

A. Comply with TIA-569-D, Annex A, "Firestopping."


END OF SECTION 271100
SECTION 271513 – COMMUNICATIONS COPPER HORIZONTAL CABLING

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. Scope of Work:

1. Provide the installation and termination of a complete and working twisted pair horizontal cabling system deployed through pathways from the Telecommunication Room to the wall outlet or video surveillance camera.
2. Testing, labeling, and documentation shall be required for each cabled link.
3. It shall be the Contractor’s responsibility to follow recognized installation practices.
4. Compliance with codes and standards shall be required to achieve specified performance and network reliability.

B. Section Includes: This section includes, but is not limited to, the minimum requirements for product design, quality, and performance for the following:

1. Category 6 100 Ohm Balanced UTP Cable
2. Station Cords

C. General Requirements:

1. Provide all labor, materials, and equipment for the complete installation of work called for in the Contract Documents.
2. The Contractor shall verify with the manufacturer any part number listed within this Section and on the drawings prior to the purchase of those items to ensure the correct part is specified for the intended purpose.

1.3 DEFINITIONS

A. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.

B. EMI: Electromagnetic interference.

C. FTP: Shielded twisted pair.
D. F/FTP: Overall foil screened cable with foil screened twisted pair.
E. F/UTP: Overall foil screened cable with unscreened twisted pair.
F. IDC: Insulation displacement connector.
G. LAN: Local area network.
H. Jack: Also commonly called an "outlet," it is the fixed, female connector.
I. Plug: Also commonly called a "connector," it is the removable, male telecommunications connector.
J. RCDD: Registered Communications Distribution Designer.
K. Screen: A metallic layer, either a foil or braid, placed around a pair or group of conductors.
L. Shield: A metallic layer, either a foil or braid, placed around a pair or group of conductors.
M. S/FTP: Overall braid screened cable with foil screened twisted pair.
N. S/UTP: Overall braid screened cable with unscreened twisted pairs.
O. UTP: Unscreened (unshielded) twisted pair.

1.4 COPPER HORIZONTAL CABLING DESCRIPTION

A. Horizontal cable cabling system shall provide interconnections between Distributor A, Distributor B, or Distributor C, and the equipment outlet, otherwise known as "Cabling Subsystem 1," in the telecommunications cabling system structure. Cabling system consists of horizontal cables, intermediate and main cross-connects, mechanical terminations, and patch cords or jumpers used for horizontal-to-horizontal cross-connection.

1. TIA-568-C.1 requires that a minimum of two equipment outlets be installed for each work area.
2. Horizontal cabling shall contain no more than one transition point or consolidation point between the horizontal cross-connect and the telecommunications equipment outlet.
3. Bridged taps and splices shall not be installed in the horizontal cabling.

B. A work area is approximately 100 sq. ft. (9.3 sq. m) and includes the components that extend from the equipment outlets to the station equipment.

C. The maximum allowable horizontal cable length is 295 feet (90 m). This maximum allowable length does not include an allowance for the length of 16 feet (4.9 m) to the workstation equipment or in the horizontal cross-connect.

1. For video surveillance camera location that exceed distance limitations, provide a Ethernet/PoE extender.
1.5 PERFORMANCE REQUIREMENTS

A. General Performance: Horizontal cabling system shall comply with transmission standards in TIA/EIA-568-C.1, when tested according to test procedures of this standard.

1.6 SUBMITTALS

A. Product Data: Provide manufacturers catalog sheets and specifications for the following products:
   1. Copper Cable
   2. Patch and Station Cords

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Cabling Installer must have personnel certified by Manufacturer or by BICSI on staff.
   1. Layout Responsibility: Preparation of Shop Drawings, cabling administration Drawings, and field testing program development by Certified Installer or by an RCDD.
   2. Installation Supervision: Installation shall be under the direct supervision of Technician or Level 2 Installer, who shall be present at all times when Work of this Section is performed at Project site.

B. Testing Supervisor: Currently certified by Manufacturer or by BICSI as an RCDD to supervise on-site testing

C. All cable and connectors shall be installed in a neat and workmanlike manner.

D. All methods of construction that are not specifically described or indicated in the contract documents shall be subject to the control and approval of the Engineer.

E. Cables shall be installed according to recognized industry installation practices, and applicable codes and standards.

F. Source Limitations: Equipment and materials shall be of the quality and manufacture indicated. The equipment specified is based upon the acceptable manufacturers listed. Where "approved equal" is stated, equipment shall be equivalent in every way to that of the equipment specified and subject to approval.

G. 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.

H. Telecommunications Pathways and Spaces: Comply with TIA/EIA-569-B.

1.8 WARRANTY

A. Product is warranted free of defects in material or workmanship.

B. Product is warranted to perform the intended function within design limits.

C. Where applicable, installed horizontal cable may be granted a permanent link or channel link warranty, under the condition stated below.

1. Construction is performed by an installer that is certified by the cabling manufacturer.
2. Contractors performing the certified installation are properly registered with the cabling manufacturer.
3. The link or channel components are supplied by the cabling manufacturer or an approved cabling partner (including patch and station cords for channel).
4. Cable used in the installation is qualified and supplied by the cabling manufacturer.
5. Links or channels in the installation are properly documented and tested in accordance with these specifications.
6. Required test results and documentation is properly submitted by the registered Contractor.

1.9 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.10 COORDINATION

A. Coordinate layout and installation of cable support and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

B. Coordinate layout and installation of telecommunications pathways and cabling with Owner's telecommunications and LAN equipment and service suppliers.

C. Coordinate telecommunications outlet/connector locations with location of power receptacles at each work area.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Manufacturers: In other PART 2 articles, the following requirements apply to product selection:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or an approved equal:
   a. Belden Inc.
   b. Berk-Tek
   c. CommScope
   d. General Cable
   e. Mohawk
   f. Paige Electric
   g. Panduit
   h. Siemon Company

B. General:

1. Cables shall be Underwriters Laboratory (UL) listed, comply with Article 800 (Communications Circuits) of the NEC and shall meet the specifications of NEMA (low loss), UL 444, and ICEA.

2. All cables shall be suitable for installation in the environment in which it is installed.

3. Communications cables installed in cable trays or racks shall be APPROVED for use in such and shall be of fire-resistive construction.

C. A dedicated 4-pair cable shall be provided for each application or service planned, present and future. Each of the four (4) cable pairs of each horizontal cable must be terminated on an individual modular connector at the outlet and on either a patch panel or terminal block in the TR. Pairs within a cable shall not be split, and all pairs must be terminated. Splitting of pairs within a cable between different jacks shall not be permitted.

D. General Performance: Horizontal cabling system shall comply with transmission standards in TIA-568-C.1, when tested according to test procedures of this standard.

E. Telecommunications Pathways and Spaces: Comply with TIA-569-D.

F. Grounding: Comply with TIA-607-B.

2.2 HORIZONTAL TWISTED PAIR COPPER CABLES

A. General:

1. Cables shall be Underwriters Laboratory (UL) listed, comply with Article 800 (Communications Circuits) of the NEC and shall meet the specifications of NEMA (low loss), UL 444, and ICEA.

2. All cables shall be suitable for installation in the environment defined. The cable shall be UL Listed Type CM (non-plenum), UL Listed Type CMR (riser), or UL Listed Type CMP (plenum) as required for the area into which it is installed.

3. All cables shall be suitable for installation in the environment defined. This included indoor and outdoor rated cables and associated transitions between.

4. Communications cables installed in cable trays or racks shall be APPROVED for use in such and shall be of fire-resistive construction.

5. A dedicated 4-pair cable shall be provided for each application or service planned, present and future. Each of the four (4) cable pairs of each horizontal cable must be
terminated on an individual modular connector at the outlet and on either a patch panel or terminal block in the TR. Pairs within a cable shall not be split, and all pairs must be terminated. Splitting of pairs within a cable between different jacks shall not be permitted.

B. Category 6 UTP Cable: 350 MHz bandwidth cable for 1000BASE-T systems, or 10GBASE-T systems up to 55 meters.
   
   1. Description: Four-pair, balanced-twisted pair cable, certified to meet transmission characteristics of Category 6 cable at frequencies of a minimum of 350MHz. Provide mid-grade compliance.

   2. Category cabling terminating in an outdoor environment shall be CMX, outdoor rated. Upon entering building, cable shall transition from outdoor rated cable to indoor rated cable.

   3. Manufacturer shall be by one of the following or an approved equal:
      
      a. Belden Inc.
      b. Berk-Tek
      c. CommScope
      d. General Cable
      e. Mohawk
      f. Paige Electric
      g. Panduit
      h. Siemon Company

   4. Physical Characteristics:
      
      a. Cable construction shall be four twisted pairs of #23 AWG insulated solid copper conductors, surrounded by a tight outer jacket.
      b. The jacket shall be sequentially marked in 1 ft. to 3 ft. (0.3048 M to 0.9144 M) increments the entire length of the cable. Category marking shall be printed at regular intervals.
      c. The maximum cable pulling tensions shall not exceed 25 lbf (max).
      d. The color of the indoor cable shall be BLUE. Final color shall be coordinated with and approved by approved Owner’s IT personnel prior to commencing work.

2.3 COPPER STATION CORDS

   A. General: Station cords shall be used to attach work location equipment to a communication outlet. Station cords shall be Owner furnished, Owner installed.

PART 3 - EXECUTION

3.1 GENERAL
A. The Contractor shall install all components in accordance with manufacturer’s recommendations.

B. All work shall comply with the requirements in ANSI/TIA/EIA and ISO/IEC standards listed in PART 1 above. Where questions arise regarding which standards apply the more stringent specification or policy shall prevail.

C. Materials (ceiling tiles, cables, network equipment, etc.) inadvertently demolished or damaged by the Contractor during the course of construction shall be replaced and/or repaired by the Contractor at no additional cost to the Owner.

3.2 WIRING METHODS


   1. Install plenum cable in environmental air spaces, including plenum ceilings.
   2. Install outdoor rated cables in outdoor environments.
   3. Comply with requirements for raceways and boxes specified in Section 270528 "Pathways for Communications Systems.”

B. Wiring within Enclosures: Bundle, lace, and train cables within enclosures. Connect to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools. Install conductors parallel with or at right angles to sides and back of enclosure

3.3 INSTALLATION OF TWISTED-PAIR HORIZONTAL CABLES

A. All cable placement shall conform to industry standards with regard to anchoring, cable support and separation from other facilities.

B. Cables shall not sag or droop but should be installed so as to maintain a flat plane with smooth transitions from one level or direction to another.

C. Topology: The horizontal cabling shall be configured in a star topology; each WA outlet is connected to a horizontal cross-connect (HC) in a Communication Room.

D. The Contractor shall be responsible for verifying the actual footage's and distances identified on the drawings.

E. The Contractor shall be responsible for verifying that conduits and raceways are "ready for occupancy" before cable placement.

F. The Contractor shall assume the responsibility for any difficulties or damage to the cable during placement.

G. Wiring Method: Install wiring in raceway, in cable tray or on ladder rack except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces and in gypsum...
board partitions where unenclosed wiring method may be used. Conceal cable and raceway wiring except in unfinished spaces.

H. Install components as indicated and according to manufacturers’ written instructions. Use techniques, practices and methods that are consistent with the requirements of the Category rating of the components.

I. Install cable without damaging conductors, shield or jacket.

J. Do not bend cable in handling or installation to smaller radii than minimums recommended by manufacturers.

1. Pull cables without exceeding cable manufacturer's recommended pulling tensions.
2. Pull cables simultaneously where more than one is being installed in the same raceway.
3. Use pulling compound or lubricant where necessary. Use compounds that will not damage conductor or insulation.

K. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage media or raceway.

L. Install exposed cable parallel and perpendicular to surfaces or exposed structural members, and follow surface contours where possible.

M. Horizontal Cable Support: In suspended ceiling where cable trays or conduit are not available, the Contractor shall bundle, in bundles of fifty (50) or less, station cables with a Velcro strap solution.

1. Cable bundles shall be supported by J-Hook, Cable Hook or Cable Hanger system spaced a maximum of 5 ft. (1.524 M) apart. Plastic cable ties or bridle rings shall not be used.
2. Cables shall not be attached to lift out ceiling grid supports or laid directly on the ceiling grid.
3. Cables shall not be attached to or supported by fire sprinkler heads or delivery systems or any environmental sensor located in the ceiling air space.

N. Provide additional slack at both ends to accommodate future cabling system changes. Leave a 10 ft. (3.048 M) service loop on each cable within all TR's and leave 12 inch (304.8 mm) slack on each cable in each outlet.

1. Do not store slack in bundled loops. Slack shall be stored in a figure 8-configuration in an extended loop. Store slack above lay-in ceiling where possible.
2. Store slack at the wall outlet in a loop above the access ceiling at the top of the conduit stub up.

O. Separation from EMI Sources:

1. Comply with BICSI TDMM and TIA/EIA-569-C for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
   a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inch (127 mm).
   b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inch (300 mm).
   c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inch (610 mm).

3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
   a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inch (64 mm).
   b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inch (150 mm).
   c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inch (300 mm).

4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
   b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inch (76 mm).
   c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inch (150 mm).

5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inch (1200 mm).

6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inch (127 mm).

P. Test and verify in accordance with Section 271700.

Q. Identify, label and document in accordance with Section 270553.

3.4 COPPER CABLE TERMINATION

A. Make terminations only at indicated outlets, terminals and cross-connect and patch panels. Splices are not permitted for twisted-pair horizontal cabling. Bridged taps are not permitted in copper-based horizontal cabling.

B. All pairs shall be terminated.

C. Pairs shall not be untwisted more than 0.5 inch (12.7 mm) when terminating.
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. General:

1. This document describes the products and execution requirements relating to furnishing and installing Telecommunications faceplates and connectors for the horizontal cabling comprised of Copper Cabling.
2. Product specification, general design considerations, and installation guidelines are provided in this document.

B. Scope of Work:

1. Provide the installation and termination of jacks, faceplates, and connectors for a complete and working system.
2. Testing, labeling, and documentation shall be required for each termination.
3. It shall be the Contractor’s responsibility to follow recognized installation practices.
4. Compliance with codes and standards shall be required to achieve specified performance and network reliability.

C. Section Includes: This section includes, but is not limited to, the minimum requirements for product design, quality, and performance for the following:

1. Connector Jacks.
2. Faceplates and Outlets.

D. General Requirements:

1. Provide all labor, materials, and equipment for the complete installation of work called for in the Contract Documents.
2. The Contractor shall verify with the manufacturer any part number listed within this Section and on the drawings prior to the purchase of those items to ensure the correct part is specified for the intended purpose.
1.3 DEFINITIONS

A. Outlet/Connectors: A connecting device in the work area on which horizontal cable or outlet cable terminates.

B. EMI: Electromagnetic interference.

C. FTP: Shielded twisted pair.

D. F/FTP: Overall foil screened cable with foil screened twisted pair.

E. F/UTP: Overall foil screened cable with unscreened twisted pair.

F. IDC: Insulation displacement connector.

G. LAN: Local area network.

H. RCDD: Registered Communications Distribution Designer.

I. Screen: A metallic layer, either a foil or braid, placed around a pair or group of conductors.

J. Shield: A metallic layer, either a foil or braid, placed around a pair or group of conductors.

K. S/FTP: Overall braid screened cable with foil screened twisted pair.

L. S/UTP: Overall braid screened cable with unscreened twisted pairs.

M. UTP: Unscrened (unshielded) twisted pair.

1.4 SUBMITTALS

A. Provide product data, manufacturer’s instructions, and product catalog literature for the following:

   1. Connector Jacks.
   2. Faceplates and Outlets.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI or approved manufacturer installer on staff.

   1. Installation Supervision: Installation shall be under the direct supervision of Technician or Level 2 Installer, who shall be present at all times when Work of this Section is performed at Project site.

   2. Testing Supervisor: Currently certified by BICSI as an RCDD or Manufacturer’s approved installer to supervise on-site testing.
B. All jacks, connectors, and adapters shall be installed in a neat and workmanlike manner. All methods of construction that are not specifically described or indicated in the contract documents shall be subject to the control and approval of the Engineer.

C. Jacks, connectors, and adapters shall be installed according to recognized industry installation practices, and applicable codes and standards.

D. Telecommunications Pathways and Spaces: Comply with TIA/EIA-569-A.


1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.7 COORDINATION

A. Coordinate layout and installation of cable support and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

B. Coordinate layout and installation of telecommunications pathways and cabling with Owner's telecommunications and LAN equipment and service suppliers.

C. Coordinate telecommunications outlet/connector locations with location of power receptacles at each work area.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Manufacturers: In other PART 2 articles, the following requirements apply to product selection:

B. Telecommunications Pathways and Spaces: Comply with TIA-569-D.

C. Grounding: Comply with TIA-607-B
2.2 CONNECTOR JACK

A. Description: Jacks shall be 8-pin modular jack connector assembly.

1. The interface between the jack and the station cable shall be a 110 block or insulation displacement type contact. Termination components shall be designed to maintain the cable's pair twists as closely as possible to the point of mechanical termination.
2. Connector jack shall be utilized for both voice and data cable terminations.
3. Connector jack shall match category rating and type with horizontal copper cabling.

B. Manufacturer: Basis of Design. Provide by one of the following manufacturers or an approved equal:

a. Belden Inc.
b. CommScope
c. Hubbell Incorporated
d. Leviton
e. Ortronics, Legrand
f. Panduit
g. Siemon Company
h. Systimax Solutions

C. Transmission characteristics of the jack shall be as required to meet the TIA/EIA performance criteria for that rating.

1. The jack shall utilize the T568B wiring scheme for conductor terminations.
2. Performance Requirements: All connectors shall meet or exceed the electrical channel requirements of the IEEE 10 Gigabit Std. 802.3an (latest draft).

   a. The connector shall be capable of being in a modular patching situation or as a modular telecommunication outlet supporting current and evolving high-speed, high-bandwidth applications, including Ethernet, 10GBASE-T, 1000BASE-T, Token Ring, 100 Mbps TP-PMD, 155 Mbps ATM, 622 Mbps ATM using parallel transmission schemes.
   b. Power Sum Alien Crosstalk (PSANEXT) up to 500 MHz.
   c. Insertion Loss, NEXT, PSNEXT, ELFEXT, and PSELFEXT up to 500 MHz.
   d. Return Loss up to 400 MHz, with 8 dB limit above 400 MHz up to 500 MHz.

3. Performance Requirements: All connectors shall meet or exceed the electrical channel requirements of the IEEE 1000Base-T Std. 802.3ab.

   a. All connectors shall meet or exceed Power Sum NEXT and transmission requirements for connecting hardware, as specified in ANSI/TIA/EIA 568-B Commercial Building Telecommunications Cabling Standard, Horizontal Cable Section, and be part of the UL LAN Certification and Follow-up Program.
   b. The connector shall be capable of being in a modular patching situation or as a modular telecommunication outlet (TO) supporting current and evolving high-speed, high-bandwidth applications, including Ethernet, 1000BASE-T, Token Ring, 100 Mbps TP-PMD, 155 Mbps ATM, 622 Mbps ATM using parallel transmission schemes.
4. Connector Requirements:
   a. The connector shall use IDC with snap-lock termination cap.
   b. The connector shall be universal application/multi-vendor supportive accepting modular RJ-45 plugs.

5. Color: The color of the jack shall be BLUE. Final color shall be coordinated with and approved by Owner’s IT personnel prior to commencing work.

2.3 FACEPLATES AND OUTLETS

A. Description: The communication outlet shall be the interface between the horizontal wiring and the workstation.

1. The faceplates, outlets, and surface-mount boxes shall support the network and A/V system.
2. Each outlet shall be complete with modular connector(s) in the quantities and type as indicated on the drawings, shall be complete with labeling and a faceplate assembly to accommodate modules and shall be attached permanently to an approved fixture.
3. Each horizontal station cable shall each be terminated at the designated outlet location with the connector type as described in this section.

B. Manufacturer: Basis of Design or similar dependent on installation location.

1. Single Gang 2-Port Faceplate:
   a. Faceplate shall be modular 2-port, flush faceplate.
   b. Include label/label cover for port identification
   c. Color shall be coordinated with and approved by Owner.

2. Single Gang 4-Port Faceplate:
   a. Faceplate shall be modular 4-port, flush faceplate.
   b. Include label/label cover for port identification
   c. Color shall be coordinated with and approved by Owner.

C. Requirements:

1. The same orientation and positioning of jacks and connectors shall be utilized throughout the installation and shall match other adjacent devices.
2. The communication outlet frame shall incorporate a mechanism for adjusting the surface plate to a plumb position.
3. Color of Faceplate and Outlet Frame shall match.
D. Faceplate: Faceplates shall be Decora Style with a Décor Outlet Frame which utilize modular connectors.

1. Faceplate shall be available with one decora opening in a single gang faceplate and two decora openings for a double gang faceplate.
2. The faceplate shall be constructed of High Impact Plastic and/or Stainless.
3. Color:
   a. Faceplate color shall match the faceplate color used for other device and components with the space or throughout the building.
   b. When installed in surface raceway, faceplate shall match the color of that raceway.
   c. Faceplate color shall be coordinated with and approved by the Architect. All jacks shall exit the frame flush with the front of the faceplate.
5. Mounting: Flush-mounted, except as otherwise indicated. Surface mounted on systems furniture or surface raceway.
6. Labeling: Wall Mount Outlet Faceplates shall incorporate recessed designation strips at the top and bottom of the frame for identifying labels. Designation strips shall be fitted with clear plastic covers.

E. Blanks: Provide blank module inserts for all unused module locations. Blank shall match the faceplate into which it is installed. The color of the blank shall match the faceplate color.

PART 3 - EXECUTION

3.1 GENERAL

A. The Contractor shall install all components in accordance with manufacturer’s recommendations.

B. All work shall comply with the requirements in ANSI/TIA/EIA and ISO/IEC standards listed in PART 1 of this Section. Where questions arise regarding which standards apply the more stringent specification or policy shall prevail.

C. Materials (ceiling tiles, cables, network equipment, etc.) inadvertently demolished or damaged by the Contractor during the course of construction shall be replaced and/or repaired by the Contractor at no additional cost to the Owner.

3.2 COMMUNICATION OUTLET

A. Work area communications outlets shall be installed as shown on walls or on floor.

1. Jack installation shall be in accordance with manufacturer's instructions.
2. The same orientation and positioning of jacks and connectors shall be utilized throughout the project.
3. Where installed in wire ways, modular furniture, etc., mounting shall be die punched for devices or adapter plates. Field cutting of device plates or other mounting is not permitted.
4. Cables shall be dressed and terminated in accordance with the recommendations made in the TIA/EIA-568-B document, manufacturer's recommendations, and best industry practices.
5. Pair untwist at the termination shall not exceed 0.125 inch (3.18 mm).
6. Bend radius of the cable in the termination area shall not be less than 4 times the outside diameter of the cable.
7. The cable jacket shall be maintained to within 1 inch (25mm) of the termination point.

END OF SECTION 271543
SECTION 271700 – TESTING AND DOCUMENTATIONS

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. Methods and procedures for testing cables at the Project site.
2. Link and channel testing methods and procedures for communication cabling for this Project. Unless noted otherwise, a permanent link test shall be performed on all new horizontal cables and if applicable, on existing horizontal cables that have been re-terminated or where termination is disturbed.
3. Optical fiber testing methods and procedures for backbone cable
4. This Section identifies the administration method and numbering scheme utilized with this cabling system.

1.3 DEFINITIONS

A. Permanent Link Definition: A permanent link consists of up to 295 ft. (90 M) of permanently installed horizontal cabling, the mated connection at each end of the cable, and an optional transition point.

B. Channel Test Definition: The channel link includes up to 295 ft. (90 M) of horizontal cable, a work area equipment cord, an optional consolidation point, two (2) cross-connections in the telecommunications room, a patch jumper between these two connections, and a telecommunications room patch cord. The total length of the channel shall not exceed 328 ft. (100 M).

1.4 PERFORMANCE REQUIREMENTS

A. Unless otherwise specified herein, all testing definitions, parameters, methods, and practices shall comply with the Performance Standards identified in this Section.

B. The contractor shall ensure the proper installation and operation of the Communication Cabling System. All communication cabling shall be tested.
1.5 SUBMITTALS

A. Submit product data under provisions of Division 01 GENERAL REQUIREMENTS, of the Contract.

B. Field Test Equipment and Observation Reports: Provide a list of proposed test equipment for use in verifying the installation of the cabling system.

1. Provide for each testing device:
   a. Manufacturer and product number.
   b. Manufacturer documentation showing date and outcome of last re-calibration. Testing device shall have been re-calibrated within the last 6 months.
   c. Manufacturer documentation showing software revision. Software revision shall be most current revision available for device and based upon the most current TIA/EIA testing guidelines.

2. Provide proposed UTP cable and fiber optic cable test report forms.

1.6 QUALITY ASSURANCE

A. All work shall be performed in accordance with industry standards and manufacturer recommendations. Work shall also be in accordance with the general principals outlined in the BICSI TDMM, latest edition.

B. Contractor Qualifications:

1. The Contractor shall provide sufficient skilled labor to complete testing within the project time lines, approved by the Engineer.
2. The Contractor shall have a minimum of 3 years’ experience installing and testing structured cabling systems. Trained technicians who have successfully attended an appropriate training program and have obtained a certificate, as proof thereof shall execute the test.

1.7 COORDINATION

A. The Contractor shall coordinate activities and cooperate with others on the Project to ensure that systems are energized when required and that other requirements of this Specification are carried out in a timely, coordinated basis.

B. The Contractor shall conduct tests and present test results to the Engineer. Results shall be presented to the Owner only after the Engineer's approval.
1.8 WARRANTY

A. System Acceptance:

1. Acceptance shall be subject to completion of all work, successful post-installation testing which yields 100 percent PASS rating, and receipt of full documentation as described in this Section.

2. Once all work has been completed, test documentation has been submitted, and the Engineer and the Owner are satisfied that all work is in accordance with contract documents, the Owner shall notify Contractor in writing of formal acceptance of the system.

B. Acceptance Requirements:

1. The Contractor shall complete testing of all equipment, cabling, and connectivity and furnish compliant test results.
   a. The Contractor shall warrant in writing that 100 percent of the installation of each system meets the requirements of the standards for that system as specified.
   b. Any failing link must be diagnosed and corrected. The corrective action shall be followed with a new test to prove that the corrected link meets the performance requirements.

2. Owner reserves the right to conduct, using Contractor equipment and labor, a random re-test of up to 5 percent of the cable plant to confirm documented results. Any failing cabling shall be re-tested and restored to a passing condition. In the event more than 2 percent of the cable plant fails during re-test, the entire cable plant shall be re-tested and restored to a passing condition at no additional cost to the Owner.

3. The Engineers and Owners may agree to allow certain cabling runs to exceed standardized performance criteria (e.g. length). In this event, such runs shall be explicitly identified and excluded from requirements to pass standardized tests. In this special circumstance, contractor shall obtain written Owner and Engineer permission.

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

A. Furnish suitable electrical instruments and all other equipment necessary to perform all tests specified.

B. Make necessary setups for testing instruments and place and connect all instruments, equipment and devices necessary for the tests. Upon completion of tests, remove instruments and instrument connections and restore all to original permanent condition.
2.2 COMMON COPPER CABLE TEST EQUIPMENT

A. Tone Generator/Induction Amplifier: Identifies specific pairs by generating tone on one pair end with an inductive amplifier to identify the tone on the other end.

B. Volt-Ohm-Ammeter:
   1. Measures voltage, current, and resistance.
   2. Measures continuity with a shorting device on one pair end.

C. Time Domain Reflectometer:
   1. The TDR locates and tests all cable defects, splice and connectors and returns loss values for each occurrence.
   2. The TDR is used to measure the electrical length of the cable.

2.3 UTP COPPER CABLE TESTERS

A. Test equipment used under this contract shall be from manufacturers that have a minimum of 5 years experience in producing field test equipment. Manufacturers must be ISO 9001 certified.

B. Test Equipment Manufactures: Provide test equipment from the following or an approved equal.
   1. Agilent
   2. Fluke
   3. IDEAL
   4. Microtest
   5. Wavetek

C. All test tools of a given type shall be from the same manufacturer, and have compatible electronic results output.

D. All equipment and accessories shall be from the same manufacturer or be approved by the manufacturer for use.

E. Test equipment shall be within the calibration period recommended by the manufacturer to achieve measurement accuracy.

F. Test adapter cables must be by the manufacturer or approved by the manufacturer for use.
   1. The tester interface adapters shall be high quality.
   2. Cable adapter shall not show any twisting or kinking resulting from coiling and storing of the tester interface adapters.

G. Baseline accuracy of the test equipment must exceed TIA Level 2e or Level III, as indicated by independent laboratory testing, for the Category type of cable tested.

H. Test equipment must be capable of certifying links or channels.
I. Test equipment must have a dynamic range of at least 100 dB to minimize measurement uncertainty.

J. Test equipment must be capable of storing full frequency sweep data for all tests and printing color graphical reports for all swept measurements.

K. Test equipment must include S-Band time domain diagnostics for NEXT and return loss (TDNXT and TDRL) for accurate and efficient troubleshooting.

L. Test equipment must be capable of running individual NEXT, return loss, etc measurements in addition to auto tests. Individual tests increase productivity when diagnosing faults.

M. Test equipment must store at least 1000 auto tests in internal memory.

N. Test equipment must include DSP technology for support of advanced measurements.

O. Test equipment must make swept frequency measurements in compliance with TIA standards.

P. The measurement reference plane of the test equipment shall start immediately at the output of the test equipment interface connector. There shall not be a time domain dead zone of any distance that excludes any part of the link from the measurement.

PART 3 - EXECUTION

3.1 GENERAL

A. Testing before cable installation:

1. Test optical fiber cable while on reels. Use an optical time domain reflectometer to verify the cable length and locate cable defects, splices, and connector, including the loss value of each. Retain test data and include the record in maintenance data.

2. Test each pair of UTP cable for open and short circuits.

B. Testing: Upon installation of cable and connectors, demonstrate product capability and compliance with requirements.

1. Test each signal path for end-to-end performance.

   a. Perform end-to-end tests including power meter light source and OTDR tests.

2. Perform OTDR measurements as required by EIA TIA/EIA-568-B.1 and EIA TIA/EIA-568-B.3.

   a. Multimode fiber shall be tested in accordance with EIA TIA/EIA-526-14A (Optical Power Loss).

3. Remove temporary connections when tests have been satisfactorily completed.
4. The Owner/Engineer shall be notified when the system is completed and ready to be tested. Test date(s) and time(s) shall be during a mutually agreed upon period with final approval of time determined by the Owner/Engineer.
5. Trained technicians who have successfully attended an appropriate training program and have obtained a certificate, as proof thereof shall execute the tests.
6. Provide all necessary power, utility services, technicians, test equipment, calibration equipment as required to perform reel and final acceptance tests of the media.
7. The test equipment shall be within the calibration period recommended by the vendor in order to achieve the vendor-specified measurement accuracy. The tester interface adapters must be of high quality and the cable shall not show excessive twisting or kinking resulting from repetitive coiling and storing of the tester interface adapters.

C. Correct malfunctioning units (copper, coax or fiber) at site, where possible, and retest to demonstrate compliance; otherwise, remove and replace with new units and retest.

1. All media which fail the factory or reel tests or final acceptance field tests shall be replaced and re-tested at the Contractors expense.

D. Strictly follow the test equipment manufacturer's instructions for equipment setup, initialization, and calibration.

3.2 HORIZONTAL COPPER CABLE

A. Testing shall be performed with the tester at the distribution frame and the injector at the work area outlet.

B. Horizontal Copper Cable Testing: Each cable shall be inspected for physical damage and every cabling link in the installation shall be tested.

1. Field Test Specifications: Cables shall be tested in accordance with the field test specifications defined for:

   a. Category 6: Every link in the installation shall be tested in accordance with the field test specifications defined in ANSI/TIA-568-C.2.; "Balanced Twisted-Pair Cabling Components."

2. The installed twisted pair horizontal links shall be tested from the Communication Room to the work area outlet.

3. 100 percent of the installed cabling links must be tested and pass the requirements of the standards for the Category rating of the cable mentioned in the Field Test Specifications listed above. Any failing link must be diagnosed and corrected. The corrective action shall be followed with a new test to prove that the corrected link meets the performance requirements.

4. The test equipment, including the appropriate interface adapter(s), shall comply with the accuracy requirements for:

5. Performance Testing: The test of each link shall contain all of the following test parameters as detailed below:

a. In order to pass the test, all measurements (at each frequency in the range from 1 MHz through 250 MHz for Category 6) must meet or exceed the limit value determined in the standard for:


b. Wire Map: The wire map shall indicate the correct termination and continuity on all pairs.

c. Length: Measure the length of all pairs of the basic link or channel. The physical length of the link shall be calculated using the pair with the shortest electrical delay.

d. Insertion Loss (Attenuation) shall measure the signal loss in the permanent link or channel. Measure the insertion loss at the same frequency intervals as NEXT Loss. Identify the worst wire pair.

e. NEXT Loss: Pair-to-pair near-end crosstalk loss shall be tested for each wire pair combination from each end of the link (a total of 12 pair combinations). Identify the wire pair combination that exhibits the worst case NEXT margin and the wire pair combination that exhibits the worst value of NEXT (worst case). NEXT shall be measured from each end of the link-under-test.

f. PSNEXT Loss: Power Sum NEXT Loss shall be evaluated and reported for each wire pair from both ends of the link-under-test. Identify the wire pair that exhibits the worst case margin and the wire pair that exhibits the worst value for PSNEXT. These wire pairs shall be identified for the tests performed from each end.

g. ELFEXT Loss: Pair-to-pair FEXT Loss shall be measured for each wire-pair combination from both ends for the link-under-test. Identify the wire pair combination that exhibits the worst case margin and the wire pair combination that exhibits the worst value for ELFEXT. These wire pairs must be identified for the tests performed from each end.

h. PSELFEXT Loss shall measure the combined effect of the FEXT disturbance from three wire pairs on the fourth one. Identify the wire pair that exhibits the worst case margin and the wire pair that exhibits the worst value for PSELFEXT.

i. Return Loss shall be measured from both ends of the link-under-test for each wire pair. Identify the wire pair that exhibits the worst case margin and the wire pair that exhibits the worst value for Return Loss. These wire pairs must be identified for the tests performed from each end.

j. Propagation Delay shall be measured to determine the time required for the signal to travel from one end of the link to the other. This measurement shall be performed for each of the four wire pairs. Identify the wire pair with the worst case propagation delay.

k. Delay Skew shall identify the difference in propagation delay between the 4-wire pairs. Identify the wire pair with the worst case propagation delay.
C. Copper Station Cable Test Result Documentation: Documentation of cable testing shall be required. Refer to Division 27 specifications for additional requirements.

1. Test reports shall be submitted in printed and in electronic format. Hand written reports shall not be accepted.
2. The test results information for each link shall be recorded in the memory of the field tester upon completion of the test.
3. The test results records saved by the tester shall be transferred into a Windows™-based database utility that allows for the maintenance, inspection and archiving of these test records. A guarantee must be made that the measurement results are stored then transferred to the PC unaltered at the end of the tests and that these tests cannot be modified at a later time.
4. Printed Reports: A table of test results assembled in a three-ring binder shall be submitted with the record drawings that list all the links that have been tested.
   a. An affidavit verifying passing execution of all tests shall accompany the test results.
   b. The test results shall be three-hole punched and numerically ordered by cable identification number within the notebook.
   c. The test results shall be three-hole punched and numerically ordered within the notebook by room number then sorted for each room number by the cable identification number.
   d. Reports shall contain, at a minimum, the following information:
      1) The Owner of the test equipment.
      2) The serial number of the test equipment used in performing the tests.
      3) The cable type being tested.
      4) The identification of the link in accordance with the naming convention defined in the overall system documentation.
      5) The length of the cable tested.
      6) The overall Pass/Fail evaluation of the link being tested including the NEXT Headroom (overall worst case) number.
      7) The date and time the test results were saved in the memory of the tester.
   e. The Contractor shall provide the test data in a complete and consistent format. All results shall be printed from a laser printer.
   f. The cover of the notebook, at a minimum, shall display the Project Name, the title "UTP Test Results," the Volume Number, and the date of the creation of the notebook.
   g. The Contractor shall verify that a report for each jack in the Project is contained in the notebooks.

5. Electronic Reports: The database for the completed job shall be stored and delivered on CD-ROM including the software tools required to view, inspect, and print any selection of test reports.
b. The detailed test results data to be provided in the electronic database for each tested link shall contain the following information:

1) Frequency Dependent Tests: For each of the frequency-dependent test parameters, the value measured at every frequency during the test is stored. In this case, the PC-resident database program must be able to process the stored results to display and print a color graph of the measured parameters. The PC-resident software must also provide a summary numeric format in which some critical information is provided numerically as defined by the summary results (minimum numeric test results documentation) as outlined above for each of the test parameters.

   a) Length: Identify the wire-pair with the shortest electrical length, the value of the length rounded to the nearest 1.64 ft. (0.5 M) and the test limit value.
   b) Propagation delay: Identify the pair with the shortest propagation delay, the value measured in nanoseconds (ns) and the test limit value.
   c) Delay Skew: Identify the pair with the largest value for delay skew, the value calculated in nanoseconds (ns) and the test limit value.
   d) Attenuation: Minimum test results documentation as explained in Section for the worst pair.
   e) Return Loss: Minimum test results documentation as explained in Section for the worst pair as measured from each end of the link.
   f) NEXT, ELFEXT, ACR: Minimum test results documentation as explained in the Section above for the worst pair combination as measured from each end of the link.
   g) PSNEXT, PSELFEXT, and PSACR: Minimum test results documentation as explained in the Section above for the worst pair as measured from each end of the link.

END OF SECTION 271700
SECTION 280528 – PATHWAYS FOR ELECTRONIC SAFETY AND SECURITY

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 conduits, tubing, and fittings.
2. Boxes, enclosures, and cabinets.
3. J-Hooks
4. Fire Rated Devices

B. Related Requirements:

1. Section 270528 "Pathways for Communications Systems" for conduits, surface pathways, innerduct, boxes, and faceplate adapters serving communications systems.

1.3 SUBMITTALS

A. Product Data: Provide catalog cut sheets, construction details, material descriptions, dimensions of individual components, and rated capacities for the following:

2. Cable Tray
3. Fire Rated Devices

B. Shop Drawings:

1. Submit schedule of opening locations and sizes, penetrating items, and required listed design numbers to seal openings to maintain fire resistance ratings.
2. Show fabrication and installation details of cable trays, including plans, elevations, and sections of components and attachments to other construction elements. Designate components and accessories, including clamps, brackets, hanger rods, splice-plate connectors, expansion-joint assemblies, straight lengths, and fittings.

C. Certificates: Product certificates signed by firestop system manufacturer certifying material compliance with applicable code and specified performance characteristics.
1.4 QUALITY ASSURANCE

A. Strictly adhere to industry standard installation practices when installing raceways and pathways.

B. Raceway Systems installation and components shall comply with UL Standard 5A and separate UL listing for non-metallic surface raceway: UL-E143298, E143309, and CSA Certified LR87514.

C. Products/Systems: Provide firestopping systems that comply with the following requirements:
   1. Firestopping tests are performed by a qualified, testing and inspection agency. A qualified testing and inspection agency is UL, or another agency performing testing and follow-up inspection services for firestop system acceptable to Authorities Having Jurisdiction.
   2. Firestopping products bear the classification marking of qualified testing and inspection agency.

1.5 PROJECT CONDITIONS

A. Do not install until enclosed and weathertight, wet work in spaces is complete and dry, and work above ceilings is complete.

B. Do not install firestopping products when ambient or substrate temperatures are outside limitations recommended by manufacturer.

C. Do not install firestopping products when substrates are wet due to rain, frost, condensation, or other causes.

D. Maintain minimum temperature before, during, and for a minimum 3 days after installation of materials.

E. Do not use materials that contain flammable solvents.

F. Coordinate construction of openings and penetrating items to ensure that through-penetration firestop systems are installed according to specified requirements.

G. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration firestop systems.

H. Schedule installation of firestopping after completion of penetrating item installation but prior to covering or concealing of openings.
1.6 COORDINATION

A. Coordinate layout and installation of communications raceways with Owner's communications and LAN equipment and service suppliers.

1. Meet jointly with communications and LAN equipment suppliers, local exchange carrier representatives, and Owner to exchange information and agree on details of equipment arrangements and installation interfaces.
2. Record agreements reached in meetings and distribute them to other participants.
3. Adjust arrangements and locations of raceways with distribution frames, cross-connects, and patch panels of cabling systems of other communications, electronic safety and security, and related systems.

B. Coordinate location of communications equipment, requiring electrical power, with power raceways and receptacles

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

2.2 METAL CONDUITS AND FITTINGS

A. Description: Metal raceway of circular cross section with manufacturer-fabricated fittings.

B. General Requirements for Metal Conduits and Fittings:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Comply with TIA-569-D.

C. GRC: Comply with ANSI C80.1 and UL 6.

D. IMC: Comply with ANSI C80.6 and UL 1242.

E. EMT: Comply with ANSI C80.3 and UL 797.

F. Conduit Requirements:

1. Only electrical metal tubing (EMT) shall be used for all conduits.
2. Fittings shall be formed steel compression ring type. Di-cast fittings shall not be allowed.
3. All conduits shall have a plastic or nylon bushing installed.
4. Flexible or BX type conduits shall not be acceptable unless it is approved prior to installation by the Engineer and is the only practical solution. When used in such an application, the conduit size shall be increased by a minimum of one trade size and be approved by Engineer prior to installation.

G. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.

1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886 and NFPA 70.
2. Fittings for EMT:
   a. Material: Steel.
   b. Type: Setscrew.

2.3 BOXES, ENCLOSURES, AND CABINETS

A. General Requirements for Boxes, Enclosures, and Cabinets:

1. Comply with TIA-569-D.
2. Boxes, enclosures and cabinets installed in wet locations shall be listed for use in wet locations.

B. Sheet-Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

C. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

D. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

E. Device Box Dimensions: 4 inches by 2-1/8 inches by 2-1/8 inches deep.

F. Gangable boxes are allowed.

2.4 J-HOOKS

A. Description: Prefabricated cable supports for telecommunications cable.

B. Basis of Design Product: Provide product indicated on Drawings for comparable product by one of the following:

1. Legrand J-Hooks
2. MonoSystems The Hook
3. Panduit, J-Mod Cable Support System
4. Pentair CADDY CAT HP J-hook System
C. Open top J-hook cable support shall be used in suspended ceiling and raised floor areas where duct, cable tray or conduit is not available.

1. Shall support horizontal cabling in bundles of fifty (50) cables or less.
2. Support system shall have the ability to retain the cable bundle utilizing Velcro straps or the manufacturer’s retaining device.
3. System pathway shall be suitable for use in the air handling space in which it is installed. Provide an accordance to UL 2043 where applicable.

D. Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.

E. Comply with TIA-569-D.

F. Galvanized steel.

G. J-hooks shall be sized to accommodate cables in which it is supporting and an addition 25% spare capacity for future growth.

H. Multi-Tiered Non-Continuous Cable Support Assemblies:

1. Multi-tiered non-continuous cable support assemblies shall be used where separate cabling compartments are required. Assemblies may be factory assembled or assembled from pre-packaged kits. Assemblies shall consist of a steel angled hanger bracket holding up to six (6) non-continuous cable supports, rated for indoor use in non-corrosive environments.
2. Assemble using manufacturer recommended specialty fasteners including beam clips, flange clips, C and Z purlin clips, as required

PART 3 - EXECUTION

3.1 GENERAL

A. Routing: The Contractor shall determine the exact routing of pathways and cables in the field.

1. Routing shall be laid out in advance of actual installation.
2. Routing shall not interfere with nor affect structural sections.
3. Routing shall be coordinated with architecture, structure and other trades.

B. Penetrations: Where conduits, wire-ways, and other raceways pass through fire partitions, fire walls or walls and floors, install a firestop that provides an effective barrier against the spread of fire, smoke and gases. Where called for on Drawing or where large bundles of cables pass through fire partitions, utilize EZ-Path fire rated pathway sleeves.

1. Firestop material shall be packed tight and completely fill clearances between raceways and openings.
2. Firestop material shall be in accordance with reference codes standards, regulations, and contract documents.
C. Floor, exterior wall, and roof seals shall be watertight.

D. Horizontal pathways shall follow building lines as much as possible. Pathways shall be parallel and perpendicular to building lines.

3.2 PATHWAY APPLICATION

A. Indoors: Apply pathway products as specified below unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: EMT.
2. Exposed, Not Subject to Severe Physical Damage: EMT.
3. Concealed in Ceilings and Interior Walls and Partitions: EMT.

B. Minimum Pathway Size: 3/4-inch trade size. Minimum size for optical-fiber cables is 1 inch.

C. Pathway Fittings: Compatible with pathways and suitable for use and location.

1. EMT: Use setscrew fittings. Comply with NEMA FB 2.10.

3.3 INSTALLATION

A. Comply with NECA 1, NECA 101, and TIA-569-D for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum pathways. Comply with NFPA 70 limitations for types of pathways allowed in specific occupancies and number of floors.

B. Keep pathways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal pathway runs above water and steam piping.

C. Complete pathway installation before starting conductor installation.

D. Comply with requirements in Section 260529 "Hangers and Supports" for hangers and supports.

E. Arrange stub-ups so curved portions of bends are not visible above finished slab.

F. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications wiring conduits for which only two 90-degree bends are allowed. Support within 12 inches of changes in direction.

G. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

H. Support conduit within 12 inches of enclosures to which attached.
I. Stub-ups to Above Recessed Ceilings:
   1. Use EMT for pathways.
   2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

J. Install pathways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.

K. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to conduit assembly to assure a continuous ground path.

L. Cut conduit perpendicular to the length. For conduits of 2-inch trade size and larger, use roll cutter or a guide to ensure cut is straight and perpendicular to the length.

M. Install pull wires in empty pathways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground pathways designated as spare above grade alongside pathways in use.

N. Install pathway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed pathways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install pathway sealing fittings according to NFPA 70.

O. Expansion-Joint Fittings:
   1. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
   2. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

P. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.

Q. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

R. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

S. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

T. Set metal floor boxes level and flush with finished floor surface.

U. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.
3.4 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRONIC SAFETY AND SECURITY PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 280544 “Sleeves and Sleeve Seals for Electronic Safety and Security Pathways and Cabling.”

3.5 FIRESTOPPING

A. Install firestopping at penetrations of fire-rated floor and wall assemblies.

END OF SECTION 280528
SECTION 281000 – ACCESS CONTROL SYSTEM (ACS)

PART 1 - GENERAL

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

1.2 SUMMARY
A. This section includes the expansion of the existing Genetec Access Control Management System. Communication from existing Access Control System (ACS) head-end servers to access control intelligent field panels shall be similar to existing installations. This section will specify the access control panels, door devices, cabling and system testing procedures.

B. This Contractor shall coordinate with the Door Hardware Contractor for the installation of secure door devices provided under Division 8. It is this Contractor’s responsibility to provide a complete, working security system per the specifications, drawings and Owner’s input.

C. This Contractor shall coordinate with the Security Gate Contractor for the installation of secure gate devices provided under Division 8. It is this Contractor’s responsibility to provide a complete, working security system per the specifications, drawings and Owner’s input.

D. Related Requirements: All sections of Division 26, 27 and 28 of these specifications apply to this section.

1.3 SYSTEM DESCRIPTION
A. General: This contract requires the provision of a new distributed ACS system and the integration with the Owner’s existing systems. The ACS components are specified here to be compatible with the existing ACS system. This contract includes purchasing compatible ACS equipment. Operating features of hardware and software specified in this section are intended to limit the ACS components to compatible Genetec software and equipment.

B. Software licensing shall be by Owner if required. Contractor shall coordinate with Owner.

C. Testing of installed components is included: This contract includes the provision, programming, installation and testing of new access control units (ACU) and their connection to an Owner existing system. The ACU is capable of stand-alone operation, and its proper stand-alone operation and control of all devices included under this contract shall be required for final acceptance. This project shall provide all hardware, software, cable and other components necessary for a full functioning ACS capable of stand-alone operation.

D. Database Modifications: This Contractor shall be responsible for updating and integrating all existing databases affected by the provision and integration of the ACS. A certified Genetec representative shall perform all database modifications, uploading and integration between the existing main ACS head-end and all components, new or existing, affected by the extension.
E. The ACS and card readers shall be capable of reading and processing existing Owner proximity cards. Coordinate with Owner Security on exact type of card in use.

F. Alarm Programming: This Contractor shall coordinate with the Owner on specific alarm programming requirements. Contractor shall be responsible for programming alarm and trouble text for each door and respective door device. Coordinate with the Owner on descriptors and tag numbers for each device and door.

1.4 SCOPE OF WORK

A. Contractor shall furnish and install a complete Security System consisting of, but not limited to:

1. Access control system including:
   a. Head end/expansion equipment.
   b. Peripheral devices.
   c. Connection to Owner existing system.
   d. Inclusion of software modifications to include new components.
   e. Cabling

2. Installation and connection of electrified door hardware, strikes or panic devices.
3. Installation and connection of security gate hardware, strikes or panic devices.
4. Installation and connection of Audio/Video Intercom system/devices, components and cabling.

B. Installations shall include:

1. Coordination with Owner system.
2. All required equipment, components and cabling for a fully installed system.
3. Access control system shall be integrated with the fire alarm system to release controlled doors upon alarm.
4. All cables shall be installed above drop ceilings where possible.
5. Where solid ceilings are present, cables shall run in conduit or surface metal raceway.

C. Verify and coordinate rough-in requirements with architectural features, construction, and the equipment provided.

D. Provide labor, material, mounting hardware, terminations, tools, transportation, services, and equipment necessary to complete work shown on the drawings and as specified in the related sections for a "TURNKEY" and fully complete installation of a security system. It is the intent of the drawings and specifications that systems be complete and ready for operation.

E. The scope includes provision of new systems at this building and making connection to Owner network.

F. Contractor shall be responsible for providing all required 120 VAC power circuits to support the Security systems, even if not shown on drawings. All circuits associated with the Security system shall be protected with LOCK-ON devices and permanently labeled “SECURITY SYSTEMS” adjacent to the circuit breaker and typewritten on the panelboards index card.
1.5 SUBMITTALS

A. General: Submit the following according to Conditions of Contract and Division 1 Specification Sections.

1. Submit manufacturer’s data on ACS components including, but not limited to, electrical specifications, mechanical specifications, rough-in diagrams and instructions for installation, operation and maintenance, suitable for inclusion in maintenance manuals.

2. Wiring diagrams from manufacturer differentiating between factory- and field-installed wiring: Include diagrams for equipment and for system with all terminals and interconnections identified. Indicate components for both field and factory wiring.

3. Plan Drawings: Provide plan drawings showing locations of all active components.

4. Testing: Prepare and submit Test Plans, Test Procedures and Test Reports according to this Section, for Installation Test, System Test, and Integration Test.

1.6 CLOSEOUT SUBMITTALS

A. Record Drawings

1. Floor plan drawings indicating device locations, with device legends indicating manufacturers and model numbers for each device.

2. Floor plan drawings indicating wire routing. Wire routing shall be delineated in straight line runs and be tagged with cable identification and terminal strip numbers to coincide with the installation.

3. Wiring diagrams for each field panel (IFP). Wiring diagrams shall be identical to those laminated and located with each IFP.

4. Layout details for each riser location, including security panels, power supplies, junction boxes, conduit, and any other security related equipment.

B. Operation and Maintenance Manuals: For security system to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data" include the following:

1. Hard copies of manufacturer's specification sheets, operating specifications, design guides, user's guides for software and hardware, and PDF files on CD-ROM of the hardcopy submittal.

C. System installation and setup guides, with data forms to plan and record options and setup decisions.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

1. Cable installer must have on staff a registered communication distribution designer certified by Building Industry Consulting Service International.

B. Source Limitations: Obtain ACS panels, modules, controllers, and all software through one source from single manufacturer.

C. 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.

D. Comply with NFPA 70, "National Electrical Code."
E. Comply with SIA DC-01 and SIA DC-07.

F. UL Compliance and labeling: Provide system components that are UL-listed and labeled.

G. Americans with Disability Act (ADA) Compliance: Provide Access Control System components that are ADA compliant.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Equipment

1. Store in temperature-and humidity-controlled environment in original manufacturer's sealed containers. Maintain ambient temperature between 50 and 85 deg F (10 and 30 deg C), and not more than 80 percent relative humidity, noncondensing.

2. Open each container; verify contents against packing list; and file copy of packing list, complete with container identification, for inclusion in operation and maintenance data.

B. Save original manufacturer's containers and packing materials and deliver as directed under provisions covering extra materials.

1.9 WARRANTY

A. General: The Contractor shall provide to the Owner a local Genetec System contact (name, address and phone number) who is affiliated with a certified service center. Contractor shall respond on-site within eight (8) hours of trouble call after receipt of call to address warranty issues.

B. Period: The Contractor shall guarantee all labor, workmanship, and materials for a period of one year from date of final acceptance. Should a failure occur within the first year of the system, the Contractor shall provide all labor and materials necessary to restore the system to the condition required for testing and acceptance for this contract, at no cost to the Owner.

C. Tie-ins: During the warranty period, additional card readers and door contacts will be connected and their use entered in database. New devices will be connected in the same manner as shown on the drawings for this contract and the existence of the new connections shall not void this guarantee.

1.10 THEORY OF OPERATION

A. A theory of operation for each door type has been provided in specification section no. 087100. This Contractor shall coordinate the final operation of each door and its respective alarm/trouble responses locally at the door and at the security computer with the Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Access Control System (software, controllers, and modules):
a. Genetec

2. Card Readers:
   a. HID Indala Series
   b. Schlage
   c. Apti-Q
   d. Other approved equal compatible with the Genetec System

2.2 ACCESS CONTROL SYSTEM DESCRIPTION

A. General: This contract requires extension of an existing distributed Access Control System (ACS). The ACS components are specified here to be compatible with the existing ACS system. This contract includes purchasing compatible ACS equipment. Operating features of hardware and software specified in this section are intended to limit the ACS components to compatible Genetec equipment.

B. Testing of installed components is included: This contract includes the provision, programming, installation and testing of new access control intelligent field panels (IFP) and their connection to the existing system. The IFP is capable of stand-alone operation, and its proper stand-alone operation and control of all devices included under this contract shall be required for final acceptance. This project shall provide all hardware, software, cable and other components necessary for a full functioning system capable of stand-alone operation.

C. Database Modifications: This Contractor shall be responsible for updating and integrating all existing databases affected by the extension of the system. A certified S2 Security Corporation representative shall perform all database modifications, uploading and integration between the existing main ACS head-end and all components, new or existing, affected by the extension.

D. Alarm Programming: This Contractor shall coordinate with the Owner on specific alarm programming requirements. Contractor shall be responsible for programming alarm and trouble text for each door and respective door and gate device. Coordinate with Owner’s Security Department on descriptors and tag numbers for each device and door.

E. The ACS and card readers shall be capable of reading and processing existing Owner proximity smart cards.

F. This project consists of the extension of an existing ACS to secure, monitor and control secured doors and equipment. The extension of this system shall be seamless in that access points installed under this project will operate, alarm and report in the same manner as existing access points. It is the Contractor’s responsibility to meet with Owner’s Security Department and coordinate the exact operation and integration of access points.

G. The security integrator shall provide all required programming, software and graphic map updates required for the extension of the ACS. All programming, software updates, database modifications, graphic user maps, etc. shall be provided and installed/programmed by an authorized and certified S2 Security Corporation representative.

H. This project shall provide for the integration of the ACS to the following systems:

I. Access Control Functions:

1. Card reader and remote control of doors as indicated in the drawings.
2. Control point outputs for lock power control activated by card reader, file server/system workstation keyboard or time schedule.
3. Control of access through card reader controlled devices based on the card user's access levels. An access level shall define a door or group of doors accessible by a card holder during a certain time period. Time periods shall include both authorized days and hours, and shall include independent holiday schedules. The ACS allows each card holder to have multiple access levels.
4. Alarm indication at the file server / alarm monitoring system workstation for unauthorized reader use attempts. Unauthorized reader use alarms shall be user selectable on an individual card reader basis.
5. Access requests, both authorized and denied, shall be sent to the host for storage and annunciation, as required, with the cardholder number, name, and access point/area where access was attempted or gained.
6. System workstation display and event printing of card use (all transactions or violations only; by card and / or by card reader).
7. Momentary, programmable time, or maintained release of card reader controlled door locks via the system workstation keyboard.
8. Monitoring of the status of card reader controlled doors against intrusion or door propping.
9. Selective card reader tracking by individual card reader or groups of card readers.

J. The ACS shall offer an individually selectable door shunt time to allow persons with disabilities additional time to access a portal and an extended shunt time to allow additional time to pass through the door before alarm. This shall be selectable by cardholder and shall meet all of the requirements as set forth in the Americans with Disabilities Act.

K. Provide controllers compatible with Owner’s existing system.

2.3 AUDIO/VIDEO INTERCOM SYSTEM DESCRIPTION

A. All audio/video equipment and components, including programming, cabling and hardware shall be provided with the Contractor. Provide all appropriate mounting and accessories.

B. System Description:

1. Master/Sub-master station shall be located in main office or security areas. Refer to drawings for locations and system descriptions. Exact locations shall be coordinated with and approved by Owner prior to rough-in and installation. This shall be the primary means of door release.
2. Provide network software licensing for a secondary means of door release. Provide a minimum of 2 network licenses.
3. Door Call station shall be located at Main Entry Doors or as shown on drawings.
4. Upon CALL button depression of door calls station, a chime tone will sound at Master/Sub-Master Station.
5. Caller is seen on the video monitor and outside audio is heard.
6. Press TALK button momentarily, and after beep, communicate hands free. Red transmit LED lights when you talk and goes off as you listen to caller or hear outside sounds.
7. After finishing communication, press OFF button and communication will end after beep.
8. Audio and video turn off after approximately 45 seconds if not answered.
9. Master/Sub-Master station press DOOR RELEASE button which then allows the release of the door’s electronic locking mechanism. After pre-set time, the door’s electronic locking mechanism shall re-engage. Contractor shall coordinate DOOR RELEASE with ADA actuation.

10. If a call is received from video door station, unit starts recording automatically.

11. System also allows for Entrance Monitoring by pressing the MONITOR button, which then displays the video and audio from the door station.

2.4 GENERAL

A. Door Hardware: The card readers, request-to-exit buttons, passive infra-red motion detectors and ACS hardware shall be provided by this contractor. Locking Devices and door contacts including electromagnetic locks, electric strikes, electrified panic bars, electric/power hinges and door contact switches shall be furnished and installed by Division 8 contractor and wired by this contractor. This Contractor shall provide wiring, termination to the ACS and testing of the devices as required to connect to the ACS, including tamper switches for the power supply enclosures and interface to automatic door control panels. Reference Division 8 Door Hardware Schedule for more information.

2.5 HARDWARE EQUIPMENT

A. Proximity Card Reader

1. Provide card reader at locations shown on drawings. The card readers shall be capable of reading existing Owner cards. The card reader shall have the following characteristics:

2. Construction: Weatherized, polycarbonate, vandal resistant enclosure with conformal coating. Provide built-in heater on all exterior units.

3. Mounting: Reader shall mount to a standard single gang mounting plate attached to a double gang outlet box.


5. Audio/Visual Indicators: Reader shall be equipped with multicolor LEDS and beeper for audio/visual feedback to user. LEDs shall change state upon presentation of valid card (green) and invalid card or pin number (red and audio beep). Coordinate with the Owner on exact A/V response from reader on specific tasks.

6. Certifications: UL294/1076, CE, CSA.

7. Warranty: Two years minimum.

8. Weather Shroud: Provide a weather shroud to protect the reader against rain, snow and ice when exterior mounted.

9. Power: Card reader shall be powered from its associated Controller, including its standby power source.

10. Response Time: Card reader shall respond to passage requests by generating a signal that is sent to the Controller. Response time shall be 800 ms or less, from the time the card reader finishes reading the credential card until a response signal is generated.

11. Enclosure: Suitable for surface, semiflush, or pedestal mounting.

B. Access Control Panel (ACP)

1. Controllers: Intelligent peripheral control unit, complying with UL 294, that stores time, date, valid codes, access levels, and similar data downloaded from the Central Station or workstation for controlling its operation.

2. Subject to compliance with requirements in this Article, manufacturers may use multipurpose Controllers.
3. Battery Backup: Sealed, lead acid; sized to provide run time during a power outage of 90 minutes, complying with UL 924.

4. Alarm Annunciation Controller:
   a. The Controller shall automatically restore communication within 10 seconds after an interruption with the field device network with dc line supervision on each of its alarm inputs.
      1) Inputs: Monitor dry contacts for changes of state that reflect alarm conditions. Provides at least eight alarm inputs, which are suitable for wiring as normally open or normally closed contacts for alarm conditions.
      2) Alarm-Line Supervision:
         a) Supervise the alarm lines by monitoring each circuit for changes or disturbances in the signal, and for conditions as described in UL 1076 for line security equipment by monitoring for abnormal open, grounded, or shorted conditions using dc change measurements. System shall initiate an alarm in response to an abnormal current, which is a dc change of 5 percent or more for longer than 500 ms.
         b) Transmit alarm-line-supervision alarm to the Central Station during the next interrogation cycle after the abnormal current condition.
      3) Outputs: Managed by Central Station software.
   b. Auxiliary Equipment Power: A GFI service outlet inside the Controller enclosure.

5. Entry-Control Controller:
   a. Function: Provide local entry-control functions including one- and two-way communications with access-control devices such as card readers, keypads, biometric personal identity verification devices, door strikes, magnetic latches, gate and door operators, and exit push-buttons.
      1) Operate as a stand-alone portal Controller using the downloaded database during periods of communication loss between the Controller and the field-device network.
      2) Accept information generated by the entry-control devices; automatically process this information to determine valid identification of the individual present at the portal:
         a) On authentication of the credentials or information presented, check privileges of the identified individual, allowing only those actions granted as privileges.
         b) Privileges shall include, but not be limited to, time of day control, day of week control, group control, and visitor escort control.
      3) Maintain a date-, time-, and Location-stamped record of each transaction. A transaction is defined as any successful or unsuccessful attempt to gain access through a controlled portal by the presentation of credentials or other identifying information.
   b. Inputs:
      1) Data from entry-control devices; use this input to change modes between access and secure.
2) Database downloads and updates from the Central Station that include enrollment and privilege information.

c. Outputs:

1) Indicate success or failure of attempts to use entry-control devices and make comparisons of presented information with stored identification information.
2) Grant or deny entry by sending control signals to portal-control devices and mask intrusion alarm annunciation from sensors stimulated by authorized entries.
3) Maintain a date-, time-, and Location-stamped record of each transaction and transmit transaction records to the Central Station.
4) Door Prop Alarm: If a portal is held open for longer than 20 seconds, alarm sounds indication will be sent to the security personnel.

d. Data Line Problems: For periods of loss of communications with Central Station, or when data transmission is degraded and generating continuous checksum errors, the Controller shall continue to control entry by accepting identifying information, making authentication decisions, checking privileges, and controlling portal-control devices.

1) Store transactions during periods of communication loss between the Controller and access-control devices for subsequent upload to the Central Station on restoration of communication.

e. Controller Power: NFPA 70, Class II power supply transformer, with 12- or 24-V ac secondary, backup battery and charger.

1) Backup Battery: Premium, valve-regulated, recombinant-sealed, lead-calcium battery; spill proof; with a full 1-year warranty and a pro rata 9-year warranty. With single-stage, constant-voltage-current, limited battery charger, comply with battery manufacturer's written instructions for battery terminal voltage and charging current recommendations for maximum battery life.
2) Backup Power Supply Capacity: 90 minutes of battery supply. Submit battery and charger calculations.
3) Power Monitoring: Provide manual dynamic battery load test, initiated and monitored at the control center; with automatic disconnection of the Controller when battery voltage drops below Controller limits. Report by using local Controller-mounted LEDs and by communicating status to Central Station. Indicate normal power on and battery charger on trickle charge. Indicate and report the following:

   a) Trouble Alarm: Normal power off load assumed by battery.
   b) Trouble Alarm: Low battery.
   c) Alarm: Power off.

C. Passive Infrared Detector: Passive Infrared (PIR) Motion Detectors shall be furnished and installed as indicated on the plans. The PIR shall be used to release a lock from the inside of the door for free egress. The PIR shall also be capable of sending a request-to-exit signal to the ACU for shunting of alarm signals. Provide PIR with the following characteristics:

1. 12 or 24 VAC or VDC operation (typical 26 mA @ 12 VDC).
2. Two form "C" contacts. Relay latch time adjustable up to 60 seconds.
4. Operating temperatures of -20 degrees to +120 degrees F.
5. Certifications: UL294, CE, CSA.
6. Externally visible activation LED.
7. Adjustable "look down" coverage pattern to minimize nuisance activations, 25ft maximum.
8. Warranty: Two years minimum.

D. Request-To-Exit (REX) Pushbutton with Timer: Provide REX pushbutton as shown on drawings. The REX button that will act as a shunt switch to allow occupants to open the door while it is armed without causing an alarm. Provide pushbutton with the following characteristics:

1. General: Provide REX pushbutton as shown on drawings. The REX button that will act as a shunt switch to allow occupants to open the door while it is armed without causing an alarm.
2. Contacts: 30-second timer, 10A, SPDT.
3. Construction: single gang mounting, non-illuminated 2” square button with “PUSH TO EXIT” engraved on button.
4. Listing/Labeling: UL listed 634 for use with security systems
5. Electrified door hardware and associated power supplies are specified under Division 8 of these specifications.
6. The Contractor shall install and wire control, monitoring and power to electrified door hardware.
7. Power supplies shall be installed inside data rooms.
8. The Contractor shall be responsible for interfacing the lock power supply to the power transfer hinge and locking mechanism. Provide all cabling and electrical connectors as required.

E. ACS Interface via Local Area Network (LAN)

1. Provide LAN connections via Cat 6 cable to local LAN network equipment required for the communication of ACP panels provided under this project to the existing ACS server. The Contractor shall coordinate with Owner’s IS Department as required for network setup and configuration.

F. Audio/Video Intercom System

1. Manufacturer:
   a. Aiphone
   b. Alpha Communications
   c. Axis
   d. DoorKing, Inc.
   e. Approved equal

2. Hands-Free Color Audio/Video Master Monitor Station and Sub-Master Monitor Station
   a. System shall be Hands-Free, Color Video System with Pan, Tilt, Zoom capabilities.
   b. Power: 18 V DC.
   c. Calling: Chime and image, approximately 45 seconds.
   d. Video Monitor: 3.5” direct view with color LCD.
   e. Door Release Contact: 24 V AC/DC, 500 mA (N/O dry closure contact L, L).
   f. Integrated microphone.
   g. Integrated speaker.

3. Vandal-Resistant Audio/Video Door Station
   a. Stainless steel or die-cast zinc faceplate
   b. Integrated microphone.
c. Integrated speaker.
d. Camera

1) Complementary metal oxide semiconductor (CMOS).
2) Scanning Lines: 525.
3) Minimum Subject Illumination: 5 Lux at 50-cm (1’-6”) distance.

4. Call button.
5. Weather Resistant

2.6 WIRE AND CABLE

1. Provide access control composite cable for locking power, card reader, door contact, request to exit/spare with overall shield.
2. Cable for exterior application shall be a minimum of 18/6 due to distances.
3. Cabling shall be rated for environment in which it is installed.
4. Exact cable required shall be coordinated with access control equipment and components.
5. Manufacturer:
   a. Belden
   b. General Cable
   c. West Penn
   d. Other approved equal

2.7 LOCKING DEVICE POWER SUPPLY

A. Locking devices are furnished and installed by Division 8 Contractor. Wiring of the locking devices, including power, will be provided by this Contractor. Coordinate with Door Hardware Schedule and Specification for exact requirements of power supply.

B. Provide multi-output power supplies suitable for use with specific locking devices. Provide power supplies with the following characteristics:

1. Input Power: 120VAC, dedicated 20A circuit.
2. Battery backup: Provide sufficient battery backup to power all door security devices connected to that IFP for a period of not less than eight (8) hours.
3. Output power ten (10) individually fused 12/24VDC outputs for lock device power.
4. Two (2) NO outputs, loss of AC and low battery. Connect loss of power and low battery alarm inputs to ACU for transmission of tamper signal to system head-end.
5. Diagnostic LEDs for power and blown fuse indication.
6. Fire alarm input: power supply shall contain a single fire alarm input terminal which will drop power to ALL connected locking devices upon signal from fire alarm relay. Fire alarm relay shall be provided by fire alarm contractor. Wiring of relay to power supply shall be by this Contractor.
7. Cabinets shall be lockable and provided with tamper switches. Provide signage warning that an alarm will sound if access is attempted and giving the telephone number of the security monitoring desk. Lock shall be keyed the same as the ACU enclosure lock.
2.8 ACS HEAD-END INTERFACE VIA LOCAL AREA NETWORK (LAN)

A. The Contractor shall provide a compatible network interface to the existing S2 Systems ACS head-end. LAN equipment required for the communication of ACU panels provided under this project with the existing ACS head-end will be provided by the Owner. Owner will commission LAN equipment and inform Contractor when network is ready for use. Contractor shall coordinate with Owner’s IS Department as required for network setup and configuration.

B. Contractor shall provide all required programming, software and graphic map updates required for the extension of the ACS. All programming, software updates, database modifications, graphic user maps, etc. shall be provided and installed/programmed by an authorized and certified S2 Systems representative.

2.6 CIRCUIT AND DEVICE SURGE PROTECTION

A. All inputs shall be protected against surges induced on device wiring. Outputs shall be protected against surges induced on control and device wiring installed outdoors and as shown. All communications equipment shall be protected against surges induced on any communications circuit. All cables and conductors, except fiber optics, which serve as communications circuits from security console to field equipment, and between field equipment, shall have surge protection circuits installed at each end.

PART 3 - EXECUTION

3.1 GENERAL

A. All work shall be coordinated with the Owner’s IT and Security personnel.

B. Perform this work in accordance with industry and professional standards and practices, and procedures specified herein.

C. Install equipment and components in accordance with manufacturer’s instructions at locations indicated on drawings.

D. Where applicable, installation shall be plumb, level, square and secure.

E. Coordinate all efforts with those of related trades. In the event of any conflict, delayed or improper preparatory work by others, notify the Engineer.

F. Verify all field conditions and provide all required adjustments necessary to fulfill the operational requirements of the system and these specifications.

G. Location of equipment is indicated diagrammatically and is not to be construed as all-inclusive and accurate. Contractor shall field verify and coordinate location of Security equipment.

3.2 EXAMINATION

A. Examine pathway elements intended for cables. Check raceways and other elements for compliance with space allocations, installation tolerances, hazards to cable installation, and other conditions affecting installation.
B. Examine roughing-in for LAN and control cable conduit systems to PCs, controllers, card readers, and other cable-connected devices to verify actual locations of conduit and back boxes before device installation.

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

3.3 INSTALLATION

A. Manufacturer’s Instructions: Install Access Control System in accordance with equipment manufacturer’s written instructions and complying with applicable portions of NEC and NECA “Standard of Installation”.

B. Grounding: All pair shields shall be grounded at one point only. Cables that originate from equipment in Data Rooms and Biomed Rooms and serve field devices shall be grounded to the signal ground terminal in the respective room.

C. Protection: Contractor shall provide protection as required of installed devices to prevent damage until final testing and acceptance. Installed equipment, devices, cabling, etc. that is damaged during the construction process and before final acceptance by Owner shall be replaced by the Contractor at no cost to Owner.

3.4 ACCESS CONTROL SYSTEM EQUIPMENT

A. Install system and associated components in accordance with manufacturers printed instructions and recommendations.

B. Provide all required and necessary interconnections, services, and adjustments required for a complete and operable system.

C. Provide control signal, communications, and data transmission grounding as required to preclude ground loops, noise, and surges from damaging system operations.

D. This Contractor shall be responsible for updating and integrating all existing databases affected by the extension of the ACS. A certified S2 Systems representative shall perform all database modifications, uploading and integration between the main ACS head-end and all components new or existing, affected by the extension.

3.5 AUDIO/VIDEO INTERCOM SYSTEM EQUIPMENT

A. Install system and associated components in accordance with manufacturers printed instructions and recommendations.

B. Provide all required and necessary interconnections, services, and adjustments required for a complete and operable system.

C. Adjust hands-free color video system with pan, tilt, and zoom for proper operation in accordance with manufacturer’s instructions.

D. Demonstration and Training:

1. Demonstration and Training shall be a 4-hour session to approved Owner IT Personnel.
2. Demonstrate that hands-free color video system with pan, tilt, and zoom functions properly.
3. Provide instruction and training of Owner’s personnel as required for operation of hands-free color video system with pan, tilt, and zoom.
4. Provide hands-on demonstration of operation of system components and complete system, including user-level program changes and functions.

3.6 WIRING INSTALLATION

A. General: Installation of conductors is specified in Division 26, 27 and 28 specifications.

3.7 SYSTEM TESTING AND ACCEPTANCE

A. General: Complete each testing phase successfully before proceeding to the next. Satisfactory completion of the tests listed below shall be a prerequisite to final acceptance of the ACS.
B. Installation Test: Upon installation test the elements just installed as the installation proceeds on a door-by-door basis. Test from end device to ACU. This test is to verify connectivity between door hardware and the ACU.
C. System Test: Upon complete installation of the system components, an all-points test shall be conducted which shall include a demonstration of the operability of each point of the ACS. Every door will be exercised with valid and keycodes and alarms will be generated. Verification of correct operations of all points and the correct data from all points shall be required for final acceptance. The System Test shall include the ACUs operating in a stand-alone mode. This test is to prove the ACU to head-end communications.
D. Problem Correction: Any problems encountered including damage to Owner equipment and ACS elements during this test will be documented and brought to the attention of the Owner and corrected at Contractor's expense. The Contractor shall promptly correct all problems encountered, providing field service personnel appropriately trained for the types of problems encountered.
E. Test Documentation: All ACS functions shall be demonstrated to ensure the entire system is operational as required by these specifications and drawings.

3.8 OPERATION AND MAINTENANCE MANUALS

A. Intent: The intent of this section is to require complete documentation of the Access Control System for the purpose of system operation and maintenance during and after the warranty period.
B. Scope: The Contractor shall provide the Owner with six complete drawing books and maintenance and operation manuals on the completed system. These manuals shall include basic wiring diagrams, schematics, and functional details such that any component, wire, or piece of equipment in the system may be easily identified by going to the actual equipment and making reference to this manual. It is required that everything in the system be neatly labeled and easily identifiable. Every terminal, wire, component, or piece of equipment, relay, and other such items shall have a number or letter designation. All of these identification characteristics shall be included in the maintenance and operation manuals.
C. Maintenance Manuals, Manufacturer’s Literature:
1. General: The maintenance manual requirement of this section is in addition to shop drawing requirements. Maintenance manuals and drawing sets shall be compiled after system fabrication and testing, and shall incorporate any changes made after shop drawing submittal. The maintenance manuals and drawing books shall be permanently bound in hard plastic covers.

2. Maintenance Manuals, Manufacturer’s Literature: Provide manufacturer’s standard literature, covering all equipment included in the system. The maintenance manuals shall contain specifications, adjustment procedures, circuit schematics, component location diagrams, and replacement parts identification.

3. Drawing Books: All drawings developed specifically for this project shall be reduced to 11” X 17”, folded and bound with hard plastic covers. Provide component identification and cross reference on the drawings for the maintenance department to understand the function of each item (the block diagram), find the room where the device is mounted (contract document plans), find its location in a rack (arrangement drawings), find how it is wired (wiring diagrams), and its detailed specifications (vendor data sheets), and how to repair it (spare part lists).

4. Include the following drawings as a minimum:
   a. Functional Block Diagram: Provide an overall block diagrams showing the major interconnections between subsystems.
   b. Arrangement Drawings: Provide drawings showing the physical arrangement of all major system components.
   c. Elevation drawings of all equipment racks showing the location of each component in the racks. Components in the racks shall be identified as in the functional block diagrams.
   d. Wiring Diagrams: Provide wiring diagrams showing all field-installed interconnecting wiring. Wire identification on the diagrams shall agree with the wire markers installed on the equipment.

3.9 LABELING

A. Label cables, equipment, panels, enclosures, modules, and power supplies with permanent markings to indicate system zone, partition, and circuit, and coordinate labels with record documentation.

B. Label wires and cables as follows:
   1. Mark all wire and cable in common at both ends.
   2. Place wire identification numbers 12 inches from the ends of each cable by using sleeve type, heat shrinkable markers.
   3. Install markers to be readable from left to right or top to bottom. Locate labels near termination points.
   4. Install labels when wire and cables are installed.
   5. Labeling shall agree with record documentation.

C. Cable Labeling Scheme
   1. General
      a. The labeling scheme shall identify the type of cable (Access Control), the Communication room where the cable terminates, and a unique cable number.
      2. The labeling scheme shall not utilize room names and/or numbers as designations
3.10 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.

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

C. Perform the following field tests and inspections and prepare test reports:

1. Test each circuit and component of each system. Tests shall include, but are not limited to, measurements of power supply output under maximum load, signal loop resistance, and leakage to ground where applicable. System components with battery backup shall be operated on battery power for a period of not less than 10 percent of the calculated battery operating time. Provide special equipment and software if testing requires special or dedicated equipment.

2. Operational Test: After installation of cables and connectors, demonstrate product capability and compliance with requirements. Test each signal path for end-to-end performance from each end of all pairs installed. Remove temporary connections when tests have been satisfactorily completed.

D. Remove and replace malfunctioning devices and circuits and retest as specified above.

3.11 STARTUP SERVICES

A. Engage a factory-authorized service representative to supervise and assist with startup service.

1. Complete installation and startup checks according to approved procedures that were developed in "Preparation" Article and with manufacturer's written instructions.

B. Enroll and prepare badges and access cards for Owner's operators, management, and security personnel

3.12 TRAINING AND INSTRUCTION

A. Provide training to Owner on the operations of the ACS. Include standard operating procedures, as well as, operational requirements during alarm and trouble modes of the system.

3.13 FINAL PROCEDURES

A. Perform any remedial work to correct inadequate performance or unacceptable conditions of, or relating only to the scope of this work as deemed necessary by Owner or Engineer at no additional expense to Owner.

B. Present, review and clarify materials to Owner, Owner's representative and/or operating personnel, and fully demonstrate operation and maintenance of this work.

C. Check, inspect and, if necessary, adjust systems equipment, devices, and components, at Owner's convenience.
3.14 ACCEPTANCE

A. Acceptance will be withheld until the successful completion of the following:

1. Acceptance of all submittals.
2. Delivery of final documentation.
3. Successful testing.
4. Successful demonstration, training and documentation review.

END OF SECTION 281000
SECTION 282000 – VIDEO SURVEILLANCE SYSTEM

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 a video surveillance system consisting of cameras, digital video recorder, data transmission wiring, and a control station with its associated equipment.
B. Related Requirements:
   1. Refer to other Division 26, 27 and 28 specifications.

1.3 SCOPE OF WORK
A. Contractor shall furnish and install a complete Security System consisting of, but not limited to:
   1. Installation and connection of Video Surveillance system including:
      a. Head end/expansion equipment.
      b. Provision of camera licensing (one license per camera).
      c. Modification of existing NVR.
      d. Modification of existing Video Management Software.
      e. Peripheral devices.
      f. Cameras, alignment and programming to meet Owner requirements.
      g. Remote viewing of camera located at door or gate exterior on display located at interior door.
      h. Provision of Ethernet/PoE extender to exterior cameras exceeding EIA/TIA distance limitations
B. Installations shall include:
   1. Coordination with Owner system.
   2. Obtaining IP addresses from Owner (OA/IT).
   3. All required equipment, components and cabling for a fully installed system.
   4. All cameras shall utilize UTP (Unshielded twisted pair) cable infrastructure.
   5. Ethernet/PoE extender
   6. All cables shall be installed above drop ceilings where possible.
   7. Remote viewing displays.
   8. Where solid ceilings are present, cables shall run in conduit or surface metal raceway.
C. Verify and coordinate rough-in requirements with architectural features, construction, and the equipment provided.

D. Provide labor, material, mounting hardware, terminations, tools, transportation, services, and equipment necessary to complete work shown on the drawings and as specified in the related sections for a "TURNKEY" and fully complete installation of a security system. It is the intent of the drawings and specifications that systems be complete and ready for operation.

E. The scope includes expansion of existing systems at this building and making connection to Owner network.

F. Contractor shall be responsible for providing all required 120 VAC power circuits to support the Security systems, even if not shown on drawings. All circuits associated with the Security system shall be protected with LOCK-ON devices and permanently labeled “SECURITY SYSTEMS” adjacent to the circuit breaker and typewritten on the panelboards index card.

1.4 DEFINITIONS

A. AGC: Automatic gain control.
B. BNC: Bayonet Neill-Concelman - type of connector.
C. B/W: Black and white.
D. CCD: Charge-coupled device.
E. FTP: File transfer protocol.
F. IP: Internet protocol.
G. LAN: Local area network.
H. MPEG: Moving picture experts group.
I. NTSC: National Television System Committee.
J. PC: Personal computer.
K. PTZ: Pan-tilt-zoom.
L. RAID: Redundant array of independent disks.
M. TCP: Transmission control protocol - connects hosts on the Internet.
N. UPS: Uninterruptible power supply.
O. WAN: Wide area network.
1.5 BIDDER QUALIFICATIONS

A. This work shall be performed by an installer with personnel that have at least three (3) years direct experience with devices, equipment, and systems of type and scope specified.

B. Installation, adjustment, and testing shall be performed by a technician having no less than 2 years of experience in security system work related to and including all associated components of the system.

1.6 GENERAL REQUIREMENTS

A. Provide all labor, materials, and equipment for the complete installation of work called for in the Contract Documents.

B. The Contractor shall verify with the manufacturer any part number listed within this Section and on the drawings prior to the purchase of those items to ensure the correct part is specified for the intended purpose.

C. It shall be the Contractor’s responsibility to follow recognized installation practices.

1.7 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include dimensions and data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For video surveillance. 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. Functional Block Diagram: Show single-line interconnections between components for signal transmission and control. Show cable types and sizes.
3. Dimensioned plan and elevations of equipment racks, control panels, and consoles. Show access and workspace requirements.
4. UPS: Sizing calculations.
5. Wiring Diagrams: For power, signal, and control wiring.

C. Design Data: Include an equipment list consisting of every piece of equipment by model number, manufacturer, serial number, location, and date of original installation. Add pretesting record of each piece of equipment, listing name of person testing, date of test, set points of adjustments, name and description of the view of preset positions, description of alarms, and description of unit output responses to an alarm.

1.8 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Data: Certificates, for cameras, camera-supporting equipment, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
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.

B. Product Warranty: Sample of special warranty.

1.9 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For cameras, power supplies, infrared illuminators, monitors, videotape recorders, digital video recorders, video switches, and control-station components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

1. Lists of spare parts and replacement components recommended to be stored at the site for ready access.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of cameras, equipment related to camera operation, and control-station equipment that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Three years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 VIDEO SURVEILLANCE SYSTEM DESCRIPTION

A. Expand existing video surveillance system. Owner’s existing system is ONSSI as the video management system and compatible cameras. Expand existing NVR as required. NVR shall be sized to accommodate camera record as specified herein.

2.2 VIDEO SURVEILLANCE SYSTEM

A. All video surveillance equipment, including programming, cabling and hardware shall be provided by the Contractor.

1. Provide IP cameras, Ethernet/PoE extender and all other necessary equipment/hardware and mounting required for a complete and operable system.
2. Provide all required 120VAC power requirements to support the system.

B. Video Surveillance Video Management and NVR System: Owner’s existing system is ONSSI.

C. Video Surveillance Camera Manufacturers.

1. Basis of Design Product: Subject to compliance with requirements, provide products by one of the following:
D. Provide new Video Surveillance equipment and components as indicated and specified. Refer to Detail Drawings for additional requirements.

1. Connect new cameras to network and configure software as required per Owner direction.
2. Contractor shall provide one license per each camera required.
3. Contractor shall obtain IP address for each camera from Owner (OA/IT).
4. Fixed IP Cameras: Refer to Detail Drawings.

E. Fixed IP 3MP Camera

1. Video Resolution: 1920 x 1080/1600 x 1200/2048 x 1536
2. Shutter Time: 1/60 – 1/10000
3. Imager: 1/3 MOS
4. Frame Rate: 60fps at 1080p 30fps all other resolutions
5. Min Illumination (color): 0.04 lux
6. Min Illumination (B/W): 0.01 lux
7. Video Compression: H.264, M-JPEG
8. Wide Dynamic Range: 133dB Minimum
9. Lens Type: Varifocal 2.8mm – 10mm remote zoom auto-back focus
10. Form Factor: Mini-dome
11. Operating Temperatures: 14 °F ~ 122 °
12. Power: PoE (Class0 Device)
13. Camera Angle Adjustment: Horizontal: ± 180°, Vertical: 0-85°,
14. Image Tilt Adjustment Range: -45°(Left) to +300° (Right)
15. Streaming Video: Multiple streams individually configurable.

F. Camera-supporting Equipment

1. Minimum Load Rating: Rated for load in excess of the total weight supported times a minimum safety factor of two.
2. Mounting Brackets for Fixed Cameras: Type matched to items supported and mounting conditions. Include manual pan-and-tilt adjustment.

G. System Features: The following identifies minimum operation of the video surveillance system and is not to be construed as all-inclusive or interpreted as requiring limitation or exclusion of other system features addressed elsewhere in these Construction Documents.

1. System can be easily configured by the Owner to set any variety of activities or responses to events based upon information stored within the system.
2. System shall be capable of being monitored by a local UL approved Central Station.
3. In the event of loss of power or exhausting of UPS source and immediately upon restoration of primary system operating power, systems shall automatically reload all data, software, and instruction back to the configured state prior to power failure. System shall be fully operational within one hundred twenty (120) seconds after power restoration.

H. Cables: Reference Section 271513 – Communications Copper Horizontal Cabling.
PART 3 - EXECUTION

3.1 EXAMINATION
A. Examine pathway elements intended for cables. Check raceways and other elements for compliance with space allocations, installation tolerance, hazards to camera installation, and other conditions affecting installation.
B. Examine roughing-in for LAN, WAN, and IP network before device installation.
C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 WIRING
A. Comply with requirements in Division 27 specifications.
B. Wiring Method: Install cables in raceways unless otherwise indicated.

3.3 GENERAL
A. All work shall be coordinated with the Owner’s IT and Security personnel.
B. Perform this work in accordance with industry and professional standards and practices, and procedures specified herein.
C. Install equipment and components in accordance with manufacturer’s instructions at locations indicated on drawings.
D. Where applicable, installation shall be plumb, level, square and secure.
E. Coordinate all efforts with those of related trades. In the event of any conflict, delayed or improper preparatory work by others, notify the Engineer.
F. Verify all field conditions and provide all required adjustments necessary to fulfill the operational requirements of the system and these specifications.
G. Location of equipment is indicated diagrammatically and is not to be construed as all-inclusive and accurate. Contractor shall field verify and coordinate location of Security equipment.

3.4 VIDEO SURVEILLANCE SYSTEM EQUIPMENT
A. Provide rough-in box at each camera location, flush or surface mounted, as required by the environment.
   1. All boxes shall be flush mounted in finished exterior or interior locations.
   2. Provide boxes specific to and provided by the camera manufacturer when available.
B. Verify exact location of camera placement with Engineer and Owner.
C. Modify all programming, aiming, etc. as required.
D. Camera Assembly Installation: Provide and install positioning and support elements for camera assemblies where required. Such provisions shall attach to and wholly reside within areas designated for same.

1. Provide all required mounting hardware, lenses, and support equipment as required for the installation and application.
2. Coordinate location of boxes and conduit serving camera assembly components to minimize exposed run of cable. Conduits shall route through building wall directly into camera bracket unless structure will not allow.
3. Verify that camera assembly harnesses are properly dressed, routed and secured to preclude interference with camera motion and coverage.
4. Exterior supports shall be heavy-duty type. Obtain written approval of all visible mounting configurations prior to installation.
5. Complete optical back-focus, electrical focus, beam set and preliminary iris adjustments, camera, lenses, and pan and tilt operation checks prior to mounting.

E. Equipment/Component Installation:

1. Install enclosures square and plumb.
2. Set flush-mounted units so that face of cover, bezel, or escutcheon shall be in same plane as surrounding finished surface. Mount panels, and trim so that there are no gaps, cracks, or obvious lines between trim and adjacent finished surface, and ready them to receive final paint as applicable.
3. Provide access panels where needed to access enclosure in wall or ceilings as indicated and/or dimensioned on shop drawings. Finish panels to match adjoining surfaces, where required by the Architect/Engineer.
4. Install access covers, hinged panels, or pull-out drawers to ensure complete access to terminals and interior components.
5. Fasten removable covers containing any wired component with a continuous hinge along one side and with associated wiring secured and dressed to provide an adequate service loop. Appropriate stop locks shall be provided to hold all hinged panels and drawers in serviceable position.
6. Provide permanent label on front of each panel, including designation as assigned and referenced consistently throughout this project, circuit breaker number and associated source electrical distribution panel designation as applicable.

3.5 QUALITY ASSURANCE

A. All cable and connectors shall be installed in a neat and workmanlike manner.

B. All methods of construction that are not specifically described or indicated in the contract documents shall be subject to the control and approval of the Engineer.

C. Equipment and materials shall be of the quality and manufacture indicated. The equipment specified is based upon the acceptable manufacturers listed.

D. Where “approved equal” is stated, equipment shall be equivalent in every way to that of the equipment specified and subject to approval.
3.6 TEST EQUIPMENT

A. Furnish, store and maintain test equipment at job site as required for both routine and performance testing of this work; thereafter, remove test equipment from site.

B. Provide the following items of professional grade test equipment as required for work.

1. Continuity tester.
2. Regulated, variable 50 VDC power supply
3. Test video monitor
4. True rms AC voltmeter (audio).
5. TV pattern generator (bar, dot, crosshatch).
6. TV resolution, linearity, color charts
7. Video waveform monitor
8. Volt-ohm-multi meter.

3.7 CABLE INSTALLATION REQUIREMENTS

A. Materials (ceiling tiles, cables, network equipment, etc.) inadvertently demolished or damaged by the Contractor during the course of construction shall be replaced and/or repaired by the Contractor at no additional cost to the Owner.

B. All cable and connectors shall be installed in a neat and workmanlike manner. All methods of construction that are not specifically described or indicated in the contract documents shall be subject to the control and approval of the Engineer.

C. Horizontal Cabling Installation:

1. All UTP cable shall be installed in accordance with horizontal cabling requirements of Division 27 specifications.
2. All cable placement shall conform to EIA/TIA industry standards with regard to anchoring, cable support, and separation from other facilities. Refer to cable pathway requirements of Division 27 specifications
3. UTP cabling shall be installed utilizing rack mounted patch panels, RJ-45 outlet jacks and cover plates, and station and patch cables/cords - EIA/TIA standard horizontal cabling requirements.
4. Cables shall not sag or droop but should be installed so as to maintain a flat plane with smooth transitions from one level or direction to another.
5. Topology: The horizontal cabling shall be configured in a star topology unless specifically directed or indicated otherwise.
6. Install wiring in conduit, on J-hooks or cable trays except within consoles, cabinets, desks, and counters. In accessible ceiling spaces and in gypsum board partitions, unenclosed wiring methods may be used. All cable and raceway wiring shall be routed concealed except in unfinished spaces.
7. Install exposed cable parallel and perpendicular to surfaces or exposed structural members and follow surface contours where possible.
8. Horizontal Cable Support: In suspended ceiling where cable trays or conduit are not available, the Contractor shall bundle, in bundles of 50 or less, station cables with a velcro strap solution. Cable bundles shall be supported by J-Hook, Cable Hook or Cable.
9. Provide service loops (additional slack) at both ends to accommodate future cabling system changes. Leave a 5 ft. service loop on each cable at head end room/equipment and leave 15 ft. slack on each cable in each outlet. Do not store service loops in a bundled loop. Store slack above lay-in ceiling where possible or at a mutually agreed upon location where exposed.

10. Splices are not permitted for twisted-pair horizontal cabling.

11. Bridged taps are not permitted in copper-based horizontal cabling.

D. Power Separation: Comply with ANSI/TIA/EIA rules for separation of unshielded copper voice and data system cables from potential EMI sources, including electrical power lines and equipment. Route at right angles to electrical power circuits.

3.8 PRELIMINARY CHECKS AND TESTING

A. Conduct preliminary checks and testing prior to performance testing and subsequent to completion of related or adjacent work of other trades as applies. Verify safe and proper operation of all components, devices, or equipment, nominal signal levels within systems, and absence of extraneous or degrading signals.

B. Preliminary Check: Contractor shall perform the following verification and/or testing procedures:

1. Proper grounding of devices and equipment
2. Proper provision of power to devices and equipment
3. Absence of debris of any kind, tools, etc.
4. Preliminary aiming and setup of video camera assemblies
5. Mechanical integrity of all support and positioning provisions, i.e., associated with video camera assemblies, etc.
6. Proper locking and releasing of electronic locking mechanism.

3.9 ON-SITE COMMISSIONING AND TRAINING

A. Contractor shall provide direct participation in on-site commissioning activity.

B. Provide a minimum of 8 hours on-site training to the Owner. Training shall be coordinated with the Owner’s Director of Security.

1. Provide, at the discretion of the Owner’s Director of Security, one additional follow-up training session, and minimum of 4 hours, to repeat or refresh previous training after Owner has operated and learned the system within 12 months of initial acceptance of the system by the Owner.

C. Provide system administration that is factory trained with the expertise on installing, configuring, and commissioning the systems to the customer’s specific requirements; and to provide on-site training on the system operation and administration.

D. On-site training shall be available for system administrators, operators, and other qualified personnel.

E. On-site commissioning shall include, but not be limited to, the following:

1. Hardware set-up and testing
2. Preventative maintenance and troubleshooting
3. End-user training
4. End-user follow-up training within one year after acceptance, at the discretion of the District.
5. Database configuration and build assistance.

3.10 FINAL PROCEDURES

A. Perform any remedial work to correct inadequate performance or unacceptable conditions of, or relating only to the scope of this work as deemed necessary by Owner or Engineer at no additional expense to Owner.

B. Present, review and clarify materials to Owner, Owner's representative and/or operating personnel, and fully demonstrate operation and maintenance of this work.

C. Check, inspect and, if necessary, adjust systems equipment, devices, and components, at Owner's convenience.

3.11 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose. Tasks shall include, but are not limited to, the following:

1. Check cable connections.
2. Check proper operation of cameras and lenses. Verify operation of auto-iris lenses and adjust back-focus as needed.
3. Adjust all preset positions; consult Owner's personnel.
4. Recommend changes to cameras, lenses, and associated equipment to improve Owner's use of video surveillance system.
5. Provide a written report of adjustments and recommendations.

3.12 CLEANING

A. Clean installed items using methods and materials recommended in writing by manufacturer.

B. Clean video-surveillance-system components, including camera-housing windows, lenses, and monitor screens.

END OF SECTION 282000
SECTION 311000 - SITE CLEARING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Protecting existing vegetation to remain.
2. Removing existing vegetation.
3. Clearing and grubbing.
4. Stripping and stockpiling topsoil.
5. Removing above- and below-grade site improvements.
6. Disconnecting, capping, or sealing site utilities.
7. Temporary erosion and sedimentation control.

1.2 DEFINITIONS

A. General Permit: The General Permit for storm water discharges associated with construction activity (Land Disturbance General Permit No. MO-R100038) issued to FMDC as a blanket permit by the Missouri Department of Natural Resources, Water Pollution Program.

B. Storm Water Pollution Prevention Plan (SWPPP): A plan required by the General Permit that includes site map(s), an identification of construction/contractor activities that could cause pollutants in the storm water, and a description of measures or practices to control these pollutants.

C. Best Management Practice (BMP): Any program, technology, process, siting criteria, operating method, measure, or device that controls, prevents, removes, or reduces pollution.

D. Temporary Seeding and Mulching: Placement of a quick ground cover to reduce erosion in areas expected to be re-disturbed.

E. Silt Fence: A geotextile barrier fence to contain sediment by removing suspended particles from water passing through the fence.

F. Sediment Removal: Removal of accumulated sediment to restore the efficiency of sediment control features.

1.3 SUBMITTALS

A. The Contractor shall submit his proposed “Erosion Control Plan” for review and approval by the Owner’s Representative. Approval of the plan does not relieve the Contractor of his contractual responsibility to prevent the discharge of pollutants into the receiving drainage ways.
B. The Contractor shall review the Plans provided by the Designer, make appropriate field corrections to the document, and submit final corrected copies of the SWPPP to the Owner and facility.

1.4 MATERIAL OWNERSHIP

A. Except for materials indicated to be stockpiled or otherwise remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.5 FIELD CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed trafficways if required by Owner or authorities having jurisdiction.

B. Salvageable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises at the on-site location provided by the owner.

C. Utility Locator Service: Notify Missouri One Call and the Owner for area where Project is located before site clearing. Provide 48-hours’ notice.

D. Do not commence site clearing operations until temporary erosion- and sedimentation-control measures are in place.

E. Soil Stripping, Handling, and Stockpiling: Perform only when the topsoil is dry or slightly moist.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Section 312000 "Earth Moving."

1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.

B. Temporary Seeding:

1. December 1 to March 1: 50 lbs oats/acre.
2. March 1 to December 1: 50 lbs cereal rye or wheat.
3. Mulch shall be wheat straw.
C. Temporary Inlet Check:
   1. Silt fence ditch checks: Geotextile meeting the requirements of this specification.

D. Wire Supported and Self-Supporting Silt Fence:
   1. Geotextile Fabric
      a. Fibers used in geotextiles shall consist of longchain synthetic polymers, composed
         of at least 85 percent by weight polyolefins, polyesters, or polyamides. They shall
         be formed into a network such that the filaments or yarns retain dimensional
         stability relative to each other, including selvages.
      b. The geotextile shall be free of any treatment or coating which might adversely alter
         its physical properties after installation.
      c. Geotextile shall be furnished in 36” width rolls.
      d. Geotextile rolls shall be furnished with suitable wrapping for protection against
         moisture and extended ultraviolet exposure.
      e. Each roll shall be labeled or tagged to provide product identification sufficient for
         inventory.
      f. Rolls shall be stored in a manner, which protects them from the elements.
      g. Geotextile shall conform to the following:

<table>
<thead>
<tr>
<th>Property</th>
<th>Test Method</th>
<th>Wire Fence Supported Requirements</th>
<th>Self Supported Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tensile Strength, Lbs.</td>
<td>ASTM D4632</td>
<td>90 Minimum²</td>
<td>90 Minimum²</td>
</tr>
<tr>
<td>Elongation at 50% Minimum</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tensile Strength (45 Lbs.)</td>
<td>ASTM D4632</td>
<td>N/A</td>
<td>50 Maximum</td>
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<tr>
<td>Filtering Efficiency, %</td>
<td>VTM-51³</td>
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<td>75</td>
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<tr>
<td>Flow Rate gal/ft/min</td>
<td>VTM-51³</td>
<td>0.3</td>
<td>0.3</td>
</tr>
<tr>
<td>Ultraviolet Degradation at 500 hrs.</td>
<td>ASTM D4355</td>
<td>Minimum 70%</td>
<td>Minimum 70%</td>
</tr>
</tbody>
</table>

Notes:
1. All numerical values represent minimum average roll value.
   A. When tested in any principal direction.
   B. Virginia DOT test method.

2. Posts: Wood, steel or synthetic posts may be used. Posts shall have a minimum length of
   36” plus embedment depth (24” min.). Posts shall have sufficient strength to resist
   damage during installation and to support applied loads.
3. Support Fence: Wire or other support fence shall be at least 24” high and strong enough to support applied loads.

4. Prefabricated Fence: Prefabricated fence systems may be used provided they meet all of the above material requirements.

2.2 CERTIFICATION AND SAMPLING:

A. The Contractor shall furnish a manufacturer’s certification, stating the material conforms to the requirements of these specifications.

B. The certification shall include, or have attached, typical results of tests for the specified properties, representative of the materials supplied.

C. The Owner’s Representative reserves the right to sample and test any material offered for use.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Verify that shrubs and other vegetation to remain or to be relocated have been flagged and that protection zones have been identified and enclosed according to requirements in Section 015639 “Temporary Plant Protection.”

C. Protect existing site improvements to remain from damage during construction.

   1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

A. The Owner’s Representative may limit the surface area of erodible earth material exposed by clearing and grubbing, excavation, borrow, or fill operations.

B. The Owner’s Representative may direct the Contractor to provide immediate permanent or temporary pollution control measures to prevent contamination of adjacent streams, other watercourses, lakes, ponds, or other areas of water impoundment. Work may involve the construction of temporary berms, dikes, dams, sediment basins, slope drains, use of temporary mulches, seeding or other control devices or methods to control erosion.

C. The Contractor shall incorporate permanent erosion control features at the earliest practicable time.

D. The Contractor at no additional cost shall provide temporary pollution control measures needed to control erosion during normal construction practices to the Owner.
E. Contractor shall designate trained and knowledgable personnel to coordinate all SWPPP activities, and identify these personnel to the Owner’s Representative during construction. Missouri Department of Natural Resources offers training classes in Erosion Control free of charge in Jefferson City. Contact for training: David Goggins at (573) 751-2556.

F. The SWPPP is a living document. As the conditions of the site changes, the SWPPP should be updated by the Contractor.

G. The SWPPP is subject to random inspection by the Owner. The SWPPP should be kept up to date by the Contractor and available for inspection at any time.

H. If Contractor determines that any BMP should need modification, the changes shall be dated and documented, and all necessary field changes performed.

3.3 LIMITATION OF AREA DISTURBED

A. The Contractor’s operations shall be scheduled to install permanent erosion control features immediately after clearing and grubbing, and grading.

B. The surface area of erodible earth material exposed at one time by clearing and grubbing, excavating, fill, or borrow shall not exceed 200,000 square feet without written approval of the Owner’s Representative.

C. The Owner’s Representative may limit the area of clearing and grubbing, excavation, borrow, and embankment operations commensurate with the Contractor’s capability and progress in completing the finish grading, mulching, seeding, and other such permanent pollution control measures current.

D. The Contractor shall respond to seasonal variations. If required by weather, temporary erosion control measures shall be taken immediately.

3.4 CONFLICT WITH FEDERAL, STATE OR LOCAL LAWS, RULES OR REGULATIONS

A. In case of conflict between these requirements and pollution control laws, rules, or regulations or other Federal, State or local agencies, the more restrictive laws, rules, or regulations shall apply.

3.5 TEMPORARY SEEDING AND MULCHING

A. General

B. Construction Requirements:

1. Permanent seeding and mulching following temporary seeding will be performed during the favorable seeding seasons only.

2. Temporary seeding mixtures and planting season:

   a. December 1 to March 1: 50 lbs. oat grain per acre
b. March 1 to December 1: 50 lbs. (cereal rye or wheat) per acre

3. Temporary mulch, fertilizer, and lime for seeding:
   a. Fertilizer and mulch for temporary seed mixtures shall be applied in accordance with Section 329200.
   b. Fertilizer shall be applied at the rate specified for permanent seeding.
   c. Lime will not be required for temporary seeding.

3.6 SILT FENCE

A. General
   1. Install along the right-of-way line and around inlets to prevent sediment from entering the pipe system.

B. General Requirements:
   1. The Contractor shall install a temporary silt fence in locations shown on the drawings, around inlets that accept flows containing silt, and other locations necessary to prevent the discharge of silt from the site.
   2. Installation shall conform to the detail at the end of this section.
   3. Fence construction shall be adequate to handle the stress from hydraulic and sediment loading.

C. Installation
   1. Geotextile at the bottom of the fence shall be buried as indicated on the detail.
   2. The trench shall be backfilled and the soil compacted over the geotextile. The geotextile shall be spliced together as indicated on the detail.
   3. Post Installation
      a. Post spacing shall not exceed 8' for wire support fence installation or 5' for self supported installations.
      b. Posts shall be driven a minimum of 24" into the ground. Where rock is encountered, posts shall be installed in a manner approved by the Owner’s Representative.
      c. Closer spacing, greater embedment depth and/or wider posts shall be used in low areas, soft, or swampy ground to ensure adequate resistance to applied loads.
   4. When support fence is used, the mesh shall be fastened securely to the upstream side of the post.
      a. The mesh shall extend into the trench a minimum of 2" and extend a maximum of 36" above the original ground surface.
   5. When self-supported fence is used, the geotextile shall be securely fastened to fence posts.
   6. Maintenance
a. The Contractor shall maintain the integrity of silt fences as long as they are necessary to contain sediment runoff.
b. The Contractor shall inspect all temporary silt fences immediately after each rainfall and at least daily, during prolonged rainfall.
c. The Contractor shall immediately correct deficiencies.
d. The Contractor shall make a daily review of the location of silt fences in areas where construction activities have changed the natural contour and drainage runoff to ensure that the silt fences are properly located for effectiveness.
e. Where a single fence is not adequate to handle the volume of silt or flows are not completely intercepted, additional silt fences shall be installed.

7. The Contractor shall remove and dispose of sediment deposits when the deposit approaches one-half the height of the fence.

8. The silt fence shall remain in place until the upstream surface is stabilized. Upon removal, the Contractor shall remove the silt fence, dispose of excess silt, and restore the disturbed area in accordance with this section.

3.7 TREE AND PLANT PROTECTION

A. Protect plants remaining on-site according to requirements in Section 015639 "Temporary Plant Protection."

B. Repair or replace shrubs and other vegetation indicated to remain or be relocated that are damaged by construction operations according to requirements in Section 015639 "Temporary Plant Protection."

3.8 EXISTING UTILITIES

A. Locate, identify, disconnect, and seal or cap utilities indicated to be removed or abandoned in place.

1. Arrange with utility companies to shut off indicated utilities.

B. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others, unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Owner not less than two days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Owner’s written permission.

C. Removal of underground utilities is included in earthwork sections; in applicable fire suppression, plumbing, HVAC, electrical, communications, electronic safety and security, and utilities sections; and in Section 024116 "Structure Demolition" and Section 024119 "Selective Demolition."
3.9 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction.
   1. Grind down stumps and remove roots larger than 3 inches in diameter, obstructions, and debris to a depth of 18 inches below exposed subgrade.
   2. Do not remove trees, shrubs, grass, and other vegetation indicated to remain or to be relocated or outside of the construction limits.

B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.
   1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches, and compact to 95% of the standard laboratory density.

3.10 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.

B. Strip topsoil to depth of 4-inches in a manner to prevent intermingling with underlying subsoil or other waste materials.
   1. Remove subsoil and non-soil materials from topsoil, including clay lumps, gravel, and other objects more than 2 inches in diameter; trash, debris, weeds, roots, and other waste materials.

C. Stockpile topsoil away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water. The location of the topsoil stockpile is anticipated to be in the large parking lot on the west side of the school campus. The exact location of the topsoil stockpile will be at a mutually agreeable location between the Owner and the Contractor.
   1. Limit height of topsoil stockpiles to 72 inches or as shown on the plans.
   2. Do not stockpile topsoil within protection zones.
   3. Dispose of surplus topsoil. Surplus topsoil is that which exceeds quantity indicated to be stockpiled or reused.
   4. Stockpile surplus topsoil to allow for re-spreading deeper topsoil.

3.11 SITE IMPROVEMENTS

A. Remove existing above- and below-grade improvements as indicated and necessary to facilitate new construction.

B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.
1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut along line of existing pavement to remain before removing adjacent existing pavement. Saw-cut faces vertically.

2. Paint cut ends of steel reinforcement in concrete to remain with two coats of antirust coating, following coating manufacturer's written instructions. Keep paint off surfaces that will remain exposed.

### 3.12 DISPOSAL OF SURPLUS AND WASTE MATERIALS

**A.** Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.

**B.** Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials, and transport them to recycling facilities. Do not interfere with other Project work.

END OF SECTION 311000
SECTION 312000 - EARTH MOVING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Excavating and filling for rough grading the Site.
   2. Preparing subgrades for slabs-on-grade, walks, pavements, structures, turf and grasses and plants.
   3. Excavating and backfilling for buildings and structures.
   4. Drainage course for concrete slabs-on-grade.
   5. Subbase course for concrete walks and pavements.
   6. Subbase course and base course for asphalt paving.
   7. Excavating and backfilling trenches for utilities and pits for buried utility structures.

B. RELATED DOCUMENTS
   1. Division 31 Section "Site Clearing" for site stripping, grubbing, stripping, and stockpiling topsoil, and removal of above- and below-grade improvements and utilities.
   2. Division 32 Section "Turf and Grasses" for finish grading in turf and grass areas, including preparing and placing planting soil for turf areas.

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 Designer. 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 Designer. Unauthorized excavation, as well as remedial work directed by Designer, shall 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 man-made 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 SUBMITTALS

A. Product Data: For the following:

1. Each type of plastic warning tape.

B. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated.

1. Classification according to ASTM D 2487 of each on-site and borrow soil material proposed for fill and backfill.
2. Laboratory compaction curve according to ASTM D 698 (Standard Proctor) for each onsite and borrow soil material proposed for fill and backfill.

C. Pre-excavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by earthwork operations. Submit to the Designer before earthwork begins.

1.4 FIELD CONDITIONS

A. Utility Locator Service: Notify utility locator service for area where Project is located before beginning earth-moving operations.
B. Do not commence earth-moving operations until plant-protection measures specified in Section 015639 "Temporary Plant Protection" are in place.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Satisfactory Soils: Soil Classification Groups GW, GP, GM, SW, SP, and SM according to ASTM D 2487, or a combination of these groups; free of rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.
   1. Fill placed in building areas
      a. Liquid Limit: < 45
      b. Plasticity Limit: < 25

C. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D 2487, or a combination of these groups.
   1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

D. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; conforming to Division 1000, Materials Details, MoDOT Standard Specifications (Types 1 thru 5).

E. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; conforming to Division 1000, Materials Details, MoDOT Standard Specifications (Types 1 thru 5).

F. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.

G. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; complying with MSD 1 Bedding (for pipes 27” and smaller), or MSD 2 Bedding (for pipes 30” and larger). ASTM D 2940/D 2940M; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.

H. Drainage Course: Narrowly graded mixture of crushed stone or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch sieve and zero to 5 percent passing a No. 8 sieve.

I. Sand: ASTM C 33; fine aggregate, natural, or manufactured sand.
2.1 GEOTEXTILES

A. Subsurface Drainage Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:

1. Survivability: Class 2; AASHTO M 288.
2. Survivability: As follows:
   a. Grab Tensile Strength: 157 lbf; ASTM D 4632.
   b. Sewn Seam Strength: 142 lbf; ASTM D 4632.
   c. Tear Strength: 56 lbf; ASTM D 4533.
   d. Puncture Strength: 56 lbf; ASTM D 4833.

3. Apparent Opening Size: No. 40 sieve, maximum; ASTM D 4751.
4. Permittivity: 0.2 per second, minimum; ASTM D 4491.
5. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

B. Separation Geotextile: Woven geotextile fabric, manufactured for separation applications, made from polyolefins or polyesters; with elongation less than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:

1. Survivability: Class 2; AASHTO M 288.
2. Survivability: As follows:
   a. Grab Tensile Strength: 247 lbf; ASTM D 4632.
   b. Sewn Seam Strength: 222 lbf; ASTM D 4632.
   c. Tear Strength: 90 lbf; ASTM D 4533.
   d. Puncture Strength: 90 lbf; ASTM D 4833.

3. Apparent Opening Size: No. 60 sieve, maximum; ASTM D 4751.
4. Permittivity: 0.02 per second, minimum; ASTM D 4491.
5. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

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 DEWATERING

A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.

1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

3.3 EXPLOSIVES

A. Explosives: Do not use explosives.

3.4 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.

3.5 EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.
1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.

B. Excavations at Edges of Plant-Protection Zones:

1. Excavate by hand or with an air spade to indicated lines, cross sections, elevations, and subgrades. If excavating by hand, use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
2. Cut and protect roots according to requirements in Section 015639 "Temporary Plant Protection."

3.6 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.7 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.

D. Trenches in Plant-Protection Zones:

1. Hand-excavate to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
2. Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities.
3. Cut and protect roots according to requirements in Section 015639 "Temporary Plant Protection."
3.8  SUBGRADE INSPECTION

A.  Proof-roll subgrade below the building slabs and pavements with a pneumatic-tired dump truck to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

B.  Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Designer, without additional compensation.

3.9  STORAGE OF SOIL MATERIALS

A.  Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

   1.  Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.10  UTILITY TRENCH BACKFILL

A.  Place utility trenches per the Metropolitan St. Louis Sewer District “Standard Construction Specifications for Sewers and Drainage Facilities”.

3.11  SOIL FILL

A.  Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

B.  Place and compact fill material in layers to required elevations as follows:

   1.  Under grass and planted areas, use satisfactory soil material.
   2.  Under walks and pavements, use satisfactory soil material.
   3.  Under steps and ramps, use engineered fill.
   4.  Under building slabs, use engineered fill.
   5.  Under footings and foundations, use engineered fill.

3.12  SOIL MOISTURE CONTROL

A.  Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.

   1.  Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
   2.  Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.
3.13 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill soil materials evenly on all sides of structures to required elevations and uniformly along the full length of each structure.

C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 698:

1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 95 percent.
2. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 92 percent.
3. Under turf or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 85 percent.
4. For utility trenches, compact each layer of initial and final backfill soil material at 92 percent.

3.14 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

1. Provide a smooth transition between adjacent existing grades and new grades.
2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:

1. Turf or Unpaved Areas: Plus or minus 1/2 inch.
2. Synthetic Turf: Plus or minus 1/4 or 1/8 inch in 10 feet.
3. Walks: Plus or minus 1/4 inch.
4. Pavements: Plus or minus 1/2 inch.

3.15 SUBBASE AND BASE COURSES UNDER PAVEMENTS AND WALKS

A. Place subbase course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place subbase course under pavements and walks as follows:

1. Shape subbase course to required crown elevations and cross-slope grades.
2. Place subbase course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
3. Compact subbase course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 98 percent of the standard laboratory density.
3.16 SUBBASE AND BASE COURSES UNDER SYNTHETIC TURF

A. Place subbase course and base course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place subbase course and base course under pavements and walks as follows:
   1. Stabilize subgrade with cement modifier and prepare according to specification herein.
   2. Install separation geotextile on stabilized soil according to manufacturer's written instructions, overlapping sides and ends.
   3. Place subbase course material over separation fabric under synthetic turf.
   4. Shape subbase course and base course to required crown elevations and cross-slope grades.
   5. Place subbase course and base course 6 inches or less in compacted thickness in a single layer.
   6. Compact subbase course and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of the standard laboratory density.
   7. Compact subgrade at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of the standard laboratory density.

3.17 CONSTRUCTION ENTRANCE.

A. The Contractor shall construct a construction entrance according to the plans. The aggregate surface course (6” thick min.) may be constructed in a single lift without using a spreader provided the aggregate is deposited and trimmed with minimal blading or manipulation to prevent segregation. Compaction shall be to the satisfaction of the Engineer.

B. The Contractor shall restore the construction entrance after the completion of construction activities.

3.18 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. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Designer.
E. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:

1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least 1 test or every 2,000 square feet or less of paved area or building slab, but in no case fewer than 3 tests.
2. Foundation Wall Backfill: At each compacted backfill layer, at least 1 test for each 100 feet or less of wall length, but no fewer than 2 tests.
3. Trench Backfill: At each compacted initial and final backfill layer, at least 1 test for each 150 feet or less of trench length, but no fewer than 2 tests.

F. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

3.19 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.

3.20 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
SECTION 321313 - CONCRETE PAVING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes Concrete Paving. Including the following:
   1. Curbs and gutters.
   2. Walks.
   3. Stamped Concrete

1.2 RELATED DOCUMENTS

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


1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash and other pozzolans, and ground granulated blast-furnace slag.

B. Exposed Aggregate Detection Strip: The exposed aggregate detection strip, for a textured flatwork surface on exterior walkways, as illustrated on the drawings. The textured surface will serve as a warning to the visually impaired that the edge of the walkway is near. The textured surface should be detectable to a pedestrian’s foot and to a detection cane utilized by some with low vision.

C. Decorative stamped concrete: The decorative stamped concrete is a stamped concrete ribbon to be constructed behind the back of curb along Magnolia Avenue as illustrated on the drawings.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each type of product, ingredient, or admixture requiring color selection.

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

D. Material Test Reports: For each of the following:
1. Aggregates.

E. Field quality-control reports.

F. Mock-up panels: Mock-up 2’x2’ panel showing the color and pattern for each of the following:
   1. Decorative stamped concrete for review and approval by the Designer.
   2. Exposed aggregate concrete sidewalk for review and approval by the Designer.

1.5 QUALITY ASSURANCE

A. Comply with the applicable requirements in the current edition of the Missouri Standard Specifications for Highway Construction”.
   1. Measurement and payment provisions included in the Specifications do not apply to this work.

B. Manufacturer Qualifications: Manufacturer of ready-mixed concrete products who complies with ASTM C 94/C 94M requirements for production facilities and equipment.
   1. Manufacturer certified according to NRMCA’s “Certification of Ready Mixed Concrete Production Facilities.”

C. Testing Agency Qualifications: An independent agency qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.
   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.

D. Concrete Testing Service: The General Contractor will engage a qualified Testing Agency to perform material evaluation tests and to design concrete mixtures. The testing representative shall be ACI Concrete Field Testing Technician – Grade 1.


F. Preinstallation Conference: Conduct conference at Project site.
   a. Before submitting design mixtures, review concrete pavement mixture design and examine procedures for ensuring quality of concrete materials and concrete pavement construction practices. Require representatives, including the following, of each entity directly concerned with concrete pavement, to attend conference:
      1) Contractor’s superintendent.
      2) Independent testing agency responsible for concrete design mixtures.
      3) Ready-mix concrete producer.
      4) Concrete pavement subcontractor.
G. Comply with the applicable requirements in the current edition of the City of St. Louis Board of Public Service “Standard Specifications, Bid Items and Standard Details for Street and Alley Construction”.

1. Measurement and payment provisions included in the Standard Specifications do not apply to this work.

H. Mockups (Stamped Concrete)

1. Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   a. Build mockups of full-thickness sections of concrete paving to demonstrate typical joints; surface finish, texture, and color; curing; and standard of workmanship.
   b. Build mockups of concrete paving in the location and of the size indicated or, if not indicated, build mockups where directed by Engineer and not less than 24 inches by 24 inches.
   c. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Engineer specifically approves such deviations in writing.
   d. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 PROJECT CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

B. Cold-Weather Concrete Placement: Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing, or low temperatures. Comply with ACI 306.1 and the following:

1. When air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.

2. Do not use frozen materials or materials containing ice or snow.

3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in design mixtures.

4. No additional compensation will be allowed for cold weather protection.

C. Hot-Weather Concrete Placement: Comply with ACI 301 and as follows when hot-weather conditions exist:

1. Cool ingredients before mixing to 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 in total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.

2. Cover steel reinforcement with water-soaked burlap, so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

4. No additional compensation will be allowed for hot weather placement.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

A. ACI Publications: Comply with ACI 301 unless otherwise indicated.

2.2 MANUFACTURERS

A. In other part 2 articles where titles below introduce lists, the following requirements apply to products selection:

1. Applicable Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.

2. Products: Subject to compliance with requirements, provide one of the products specified.

3. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, manufacturers specified.

4. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.3 FORMS

A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, and smooth exposed surfaces.

1. Use flexible or uniformly curved forms for curves with a radius of 100 feet or less. Do not use notched and bent forms.

B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and that will not impair subsequent treatments of concrete surfaces.

2.4 SURFACE COLORING

A. Pigmented Mineral Dry-Shake Hardener: Factory-packaged, dry combination of portland cement, graded quartz aggregate, color pigments, and plasticizing admixture. Use color pigments that are finely ground, nonfading mineral oxides interground with cement.
2.5 STAMPING DEVICES

A. Stamp Mats: Semirigid polyurethane mats with projecting textured and ridged underside capable of imprinting texture and joint patterns on plastic concrete.

B. Stamp Tools: Open-grid, aluminum or rigid-plastic stamp tool capable of imprinting joint patterns on plastic concrete.

C. Rollers: Manually controlled, water-filled aluminum rollers with projecting ridges on drum capable of imprinting texture and joint patterns on plastic concrete.

D. Texture Rollers: Manually controlled, abrasion-resistant polyurethane rollers capable of imprinting texture on plastic concrete.

2.6 MATERIALS

A. Concrete: Provide Portland cement concrete according to the City of St. Louis Board of Public Service “Standard Specifications, Bid Items, and Standard Details for Street and Alley Construction”, latest edition.

1. Comply with slump, air entrainment, strength, and material composition requirements.

B. All admixtures shall be those approved by the Engineer.


1. Use expansion joint-filler strips with removable cap on joints to receive joint sealants.

D. Color Pigment: ASTM C 979, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, non-fading, and resistant to lime and other alkalis.

1. Manufacturers:
   a. Bayer Corporation
   b. ChemMasters
   c. Conspec Marketing & Manufacturing Co., Inc.
   d. Davis Colors
   e. Elementis Pigments, Inc.
   f. Hoover Color Corporation
   g. Lambert Corporation
   h. Scofield, L. M. Company.
   i. Solomon Colors

2. Color: The color of the concrete shall be approved by the Designer and meet ASTM C979. The color shall be added to the concrete at the batch plant. The color shall be “Solomon 413 Fox Red” or approved equal.
E. Cure and Sealant: All imprinted concrete slabs shall be cured and sealed in accordance with the product manufacturer’s recommendations and specifications.


G. Pattern: The pattern shall be according to the drawings.

H. Exposed Aggregate: Exposed aggregate to be an Iowa glacial decorative gravel or equivalent. Gravel pieces to be a minimum of ¾” in length, with a minimum of 60% of gravel pieces, in composition, to be 1”-1 ½” in length. Color to be a mix of gray, black, white, red and brown pieces, with a minimum of 50% gray and black pieces for a darker final composition.

2.7 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to Section 501 of the MoDOT Standard Specifications.

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

B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Mix concrete materials in appropriate drum-type batch machine mixer.

1. For concrete batches of 1 cu. Yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.

2. For concrete batches larger than 1 cu. Yd, increase mixing time by 15 seconds for each additional 1 cu. Yd.

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

C. Color Pigment: Add color pigment to concrete mixture according to manufacturer’s written instructions and to result in hardened concrete color consistent with approved mockup.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.

B. Proof-roll prepared subbase surface below concrete paving to identify soft pockets and areas of excess yielding.

1. Completely proof-roll base in one direction. Limit vehicle speed to 3 mph.
2. Proof-roll with a pneumatic-tired and loaded, 10-wheel, tandem-axle dump truck weighing not less than 15 tons.

3. Base course with soft spots and areas of pumping or rutting exceeding depth of ½ inch require correction according to requirements in Division 3 Section “Earth Moving”.

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

3.2 PREPARATION

A. Remove loose material from compacted subbase surface immediately before placing concrete.

3.3 EDGE FORMS AND SCREED CONSTRUCTION

A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.

B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.4 JOINTS

A. General: Form construction, isolation, and contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline unless otherwise indicated.

1. When joining existing paving, place transverse joints to align with previously placed joints unless otherwise indicated.

B. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than one-half hour unless paving terminates at isolation joints.

1. Continue steel reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of paving strips unless otherwise indicated.

2. Provide tie bars at sides of paving strips where indicated.

3. Keyed Joints: Provide preformed keyway-section forms or bulkhead forms with keys unless otherwise indicated. Embed keys at least 1 ½ inches into concrete.

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

C. Curb Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, other fixed objects, and where indicated.

1. Locate expansion joints at intervals of 30 feet unless otherwise indicated.

2. Extend joint fillers full width and depth of joint.
3. Terminate joint filler not less than ½ inch or more than 1 inch below finished surface if joint sealant is indicated.
4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
6. During concrete placement, protect top edge of joint filler with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.

D. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints, for a depth equal to at least one-fourth of the concrete thickness, to match jointing of existing adjacent concrete pavement.

1. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8 inch wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.
2. Doweled Contraction Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.

E. Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool to a 3/8 inch radius. Repeat tooling of edges after applying surface finishes. Eliminate tool marks on concrete surfaces.

3.5 CONCRETE PLACEMENT

A. Place, finish, and cure all concrete pavements according to the applicable requirements in the current edition of the City of St. Louis Board of Public Service “Standard Specifications, Bid Items and Standard Details for Street and Alley Construction”.

B. Construct all sidewalks a minimum thickness of 5 inches unless otherwise noted on the plans.

C. Provide tool groove lines for contraction joints according to the details in the plans

1. Seal all expansion joints as shown on the plans.
2. Coordinate the layout of all groove lines with the Engineer in the field, but in no case shall the groove lines be spaced more than 10 feet apart in any direction.
3. Provide ½” preformed expansion joints where new concrete pavement abuts existing pavement or buildings.

D. Finish sidewalks with a medium broom finish meeting the requirements of the current edition of the City of St. Louis Board of Public Service “Standard Specifications, Bid Items and Standard Details for Street and Alley Construction”.

E. Cure, protect, and remove forms for concrete construction.
3.6 FLOAT FINISHING

A. General: Do not add water to concrete surfaces during finishing operations.

B. Surface Texture: The surface texture for all concrete items shall conform to requirements in the current edition of the City of St. Louis Board of Public Service “Standard Specifications, Bid Items and Standard Details for Street and Alley Construction”.

3.7 PIGMENTED MINERAL DRY-SHAKE HARDENER APPLICATION

A. Pigmented Mineral Dry-Shake Hardener Finish: After initial floating, apply dry-shake materials to paving surfaces according to manufacturer's written instructions and as follows:

1. Uniformly apply dry-shake hardener at a rate of 100 lb/100 sq. ft. unless greater amount is recommended by manufacturer to match paving color required.

2. Uniformly distribute approximately two-thirds of dry-shake hardener over the concrete surface with mechanical spreader; allow hardener to absorb moisture and embed it by power floating. Follow power floating with a second application of pigmented mineral dry-shake hardener, uniformly distributing remainder of material at right angles to first application to ensure uniform color, and embed hardener by final power floating.

3. After final power floating, apply the following finish:

   a. Medium-to-Fine-Textured Broom Finish: Draw a soft-bristle broom across float-finished concrete surface, perpendicular to line of traffic, to provide a uniform, fine-line texture.

B. Pigmented Powder Release Agent: Uniformly distribute onto dry-shake-hardened and still-plastic concrete at a rate of 3 to 4 lb/100 sq. ft..

C. Liquid Release Agent: Uniformly mist surface of dry-shake-hardened and still-plastic concrete at a rate of 5 gal/1000 sq. ft..

3.8 STAMPING

A. Mat Stamping: After floating and while concrete is plastic, apply mat-stamped finish.

1. Pigmented Powder Release Agent: Uniformly distribute onto concrete at a rate of 3 to 4 lb/100 sq. ft..

2. Liquid Release Agent: Apply liquid release agent to the concrete surface and the stamp mat. Uniformly mist surface of concrete at a rate of 5 gal/1000 sq. ft..

3. After application of release agent, accurately align and place stamp mats in sequence. The imprinting tools shall be applied to the surface while the concrete is still in its plastic stage of set.

4. Uniformly load mats and press into concrete to produce required imprint pattern and depth of imprint on concrete surface. Gently remove stamp mats. Hand stamp edges and surfaces unable to be imprinted by stamp mats.

5. Remove residual release agent according to manufacturer's written instructions, but no fewer than three days after stamping concrete. High-pressure-wash surface and joint...
patterns, taking care not to damage stamped concrete. Control, collect, and legally dispose of runoff.

6. Exposed aggregate to be applied to the concrete walkway surfaces through the use of the seeding method or approved equal.

3.9 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

B. Comply with ACI 306.1 for cold-weather protection.

C. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

D. Curing Methods: Cure concrete by curing compound as follows:
   1. 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.
      a. Cure concrete finished with pigmented mineral dry-shake hardener with a pigmented curing compound.

3.10 SEALER APPLICATION FOR COLORED CONCRETE

A. Clear Acrylic Sealer: Apply uniformly in two coats in continuous operations according to manufacturer's written instructions. Allow first coat to dry before applying second coat, at 90 degrees to the direction of the first coat, using same application methods and rates.
   1. Begin sealing dry surface no sooner than 14 days after concrete placement.
   2. Allow stained concrete surfaces to dry before applying sealer.

B. Thoroughly mix slip-resistance-enhancing additive into sealer before applying sealer according to manufacturer's written instructions. Stir sealer occasionally during application to maintain even distribution of additive.

3.11 PAVING TOLERANCES

A. Comply with tolerances in ACI 117 and as follows:
   1. Elevation: ½ inch.
   2. Thickness: Plus $\frac{3}{8}$ inch, minus $\frac{1}{4}$ inch.
   3. Surface: Gap below 10-foot long, unleveled straightedge not to exceed $\frac{1}{4}$ inch.
   4. Joint Spacing: 3 inches.
5. Contraction Joint Depth: Plus ¼ inch, no minus.

B. All sidewalks constructed within the public right-of-way shall be ADA compliant according to PROWAG. All remaining sidewalk shall be ADA compliant according to ADAAG except as indicated on the plans. Any constructed sidewalk not meeting ADA requirements shall be removed and replaced at the Contractor’s expense. If an ADA issue is found in the field, it should be brought to the attention of the Designer. The Contractor shall cooperate with the Designer to develop a solution within 2-working days at no additional cost to the contract.

3.12 FIELD QUALITY CONTROL

A. Special Inspections: Engineer may perform random “quality assurance checks of the Testing Agency responsibilities”. In case of discrepancy, it shall be the General Contractor’s responsibility at no additional cost to the contract, to resolve the issue to the satisfaction of the Engineer.

B. Testing Agency: General Contractor will engage a qualified testing agency to perform tests and inspections. The testing representative shall be an ACI Concrete Field Testing Technician – Grade I.

C. Testing Services: Testing Agency shall test composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

1. Testing Frequency: Obtain at least one composite sample for each 100 cu. Yd. or 5000 sq ft. or fraction thereof of each concrete mixture placed each day.
   a. When frequency of testing will provide 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; 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, pressure method; one test for each composite sample, but not less than one test for each day's pours of each concrete mixture.

4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when it is 80 deg F and above, and one test for each composite sample.

5. Compression Test Specimens: ASTM C 31; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.

6. Compressive-Strength Tests: ASTM C 39; test one specimen at seven days and two specimens at 28 days.
   a. A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at 28 days.

D. Strength of each concrete mixture will be satisfactory if average of any three consecutice 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.

E. Test results shall be reported in writing to Engineer 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.

F. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Engineer but will not be used as sole basis for approval or rejection of concrete.

G. 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 Engineer.

H. Concrete paving will be considered defective if it does not pass tests and inspections.

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

3.13 REPAIRS AND PROTECTION

A. Remove and replace concrete paving that is broken, damaged, or defective or that does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by Engineer.

B. Drill test cores, where directed by Engineer, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory paving areas with Portland cement concrete bonded to paving with epoxy adhesive.

C. Protect concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.

D. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 321313
SECTION 321316 - DECORATIVE CONCRETE PAVING

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 colored concrete paving.

B. Related Requirements:
   1. Section 321313 “Concrete Paving”

1.3 ACTION SUBMITTALS

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

B. Samples: For each exposed product and for each color and texture specified.

C. Other Action Submittals:
   1. Design Mixtures: For each decorative concrete paving mixture. Include alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer of decorative concrete paving systems.

B. ACI Publications: Comply with ACI 301 (ACI 301M) unless otherwise indicated.

C. Mockups: Build mockups of decorative concrete paving not less than 24 inches by 24 inches to demonstrate typical joints; surface color, pattern, and texture; curing; and standard of workmanship.
PART 2 - PRODUCTS

2.1 FORMS
   A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, and smooth exposed surfaces.

2.2 STEEL REINFORCEMENT
   A. Plain-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, fabricated from as-drawn steel wire into flat sheets.
   B. Reinforcing Bars: ASTM A 615/A 615M, Grade 60

2.3 CONCRETE MATERIALS
   A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
      1. Portland Cement: ASTM C 150, white portland cement
   B. Normal-Weight Aggregates: ASTM C 33, uniformly graded. Provide aggregates from a single source.
   C. Water: Potable and complying with ASTM C 94/C 94M.
   E. Chemical Admixtures: Admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.
   F. Color Pigment: ASTM C 979, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, nonfading, and resistant to lime and other alkalis.

2.4 STAMPING DEVICES
   A. Stamp Mats: Semirigid polyurethane mats with projecting textured and ridged underside capable of imprinting texture and joint patterns on plastic concrete.
   B. Stamp Tools: Open-grid, aluminum or rigid-plastic stamp tool capable of imprinting joint patterns on plastic concrete.
   C. Rollers: Manually controlled, water-filled aluminum rollers with projecting ridges on drum capable of imprinting texture and joint patterns on plastic concrete.
2.5 CURING MATERIALS

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

B. Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type I, Class B, manufactured for colored concrete.

2.6 RELATED MATERIALS

A. Joint Fillers: ASTM D 1751, asphalt-saturated cellulosic fiber.

B. Joint Sealant:

2.7 CONCRETE MIXTURES

A. Prepare design mixtures, proportioned according to ACI 301, with the following properties:

1. Compressive Strength (28 Days): 3000 psi
2. Slump Limit: 5 inches, plus or minus 1 inch.

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

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

1. Color: Color selections as listed as follows: French Gray Limestone Sandblast texture.
2. Pattern: 29” square Sandblast Limestone pattern.

PART 3 - EXECUTION

3.1 EXAMINATION AND PREPARATION

A. Proof-roll prepared subbase surface below decorative concrete paving to identify soft pockets and areas of excess yielding.

B. Remove loose material from compacted subbase surface immediately before placing concrete.

C. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.
3.2 JOINTS

A. General: Form construction, isolation, and contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline unless otherwise indicated.

B. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than one-half hour unless paving terminates at isolation joints.

C. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows, to match jointing of existing adjacent decorative concrete paving.

3.3 CONCRETE PLACEMENT

A. Moisten subbase to provide a uniform dampened condition at time concrete is placed.

B. Comply with ACI 301 requirements for measuring, mixing, transporting, placing, and consolidating concrete.

3.4 STAMPING

A. Mat Stamping: While concrete is plastic, apply mat-stamped finish.
   1. Liquid Release Agent: Apply liquid release agent to the concrete surface and the stamp mat. After application of release agent, accurately align and place stamp mats in sequence.
   2. Produce required imprint pattern and depth of imprint on concrete surface. Hand stamp edges and surfaces unable to be imprinted by stamp mats.
   3. Remove residual release agent according to manufacturer's written instructions, but no fewer than three days after stamping concrete.

B. Tool Stamping: While concrete is plastic, apply tool-stamped finish.
   1. Cover surface with polyethylene film, stretch taut to remove wrinkles, lap sides and ends, and secure to edge forms. Lightly broom surface to remove air bubbles.
   2. Align and place stamp tools in sequence and tamp into concrete to produce required imprint pattern and depth of imprint on concrete surface. Hand stamp edges and surfaces unable to be imprinted by stamp tools.
   3. Carefully remove polyethylene film immediately after tool stamping.

3.5 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

B. Comply with ACI 306.1 for cold-weather protection.
C. Curing Compound: Apply curing compound immediately after final finishing. Apply according to manufacturer's written instructions.

3.6 PAVING TOLERANCES
A. Comply with tolerances in ACI 117.

3.7 REPAIRS AND PROTECTION
A. Remove and replace decorative concrete paving that is broken or damaged or does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by Landscape Architect.
B. Protect decorative concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.
C. Maintain decorative concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 321316
SECTION 321373 - CONCRETE PAVING JOINT SEALANTS

PART 1 - GENERAL

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

1.2 SUMMARY
   A. Section Includes:
      1. Expansion and contraction joints within concrete pavement.
      2. Joints between concrete and asphalt pavement.
   B. Related Requirements:
      1. Section 321313 "Concrete Paving” for constructing joints in concrete pavement.

1.3 SUBMITTALS
   A. Product Data: For each joint-sealant product indicated.
   B. Product Certificates: For each type of joint sealant and accessory.
   C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency for sealants.

1.4 QUALITY ASSURANCE
   A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
   B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.
1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multicomponent materials.

B. Store and handle materials to comply with manufacturer’s written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.6 FIELD CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backing materials, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

2.2 COLD-APPLIED JOINT SEALANTS

A. Provide one component urethane, matching color, pour grade, self-leveling elastomeric sealant for exterior contraction and expansion joints in sidewalks, slabs and pavements.

1. Acceptable products:

   a. Mameco International, Vulkem 45
   b. Pecora Chemical Corp, Urexpans NR201
   c. Sika Chemical Corp, Sikaflex 12SL
   d. Contech, Inc. Sonneborn Building Products Div., Sonalastic SL1

2.3 HOT-APPLIED JOINT SEALANTS

A. Sealant for joint between Concrete and Asphalt: Single-component formulation complying with ASTM D 3405.
1. Available Products:
   a. Koch Materials Company; Product No. 9005
   b. Koch materials Company; Product No. 9030

2.4 JOINT-SEALANT BACKER MATERIALS

A. Joint-Sealant Backer Materials: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by joint-sealant manufacturer, based on field experience and laboratory testing.

B. Backer Strips for Cold- and Hot-Applied Joint Sealants: ASTM D 5249; Type 2; of thickness and width required to control joint-sealant depth, prevent bottom-side adhesion of sealant, and fill remainder of joint opening under sealant.

2.5 PRIMERS

A. Primers: Product recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

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

3.2 PREPARATION

A. Surface Cleaning of Joints: Before installing joint sealants, clean out joints immediately to comply with joint-sealant manufacturer's written instructions.

   1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.

B. Joint Priming: Prime joint substrates where indicated or where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
3.3 INSTALLATION OF JOINT SEALANTS

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

B. Joint-Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions.

C. Install joint-sealant backings to support joint 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 joint-sealant backings.
   2. Do not stretch, twist, puncture, or tear joint-sealant backings.
   3. Remove absorbent joint-sealant backings that have become wet before sealant application and replace them with dry materials.

D. Install joint sealants immediately following backing installation, using proven techniques that comply with the following:

   1. Place joint sealants so they fully contact 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 Joint Sealants: Immediately after joint-sealant application and before skinning or curing begins, tool sealants according to the following requirements 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 joint sealant from surfaces adjacent to joints.
   2. Use tooling agents that are approved in writing by joint-sealant manufacturer and that do not discolor sealants or adjacent surfaces.

F. Provide joint configuration to comply with joint-sealant manufacturer's written instructions unless otherwise indicated.

3.4 CLEANING AND PROTECTION

A. Clean off excess joint sealant as the Work progresses, by methods and with cleaning materials approved in writing by joint-sealant manufacturers.

B. Protect joint sealants, during and after curing period, from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately and replace with joint sealant so installations in repaired areas are indistinguishable from the original work.
END OF SECTION 321373
SECTION 321613.43 – GRANITE CURB

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. Concrete: Concrete shall be in accordance with Section 321313, “Concrete Paving”.

1.2 SUMMARY

A. This Section includes all granite curb construction to be done by the Contractor, as shown on the plans and/or hereinafter specified.

B. Related Requirements:


1.3 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained in the installation of granite curbs with a successful record of in service performance.

PART 2 - PRODUCTS

2.1 MATERIALS

A. All materials and debris removed shall become the property of the Contractor, unless otherwise noted, and shall be completely removed from the premises as excavated, unless approved otherwise.

B. Any cobblestone encountered by the Contractor shall be removed by him and transported to a site designated by the Engineer for salvage and shall remain the property of the City of St. Louis. Cobblestones shall be reasonably clean of asphalt and other materials when stockpiled.

C. Any straight sections of granite curb that are to be removed and not used on any other street in this contractor shall be stockpiled at one location and will be delivered by the Contractor at his expense, to the storage yard at 1900 Hampton Avenue or other area as designated by the Engineer.
D. Existing granite curb that is in good condition shall be reused. The Engineer will determine the acceptability of each piece of granite curb for reuse. Chipped, cracked, or broken curbs shall not be used, unless otherwise noted or specified.

PART 3 - EXECUTION

3.1 REMOVAL OF GRANITE CURB

A. Remove and/or place granite curb as directed by the Engineer or as shown on the plans in order to proceed with construction. Removal of granite curb shall include all non-rigid pavement removal necessary to remove the exiting curb and as required to install the new work. This item shall also include the removal of all concrete attached to the “removed” granite curb.

B. Cuts in the roadway shall be made to the straight, true lines parallel with the new curb alignment. The existing pavement shall be saw-cut if necessary. Care shall be taken to avoid damage to pavements and to the pavement base remaining in place.

C. It shall be the responsibility of the Contractor to provide access to properties both for vehicular and pedestrian traffic if area is to be open for more than two (2)-calendar days.

3.2 PLACEMENT OF GRANITE CURBS

A. Onsite granite curb, new granite curb, or any granite curb received from the City shall be cleaned of all debris prior to setting. The sections of granite curb to be replaced shall have square ends to provide a tight butt-joint and shall be free of cracks and chips greater than one (1)-inch.

B. All new granite curbs provided shall meet the color and type of nearby granite curb.

3.3 PICKUP and/or DELIVERY OF ADDITIONAL GRANITE CURB

A. When it is necessary to obtain additional and/or deliver excess granite curb to or from the City Department of Streets, the Contractor will be responsible for obtaining or delivering the curb from or to the designated location, loading, transporting and unloading with his own forces.

B. Granite curb shall be set to proper grade and alignment as noted on the plans. The granite curb shall also be placed in the vertical position, not varying by more than ¼” along the face of the curb.

C. To obtain the proper grade and alignment, satisfactory bracing and shimming will be required prior to pouring the concrete footing. At a minimum, each piece of granite curb shall be braced at two locations. To shim the granite curb to the correct grade, any non-decomposable, non-corrosive material with satisfactory strength may be used. Curbs shall be set end to end, with adjacent pieces touching each other. Once the granite curb is properly placed, the concrete may be poured. The concrete footing shall be placed on two inches of crushed limestone. Soil, dirt, wood, or any other materials detrimental to the concrete footing shall be removed.

END OF SECTION 321400
SECTION 321723 - PAVEMENT MARKINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes painted markings applied to asphalt pavement.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Deliver pavement-marking materials to Project site in original packages with seals unbroken and bearing manufacturer’s labels containing brand name and type of material, date of manufacture, and directions for storage.

B. Store pavement-marking materials in a clean, dry, protected location within temperature range required by manufacturer. Protect stored materials from direct sunlight.

1.4 PROJECT CONDITIONS

A. Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F for oil-based materials, 50 deg F for water-based materials, and not exceeding 95 deg F.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Accessibility Standard: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design".

2.2 PAVEMENT-MARKING PAINT

A. Pavement-Marking Paint: Alkyd-resin type, lead and chromate free, ready mixed, complying with FS TT-P-115, Type I or AASHTO M 248, Type N.

1. Color: as indicated.

2. Some formulations of waterborne emulsions are very quick drying, others less so; see manufacturer’s literature.
B. Glass Beads: AASHTO M 247, Type 1.

PART 3 - EXECUTION

3.1 PAVEMENT MARKING

A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Engineer.

B. Sweep and clean surface to eliminate loose material and dust.

C. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.

   1. Apply graphic symbols and lettering with paint-resistant, die-cut stencils. Apply paint so that it cannot run beneath stencil.
   2. Broadcast glass beads uniformly into wet markings at a rate of 6 lb/gal.

D. The Contractor shall protect the pavement markings from damage until the pavement markings have cured fully. Any damage shall be corrected by the Contractor at their own cost.

END OF SECTION 321723
SECTION 321726 - TACTILE WARNING SURFACING

PART 1 - GENERAL

1.1 SUMMARY
   A. Section Includes:

1.2 ACTION SUBMITTALS
   A. Product Data: For each type of product.
   B. Samples for each type of exposed finish requiring color selection.

PART 2 - PRODUCTS

2.1 TACTILE WARNING SURFACING, GENERAL
   A. Accessibility Requirements: Comply with the detectable warnings on walking surfaces section of the Americans with Disabilities Act.
      1. For tactile warning surfaces composed of multiple units, provide units that when installed provide consistent side-to-side and end-to-end dome spacing that complies with requirements.

2.2 DETECTABLE WARNING TILES
   A. Cast-in-Place Detectable Warning Tiles: Accessible truncated-dome detectable warning tiles configured for setting flush in new concrete walkway surfaces, with slip-resistant surface treatment on domes and field of tile.
      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. Access Products, Inc.
         b. ACO Polymer Products, Inc.
         c. ADA Solutions, Inc.
         d. Advanced Surface Systems, LLC.
         e. AlertTile; a division of Cape Fear Systems, II, LLC.
         f. Arcis Corp.
         g. Armorcast Products Co.
         h. Detectable Warning Systems, Inc.
2. Material: Cast-fiber-reinforced polymer concrete tile
3. Color: **Red brick** as selected by the Engineer.
4. Shapes and Sizes:
   a. Rectangular panel, 12 by 12 inches.
   b. Radius panel, nominal 24 inches deep by 6-foot outside radius.
5. Dome Spacing and Configuration: 1.67-inch spacing, in square pattern.
6. Mounting:
   a. Permanently embedded detectable warning tile wet-set into freshly poured concrete.
   b. Detectable warning tile set into formed recess in concrete and adhered with adhesive.
   c. Replaceable detectable warning tile wet-set into freshly poured concrete and surface-fastened to permanently embedded anchors.

2.3 ACCESSORIES

A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of tactile warning surfaces, noncorrosive and compatible with each material joined, and complying with the following:
   1. Furnish Type 304 stainless-steel fasteners for exterior use.
   2. Fastener Heads: For nonstructural connections, use flathead or oval countersunk screws and bolts with tamper-resistant heads, colored to match tile.

B. Sealant: As recommended by manufacturer for sealing perimeter of tactile warning surfacing unit.

PART 3 - EXECUTION

3.1 INSTALLATION OF TACTILE WARNING SURFACING

A. General: Prepare substrate and install tactile warning surfacing according to manufacturer's written instructions unless otherwise indicated.

B. Place tactile warning surfacing units in dimensions and orientation indicated. Comply with location requirements of AASHTO MP 12.

C. Cast-in-Place Detectable Warning Tiles: Set each detectable warning tile accurately and firmly in place and completely seat tile back and embedments in wet concrete by tamping or vibrating.
Set surface of tile flush with surrounding concrete and adjacent tiles. Remove concrete from tile surfaces and clean using methods recommended in writing by manufacturer.

D. Protect tactile warning surfacing from damage and maintain free of stains, discoloration, dirt, and other foreign material.

END OF SECTION 321726
SECTION 321813 - SYNTHETIC GRASS SURFACING

PART 1 - GENERAL

1.1 SUMMARY

   A. Section includes synthetic grass surfacing.

1.2 RELATED DOCUMENTS

   A. Specified elsewhere:

      1. Division 31 Section “Earth Moving” for excavation, filling and backfilling, and rough grading.
      2. Division 33 Section "Storm Utility Drainage Piping" for subsurface drainage.

1.3 ACTION SUBMITTALS

   A. Shop Drawings:

      1. Show installation methods and construction indicating field verified conditions, clearances, measurements, terminations, drainage.
      2. Provide joint submission with related trades when requested by Engineer.

   B. Product Data:

      1. Submit manufacturer's catalog cuts, material safety data sheets (MSDS), brochures, specifications; preparation and installation instructions and recommendations; storage, handling requirements and recommendations.
      2. Submit fiber manufacturer's name, type of fiber and composition of fiber.
      3. Submit data in sufficient detail to indicate compliance with the contract documents.
      4. Submit manufacturer's instructions for installation.
      5. Submit manufacturer's instructions for maintenance for the proper care and preventative maintenance of the synthetic turf system, including painting and markings.

   C. Samples: Submit samples, 6 x 6 inches, illustrating details of finished product in amounts as required by General Requirements, or as requested by Engineer.

   D. Product Certification:

      1. Submit manufacturer’s certification that products and materials comply with requirements of the specifications.
      2. Submit test results indicating compliance with Reference Standards.
E. Project Record Documents: Record actual locations of seams, drains and other pertinent information in accordance with specifications.

F. List of existing installations: Submit list including respective Owner's representative and telephone number.

G. Warranties: Submit warranty and ensure that forms have been completed in Owner's name and registered with approved manufacturer.

H. Testing data to the Owner to substantiate that the finished field meets the required shock attenuation, as per ASTM F1936.

I. Testing Certification: Submit certified copies of independent (third-party) laboratory reports on ASTM testing:

1. D1577 - Standard Test Method for Linear Density of Textile Fiber
2. D1907 – Yarn Denier Skein Method
3. D2256 – Yarn Tensile & Elongation
4. D3218 – Yarn Thickness, Microns
5. D5823 – Pile Height
6. D5848 - Standard Test Method for Mass Per Unit Area of Pile Yarn Floor Covering
7. D5793 – Stitch Gauge
9. D5034 - Standard Test Method of Breaking Strength and Elongation of Textile Fabrics (Grab Test)
11. DIN 18-035 – Water Permeability
13. D7138 – Melting Point
16. F1951 – ADA Compliance
17. F2117-01 – Ball Rebound
18. D792 – Specific Gravity
19. EN 14808 – Force Reduction
20. EN 14809 – Vertical Deformation
21. EN 15301-1 – Rotational Resistance

1.4 QUALITY ASSURANCE

A. The Contractor shall verify all dimensions in the field prior to ordering materials.

B. The Contractor shall be responsible for the protection of the synthetic field surface and product after its installation through completion.

C. Turf Manufacturer Qualifications: Company specializing in manufacturing products specified in this section. The turf contractor and/or the turf manufacturer:
1. Shall be experienced in the manufacture and installation of specified type of synthetic turf system for a minimum of 3-years with the same manufacturer, product and company they are proposing for this field.

2. The Contractor installing the turf product shall have the approval of the synthetic field surfacing Manufacturer (if different). The Turf Manufacturer shall submit a letter stating the turf Installer, the base Contractor, and the Supervisory personnel are qualified to represent the Manufacturer in the installation of a synthetic turf field, including the sewing of seams and proper installation of the infill mixture.

D. Base Contractor: Company shall specialize in performing the work of this section. The Contractor shall provide competent workmen skilled in this specific type of synthetic grass installation.

   1. The designated Supervisory Personnel on the project shall be certified, in writing by the turf manufacturer, as competent in the installation of the base for their synthetic turf.

   2. The Base Contractor supervisor shall have a minimum of 3-years experience as either a construction manager or a supervisor of synthetic turf installations.

E. The General Contractor and Turf Manufacturer shall furnish evidence of having been in business for a period of not less than 3-years under present name and, if required, furnish financial statements for such.

F. Pre-Installation Conference: Conduct conference at project site at time to be determined by Engineer. Review methods and procedures related to installation including, but not limited to, the following:

   1. Inspect and discuss existing conditions and preparatory work performed under other contracts.

   2. In addition to the Contractor and the installer, arrange for the attendance of installers affected by the Work, The Owner’s representative, and the Engineer.

G. The Contractor shall verify special conditions required for the installation of the system.

H. The Contractor shall notify the Engineer of any discrepancies.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Prevent contact with materials that may cause dysfunction.

B. Deliver and store components with labels intact and legible.

C. Store materials/components in a safe place, under cover, and elevated above grade.

D. Protect from damage during delivery, storage, handling and installation. Protect from damage by other trades.

E. Inspect all delivered materials and products to ensure they are undamaged and in good condition.

F. Comply with manufacturer’s recommendations.
1.6 SEQUENCING AND SCHEDULE
   A. Coordinate the Work with installation of work of related trades as the Work proceeds.
   B. Sequence the Work in order to prevent deterioration of installed system.

1.7 WARRANTY AND GUARANTEE
   A. The Contractor shall provide a warranty to the Owner that covers defects in materials and workmanship of the turf for a period of eight 8 years from the date of substantial completion. The turf manufacturer must verify that their representative has inspected the installation and that the work conforms to the manufacturer's requirements. The manufacturer's warranty shall include general wear and damage caused from UV degradation. **The warranty shall be fully third party insured;** pre-paid for the entire 8-year term and be non-prorated. The Contractor shall provide a warranty to the Owner that covers defects in the installation workmanship, and further warrant that the installation was done in accordance with both the manufacturer's recommendations and any written directives of the manufacturer's representative. Prior to final payment for the synthetic turf, the Contractor shall submit to owner notification in writing that the field is officially added to the annual policy coverage, guaranteeing the warranty to the Owner. The insurance policy must be underwritten by an “AM Best” A rated carrier and must reflect the following values:
      1. Pre-Paid 8-year insured warranty.
      2. Insured Warranty Coverage must be provided in the form of 1 single policy
      3. Maximum per claim coverage amount of $5,000,000.
      4. Minimum of five million dollar ($5,000,000) annual aggregate
      5. Must cover full 100% replacement value of total square footage installed, minimum of $8.00 per sq ft. (in case of complete product failure, which will include removal and disposal of the existing surface)
      6. Policies that include self-insurance or self-retention clauses shall not be considered.
      7. Policy cannot include any form of deductible amount.
      8. Sample policy must be provided at time of bid to prove that policy is in force. A letter from an agent or a sample Certificate of Insurance will not be acceptable.
      9. Metal cleats cannot void the warranty.

   B. The artificial grass systems with shock pad must have a **G-max of less than 100** at initial install and less than 150 for a 16-year period as per ASTM F1936.

1.8 MAINTENANCE SERVICE
   A. Contractor shall train the Owner's facility maintenance staff in the use of the turf manufacturer's recommended maintenance equipment.
   B. Manufacturer must provide maintenance guidelines and a maintenance video to the facility maintenance staff.
PART 2 - PRODUCTS

2.1 ACCEPTABLE SYNTHETIC TURF MANUFACTURERS

A. The synthetic turf shall be a 60 oz (min.) slit-film product. Minimum face weight ounces are absolute minimums (i.e., plus tolerances are accepted but not minus). Pre-approved turf manufacturers are as follows:

1. Shaw Sportexe
   185 South Industrial Boulevard
   Calhoun, Georgia
   Phone: 866-789-7429
   Model: Momentum SD

2. Sporturf
   200 Howell Drive
   Dalton, Georgia
   Phone: 800-798-1056
   Model: Fresh Grass

3. ATGSports Industries
   1602 Galemore Street
   Festus, MO 63028
   Phone: 636-937-7790
   Model: RamTurf

4. Byrne and Jones Construction
   13940 St. Charles Rock Road
   St. Louis, MO
   Phone: 314-926-1888
   Model: 186 BJ – Bermuda Rugged

5. SYNLawn St. Louis
   1734 Clarkson Road
   Chesterfield, MO 63017
   Phone: 636-231-5844
   Model: SYNTipede 343
   Model: SYNZoysia X47

2.2 MATERIALS AND PRODUCTS

A. Artificial grass system materials shall consist of the following:

1. Infill: Controlled mixture of graded silica sand and ambient SBR rubber free of dust and other foreign material. Silica sand particle size shall be a blended mix between 1.0 and 2.0 mm. Ambient SBR rubber particle size shall be a blended mix between 0.5 and 1.0 mm.

2. Glue, thread, paint, seaming fabric and other materials used to install and mark the artificial grass.
B. Carpet Rolls shall be 15’ wide rolls.

C. Infill materials shall be approved by the manufacturer.
   1. Infill shall consist of a resilient layered granular system, comprising selected and graded dust-free silica sand and ambient SBR rubber free of dust and other foreign material. The rubber component of the infill must represent a 70% of the total infill, by weight.
   2. The sand component of the infill must represent a 30% of the total infill, by weight.

D. Thread for sewing seams of turf shall be as recommended by the synthetic turf manufacturer.

E. Glue and seaming fabric for inlaying lines and markings shall be as recommended by the synthetic turf manufacturer.

F. Manufacturer shall provide Owner with 15’ x 40’ of additional stock green for future replacements.

2.3 QUALITY CONTROL IN MANUFACTURING

A. The turf manufacturer shall have inspectors at their manufacturing plant that are experts with industry standards.

B. The turf manufacturer’s certified inspectors shall perform pre-tufting fiber testing on tensile strength, elongation, tenacity, denier, shrinkage, and twist i.e., turns per inch, upon receipt of fiber spools from fiber manufacturer.

C. Primary backing shall be inspected by the turf manufacturer’s certified inspectors before tufting begins.

D. The turf manufacturer’s certified inspectors shall verify “pick count”, yarn density in relation to the backing, to ensure the accurate amount of face yarn per square inch.

E. The turf manufacturer’s certified inspectors shall perform turf inspections at all levels of production including during the tufting process and at the final stages before the turf is loaded onto the truck for delivery.

F. The turf manufacturer shall provide a 3’ x 3’ sample from the installed turf delivered to TSi Testing Services, Inc. for testing the material properties listed in Section 1.4.I contained herein. At his option, the Engineer may choose to cut and provide the sample to TSi, but the test will be paid for by the contractor and the results will be compared to the technical specifications provided with the bid.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that all sub-base leveling is complete prior to installation.

B. Turf installer shall examine the surface to receive the synthetic turf and accept the sub-base planarity in writing prior to the beginning of installation.
1. Acceptance is dependent upon the Owner’s test results indicating compaction and planarity are in compliance with manufacturer’s specifications.

2. The surface shall be accepted by Installer as “clean” as installation commences and shall be maintained in that condition throughout the process.

C. Compaction of the aggregate base shall be 95%, in accordance with ASTM D1557 (Modified Proctor procedure); and the surface tolerance shall not exceed 0-1/8 inch over 10 feet and 0-1/4" from design grade.

D. Correct conditions detrimental to timely and proper completion of Work.

E. Do not proceed until unsatisfactory conditions are corrected.

F. Beginning of installation means acceptance of existing conditions.

3.2 PREPARATION

A. Prior to the beginning of installation, inspect the sub-base for tolerance to grade.

B. Sub-base acceptance shall be subject to receipt of test results for compaction and planarity that sub-base is in compliance with manufacturer’s specifications and recommendations.

C. Dimensions of the field and locations for markings shall be measured by a registered surveyor to verify conformity to the specifications and applicable standards. A record of the finished field as-built measurements shall be made.

D. When requested by Engineer, installed subbase shall be tested for porosity prior to the installation of the monofilament turf. A subbase that drains poorly is an unacceptable substrate.

3.3 INSTALLATION – GENERAL

A. The installation shall be performed in full compliance with approved Shop Drawings.

B. Only trained technicians, skilled in the installation of athletic caliber synthetic turf systems working under the direct supervision of the approved installer supervisors, shall undertake any cutting, sewing, gluing, shearing, topdressing or brushing operations.

C. The designated Supervisory personnel on the project must be certified, in writing by the turf manufacturer, as competent in the installation of this material, including sewing seams and proper installation of the Infill mixture.

3.4 INSTALLATION

A. Install at location(s) indicated, to comply with final shop drawings, manufacturers’/installer’s instructions.

B. The Contractor shall strictly adhere to specified procedures. Any variance from these requirements shall be provided in writing, by the manufacturer’s on-site representative, and submitted to the Engineer and/or Owner, verifying that the changes do not in any way affect the Warranty. Infill materials shall be approved by the manufacturer and installed in accordance with the manufacturer’s standard procedures.

C. Carpet rolls shall be installed directly over the properly prepared aggregate base. Extreme care
shall be taken to avoid disturbing the aggregate base, both in regard to compaction and planarity.

1. Repair and properly compact any disturbed areas of the aggregate base as recommended by manufacturer

D. Artificial turf panel seams shall be sewn along the selvedge edging flap of the turf roll. Seams secured by other means including gluing are unacceptable. Installation shall be 99% sewn.

1. Minimum gluing will only be permitted to repair problem areas, corner completions, and to cut in any logos or inlaid lines as required by the specifications.
2. Turf may be glued to the top of the curb at the fence lines.
3. Seams shall be flat, tight, and permanent with no separation or fraying.
4. In the case of all lines and logos, turf carpet must be sheared to the backing (do not cut the backing) and adhered using hot melt adhesives.

E. Infill Materials:

1. Infill materials shall be applied in numerous thin lifts. The turf shall be brushed as the mixture is applied. The infill material shall be installed to a depth determined by the manufacturer.
2. Layered infill shall be installed in a systematic order.
3. Infill materials shall be installed to fill the voids between the fibers and allow the fibers to remain vertical and non-directional. The Infill installation consists of a base layer of sand followed processed rubber. A final application of specifically sized non-marking rubber completes the system. The Infill shall be installed to the depth where only the top ½” of the fibers are visible.

F. Non-tufted or inlaid lines and markings may be painted in accordance with turf and paint manufacturers’ recommendations. Number of applications will be dependent upon installation and field conditions.

G. Synthetic turf shall be attached to the perimeter edge detail in accordance with the manufacturer’s standard procedures.

H. Upon completion of installation, the finished field shall be inspected by the installation crew and an installation supervisor.

I. Synthetic turf shall be attached to the perimeter edges in accordance with the Manufacturer’s instructions using treated wood headers. All wood headers shall be anchored and glued to concrete curbs in accordance with the Manufacturer’s standard procedures.

3.5 ADJUSTMENT AND CLEANING

A. Do not permit traffic over unprotected surface.

B. Contractor shall provide the labor, supplies, and equipment as necessary for final cleaning of surfaces and installed items.

C. All usable remnants of new material shall become the property of the Owner.
D. The Contractor shall keep the area clean throughout the project and clear of debris.

E. Surfaces, recesses, enclosures, and related spaces shall be cleaned as necessary to leave the work area in a clean, immaculate condition ready for immediate occupancy and use by the Owner.

END OF SECTION 321813
SECTION 321816.13 - PLAYGROUND PROTECTIVE SURFACING

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. Unitary, seamless surfacing.
   B. Related Requirements:
      1. Section 116800 "Play Field Equipment and Structures"
      2. Section 116801 "Play Field Equipment and Structures Ropes Courses and Climbing Wall"

1.3 DEFINITIONS
   A. Critical Height: Standard measure of shock attenuation according to ASTM F2223; same as
      "critical fall height" in ASTM F1292. According to ASTM F1292, this approximates "the
      maximum fall height from which a life-threatening head injury would not be expected to occur."
   B. SBR: Styrene-butadiene rubber.
   C. Unitary Surfacing: A protective surfacing of one or more material components bound together
      to form a continuous surface; same as "unitary system" in ASTM F2223.

1.4 ACTION SUBMITTALS
   A. Product Data: For each type of product.
   B. Shop Drawings: For each type of protective surfacing.
      1. Include plans, sections, placement details, and attachment to substrates.
      2. Include accessories and edge terminations.
      3. Include patterns made by varying colors of surfacing and details of graphics.
      4. Include fall heights and use zones for equipment and structures specified in
         Section 116800 "Play Field Equipment and Structures," coordinated with the critical
         heights for protective surfacing.
   C. Samples for Verification: For each type of protective surfacing and exposed finish.
1. Include Samples of accessories to verify color and finish selection.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and testing agency.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For playground protective surfacing to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Mockups: Build mockups to verify selections made under Sample submittals and to set quality standards for materials and execution.

1. Build mockups for protective surfacing including accessories.
   a. Size: 48 inches by 48 inches

2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

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

1.8 WARRANTY

A. Special Warranty: Manufacturer and Installer agree to repair or replace components of protective surfacing that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Reduction in impact attenuation as measured by reduction of critical fall height.
   b. Deterioration of protective surfacing and other materials beyond normal weathering.

2. Warranty Period: Three years from date of Substantial Completion.
PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Bidders are hereby informed that the playground protective surfacing was written as a performance spec. Basis of design and alternate manufacturers are designated as follow:

1. Playground Protective Surfacing
   a. Basis of Design: Primo Natural Turf
   b. Alternate: Landscape Structures
   c. Alternate: Gametime

2.2 PERFORMANCE REQUIREMENTS

A. Impact Attenuation: Critical fall height tested according to ASTM F1292.
B. Accessibility Standard: Minimum surfacing performance according to ASTM F1951.

2.3 UNITARY, SINGLE-DENSITY, SEAMLESS SURFACING

A. Description: Manufacturer's standard, site-mixed and applied, single-layer material in thickness as required, tested for impact attenuation according to ASTM F1292.
   1. Composition: Blend of SBR rubber, particles and binder, forming a wearing and cushioning product.
   2. Binder: Weather-resistant, UV-stabilized, flexible, nonhardening, 100 percent solids polyurethane.
   3. Critical Fall Height: As indicated on Drawings
   4. Overall Thickness: Varies based on Critical Fall Height but not less than 3 inches.
   5. Primer/Adhesive: Manufacturer's standard primer and weather-resistant, moisture-cured polyurethane adhesive suitable for unit, substrate, and location.
   6. Color(s): As indicated by manufacturer's designations and on drawings.
   7. Retain "Leveling and Patching Material" Paragraph below for concrete- or asphalt-substrate repair or leveling. Delete if substrate is other than concrete or asphalt.

PART 3 - EXECUTION

2.4 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for subgrade elevations, slope, and drainage and for other conditions affecting performance of the Work.

   1. Verify that substrates are sound and without high spots, ridges, holes, and depressions.
B. Hard-Surface Substrates: Verify that substrates are satisfactory for unitary, protective surfacing installation and that substrate surfaces are dry, cured, and uniformly level within recommended tolerances according to protective surfacing manufacturer's written requirements for cross-section profile.
   1. Concrete Substrates: Verify that substrates are dry and free from surface defects, laitance, glaze, efflorescence, curing compounds, form-release agents, hardeners, dust, dirt, loose particles, grease, oil, and other contaminants incompatible with protective surfacing or that may interfere with adhesive bond. Determine adhesion, dryness, and acidity characteristics by performing procedures recommended in writing by protective surfacing manufacturer.

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

2.5 PREPARATION

A. Prepare substrates to receive surfacing products according to protective surfacing manufacturer's written instructions.

B. Hard-Surface Substrates: Clean surface free of laitance, efflorescence, curing compounds, and other contaminants incompatible with protective surfacing.
   1. Repair: Fill holes and depressions in unsatisfactory surfaces with leveling and patching material.
   2. Treatment: Mechanically abrade or otherwise prepare concrete substrates according to protective surfacing manufacturer's written instructions to achieve adequate roughness.
   4. Treat control joints and other nonmoving substrate cracks to prevent telegraphing through protective surfacing.

2.6 INSTALLATION OF SEAMLESS SURFACING

A. Mix and apply components of seamless surfacing according to manufacturer's written instructions to produce uniform, monolithic, and impact-attenuating protective surfacing of required overall thickness.
   1. Substrate Primer: Apply over prepared substrate at manufacturer's standard spreading rate for type of substrate.
   2. Poured Cushioning Layer: Spread evenly over primed substrate to form a uniform layer applied at manufacturer's standard spreading rate in one continuous operation, with a minimum of cold joints.
   3. Intercoat Primer: Over cured cushioning layer, apply primer at manufacturer's standard spreading rate.
   4. Wearing Layer: Spread over primed base course to form a uniform layer applied at manufacturer's standard spreading rate in one continuous operation and, except where color changes, with a minimum of cold joints. Finish surface to produce manufacturer's standard wearing-surface texture.

END OF SECTION 321816.13
SECTION 323119.53 - DECORATIVE METAL SECURITY FENCES AND GATES

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. Decorative metallic-coated-steel security fences.
2. Swing gates.
3. Gate operators, including controls.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project Site.

1.4 APPLICABLE PUBLICATIONS

A. Comply with references to extent specified in this section.

B. ASTM International (ASTM):

1. A653/A653M-15e1 – Steel Sheet, Zinc-Coated (Galvanized) or Zinc Alloy-Coates (Galvannealed) by Hot-Dip Process.
2. A924/A924M-14e1 – General Requirements for Steel Sheet, Metallic Coated by Hot-dip Process.

C. Master Painters Institute (MPI):

1. No. 18 – Primer, Zinc Rich, Organic.

1.5 ACTION SUBMITTALS

A. Submittal Procedures: Section 013300, “Submittal”

B. Product Data: For each type of product.
C. Shop Drawings: For fencing and gates.
   1. Include plans, elevations, sections, and attachment details.
   2. Include diagrams for power, signal, and control wiring.

D. Samples: For each fence material and for each color specified.

E. Certificates: Certify each product complies products comply with specifications.
   1. Fence alignment.
   2. Structural characteristics comply with indicated and criteria on Drawings.
   3. Connections comply with requirements indicated on Drawings.

F. Qualifications: Substantiate qualifications comply with specifications.
   1. Manufacturer with project experience list.
   2. Installer with project experience list.
   3. Welders and welding procedures.

1.6 QUALITY ASSURANCE

A. Manufacturer
   1. Regularly manufactures specified products.
   2. Manufactured specified products with satisfactory service on five similar installations for minimum five years.
      a. Protect Experience List: Provide contact names and addresses for completed projects.

B. Installer
   1. Regularly installs specified products.
   2. Installed specified products with satisfactory service on five similar installations for minimum five years.
      a. Project Experience List: Provide contact names and addresses for completed projects.

C. Welders and Welding Procedures Qualifications: AWS D1.1/D1.1M.

1.7 DELIVERY

A. Deliver products in manufacturer’s original sealed packaging.

B. Mark packaging, legibly. Indicate manufacturer's name or brand, type, color, production run number, and manufacture date.

C. Before installation, return or dispose of products within distorted, damaged, or opened packaging.
1.8 STORAGE AND HANDLING
   A. Store products indoor in dry, weathertight facility.
   B. Protect products from damage during handling and construction operations.

1.9 FIELD CONDITIONS
   A. Field Measurements: Verify field conditions affecting high security fence fabrication and installation. Show field measurements on Submittal Drawings.
      1. Coordinate field measurement and fabrication schedule to avoid delay.

1.10 WARRANTY
   A. Construction Warranty: FAR clause 52.246-21, “Warranty of Construction.”

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS
   A. Wind Loading: Comply with ASCE/SEI 7 requirements for fence height, wind exposure category, design wind speed, and design wind pressure.
   B. Lightning-Protection System: Maximum grounding-resistance value of 25 ohms under normal dry conditions.
   C. Vehicle Crash Testing: Comply with requirements of ASTM F 2656 for impact category, impact velocity, and penetration rating.
   D. System components includes a fully functional fence including foundations, pickets, pales, mesh, fabric, rails, posts, gates and hardware.
   E. Gates: Design to meet same forced entry and anti-climb characteristics as other portions of fence.

2.2 PRODUCTS -GENERAL
   A. Provide fence components from one manufacturer.

2.3 7’ TALL ORNAMENTAL FENCE
   A. Style: 7’-tall, four Rail System with Extended pickets with arrow pointed spear tops (rackable).
   B. Pickets: Hot-dip galvanized steel, nominal ¾” square by 14 gauge.
C. Rails: Hot-dip galvanized steel, nominal 1-1/2” x 1-7/16” by 14 gauge.

D. Posts: Tubular steel, nominal 2-1/2” square by 14 gauge.

E. Gates:
   1. Provide gliding gates for vehicle access
   2. Provide hinged gates for pedestrian gates.

F. Approved Type:
   1. Ameristar, Aegis II
   2. Other types will be approved as a pre-approved substitution.

2.4 4’ TALL ORNAMENTAL FENCE

A. Style: 4’-tall, three Rail System.

B. Pickets: Hot-dip galvanized steel, nominal 5/8” square by 18 gauge.

C. Rails: Hot-dip galvanized steel, nominal 1-1/4” x 1-15/16” by 16 gauge.

D. Posts: Tubular steel, nominal 2” square by 16 gauge.

E. Gates:
   1. Provide gliding gates for vehicle access
   2. Provide hinged gates for pedestrian gates.

F. Approved Type:
   1. Ameristar, Aegis II
   2. Other types will be approved as a pre-approved substitution.

2.5 GATE OPERATORS

A. Provide factory-assembled automatic operating system designed for gate size, type, weight, and operating frequency. Provide operation control system with characteristics suitable for Project conditions, with remote-control stations, safety devices, and weatherproof enclosures; coordinate electrical requirements with building electrical system.

B. Comply with NFPA 70.

C. UL Standard: Manufacturer and label gate operators to comply with UL 325.

D. Motor Characteristics: See Drawings for motor characteristics.

E. Gate Operators: See Drawings for gate operator characteristics.

F. Vehicle Loop Detector: See Drawings for vehicle loop detector characteristics.
G. Obstruction Detection Devices: Provide each motorized gate with automatic safety sensor(s). Activation of sensor(s) causes operator to immediately stop gate in opening cycle and reverse gate in closing cycle, and hold until clear of obstruction.

H. Accessories: See Drawings for additional information.

2.6 STEEL MATERIALS

A. Galvanized – Coated Steel: ASMT A652, G90.

B. Tubular Steel: ASMT F2408.

2.7 COATING MATERIALS

A. Epoxy Primer for Galvanized Steel: Epoxy primer recommended in writing by topcoat manufacturer.

2.8 MISCELLANEOUS MATERIALS

A. Concrete: Normal-weight, air-entrained, ready-mix concrete complying with requirements in Section 033000 "Cast-in-Place Concrete" with a minimum 28-day compressive strength of 3000psi, 3-inch slump, and 1-inch maximum aggregate size.

2.9 GROUNDING MATERIALS

A. Comply with requirements of Section 260526 "Grounding and Bonding for Electrical Systems."

B. Grounding Conductors: Size as indicated on Drawings. Bare, solid wire for No. 6 AWG and smaller; stranded wire for No. 4 AWG and larger.

1. Material above Finished Grade: Aluminum.
2. Material on or below Finished Grade: Copper.

C. Grounding Connectors and Grounding Rods: Comply with UL 467.

2.10 STEEL FINISHES

A. Steel Paint Finish:

1. Powder-Coat Finish: Manufacturer's standard two-coat finish system as follows:
   a. Prepare galvanized steel for painting by washing and cleaning.
   b. One coat epoxy powder coat.
   c. One coat polyester powder coat.
   d. Dry-film Thickness: 0.05 mm (2 mils) minimum.
   e. Color: Black
B. Finish exposed surfaces after fabrication.

2.11 ACCESSORIES

A. Accessories: Manufacturer's required accessories for complete installation.
B. Barrier Coating: ASTM D1187/D1187M.
C. Welding Materials: AWS D1.1/D1.1M, type to suit application.
D. Fasteners: Fasteners as recommended by manufacturer.
E. Gate Hardware: Fence manufacturers standard hardware for hinged and sliding gates.
F. Galvanizing Repair Paint: MPI No. 18.
G. Touch-Up Paint: Match shop finish.

PART 3 - EXECUTION

3.1 INSTALLATION – GENERAL

A. Install products according to manufacturer’s instructions and approved submittal drawings
   1. When manufacturer’s instructions deviate from specifications, submit proposed resolution for Construction Representative’s consideration.
B. Attached fence panel to the line and end posts with manufacturer’s standard fasteners.
C. Install gate to gate posts spaced as indicated on Drawings. Install required hardware and adjust for smooth operation.
D. Touch up damaged factory finishes.
   1. Repair galvanized surfaces with galvanized repair paint.
   2. Repair painted surfaces with touch up primer.

3.2 DECORATIVE SECURITY FENCE INSTALLATION

A. Install fences according to manufacturer's written instructions.
B. Install fences by setting posts as indicated and fastening rails to posts.
C. Post Excavation: Drill or hand-excavate holes for posts in firm, undisturbed soil. Excavate holes to meet Manufacturers recommendations for concrete footings.
D. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil.
1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.

2. Concrete Fill: Place concrete around posts and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.

3. Posts Set in Concrete: Extend post to within 6 inches of specified excavation depth, but not closer than 3 inches to bottom of concrete.

4. Space posts uniformly at per Manufactures recommendations.

3.3 GATE INSTALLATION

A. Install gates according to manufacturer’s written instructions, level, plumb, and secure for full opening without interference. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.

3.4 GATE OPERATOR INSTALLATION

A. General: Install gate operators according to manufacturer's written instructions, aligned and true to fence line and grade.

B. Excavation for Concrete Bases: Hand-excavate holes for bases in firm, undisturbed soil to dimensions and depths and at locations as required by gate operator component manufacturer's written instructions and as indicated.

C. Concrete Bases: Cast-in-place or precast concrete, depth not less than 12 inches dimensioned and reinforced according to gate operator component manufacturer's written instructions and as indicated on Drawings.

D. Vehicle Loop Detector System: Cut grooves in pavement and bury and seal wire loop according to manufacturer's written instructions. Connect to equipment operated by detector.

E. Comply with NFPA 70 and manufacturer's written instructions for grounding of electric-powered motors, controls, and other devices.

3.5 GROUNDING AND BONDING

A. Comply with Section 260526 "Grounding and Bonding for Electrical Systems."

B. Fence Grounding: Install at maximum intervals of 1500 feet except as follows:

1. Fences within 100 feet of Buildings, Structures, Walkways, and Roadways: Ground at maximum intervals of 750 feet.
   a. Gates and Other Fence Openings: Ground fence on each side of opening.
C. Grounding Method: At each grounding location, drive a grounding rod vertically until the top is 6 inches below finished grade. Connect rod to fence with No. 6 AWG conductor. Connect conductor to each fence component at grounding location.

D. Bonding Method for Gates: Connect bonding jumper between gate post and gate frame.

E. Connections: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact are galvanically compatible.

F. Bonding to Lightning-Protection System: If fence terminates at lightning-protected building or structure, ground the fence and bond the fence grounding conductor to lightning-protection down conductor or lightning-protection grounding conductor, complying with NFPA 780.

3.6 FIELD QUALITY CONTROL

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

1. Grounding-Resistance Tests: Subject completed grounding system to a megger test at each grounding location. Measure grounding resistance not less than two full days after last trace of precipitation, without soil having been moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural grounding resistance. Perform tests by two-point method according to IEEE 81.

3.7 PROTECTION

A. Protect perimeter fences and gates from traffic and construction operations

B. Remove protective materials immediately before acceptance.

C. Repair damage.

END OF SECTION 323119.53
SECTION 323300 - SITE FURNISHINGS

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 information on benches, tables and trash receptacles
   B. Related Requirements:
      1. Section 321313 "Concrete Pavement"
      2. Section 321316 “Decorative Concrete Pavement”

1.2 SUBMITTALS
   1. Product Data: For each type of product listed above in Section 013300 Submittal Procedures

1.3 DELIVERY, STORAGE, AND HANDLING
   A. Deliver products to site under provisions of Section 016000 Product Requirements.
   B. Store and protect products under provisions of Section 016000 Product Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS
   A. Bidders are hereby informed that the site furnishings were written as performance specs. Basis of design and alternate manufacturers are designated as follow:
      1. Benches
         a. Basis of Design: Anova
         b. Alternate: Maglin
         c. Alternate: DuMor
      2. Tables
         a. Basis of Design: Anova
         b. Alternate: Maglin
         c. Alternate: DuMor
3. Receptacles
   a. Basis of Design: Anova
   b. Alternate: Maglin
   c. Alternate: DuMor

2.2 SEATING

A. Bench
   1. Frame: 12-gauge steel tubing, 2” square
   2. Seat and Back:
      a) Material – 14-gauge steel with perforated pattern
      b) Seat Height – As indicated
      c) Seat Surface Shape – Contoured
      d) Overall Height – As indicated
      e) Overall Width – As indicated
   3. Arms:
      a) Material – Match material, color and finish of frame
      b) Quantity – Two, one at each end
   4. Finish:
      a) Steel Finish – powder coat finish
      b) Color – Black
   5. Dimensions: As indicated
   6. Installation Method: Surface Mounted Only

2.3 TABLES

A. Picnic Table
   1. Frame: Tubular Steel – 12-gauge galvanized steel, powder coat finish. 2.38” O.D.
   2. Seat:
      a) Material – 12-gauge perforated steel
      b) Seat Height – As indicated
      c) Seat Surface Shape – Flat
      d) Overall Height – As indicated
      e) Overall Width – As indicated
   3. Table Top:
      a) Material – 12-gauge perforated steel
      b) Overall Height – As indicated
      e) Overall Width – As indicated
   4. Finish:
      a) Steel Finish – Heat fused plastisol coating meeting ASTM E1354 requirements.
      b) Color – Black
   5. Accessible End of Table: one
   6. Installation Method: Freestanding Only
2.4 TRASH RECEPTACLES

A. Trash Receptacle
   1. Frame: 14-gauge steel panels supported by a non-rusting aluminum frame
   2. Shape: As indicated
   3. Lids/Tops:
      a) Material – Steel
      b) Shape – As indicated
   4. Overall Height – As indicated
   5. Overall Width – As indicated
   6. Capacity – 30 gallon
   7. Finish:
      a) Steel Finish – Powder coat finish
      b) Color – Black
   8. Installation Method: Freestanding Only

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that site furnishings arrive on site free of defects.

3.02 INSTALLATION

A. Comply with manufacturer's written installation instructions unless more stringent requirements are indicated. Complete field assembly of site furnishings where required.

B. Unless otherwise indicated, install site furnishings after landscaping and paving have been completed.

C. Install site furnishings level, plumb, and securely anchored at locations as indicated on Drawings.

END OF SECTION 323300
SECTION 329113.19 – PLANTING SOIL MIXING

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 soil mixing, finish grading and preparation of areas shown on plans for planting beds, trees and raised planters.

B. Related Requirements:

1. Section 329300 "Turf and Grasses"
2. Section 329300 “Plants”

1.3 ACTION SUBMITTALS

A. Approved Topsoil – Contractor shall submit one (1) c.f. sample or coordinate a site visit with the landscape architect to see and approve the topsoil mix.

B. Amended Soil Mix – Contractor shall submit one (1) c.f. sample or coordinate a site visit with the landscape architect to see and approve the soil mix and soil mix process.

PART 2 PRODUCTS

2.1 MATERIALS

A. Amended Soil Mix shall conform to the following mix requirements:

1. Three (3) parts approved topsoil, part natural organic matter, and one (1) part sand (see descriptions below).

2. Approved Topsoil is preferred to be from off-site sources. Approved topsoil shall conform to the following requirements:

   a. Provide fertile, friable, natural loam, surface soil, reasonably free of subsoil, clay clumps, brush weeds and other litter, and free of roots, stumps, stone larger than 1” in any dimension, and other extraneous or toxic matter harmful to plant growth.
b. Approved topsoil must contain at least 2% natural organic matter by weight, when dried and tested in accordance with current methods of the Association of Official Agricultural Chemists.

c. Soil acidity range shall be between pH 6.0 – 7.0 inclusive.

d. Soil fertility shall be rated high in natural nutrients based on the coordinated ratings in pounds per acre as established by the Natural Soil and Fertilizer Research Committee.

3. Natural Organic Matter:

a. **Peat Moss** – Type 1 sphagnum peat moss; finely divided with a ph of 3.1 – 5.0.

b. **Sedge Peat** – pulverized, decomposed type of peat with pH reading of 4.5 or higher, water absorbing capacity 1100-2000%, moisture content approximately 30%. There should be approximately 4 cubic feet or 6 bushels per 100 pounds of peat.

c. **Leaf Mold** – thoroughly shredded, well-composted leaf material, free of trash.

d. **Pine Bark** – potting grade pine bark with no particle size larger than ½ inch and less than 10% wood fiber.

e. **Sand:** Sand shall be fine clean masonry sand.

PART 3 EXECUTION

3.1 PLACEMENT

A. After excavation and filling topsoil to the sub-grade is completed by the earthwork contractor and is approved, Planting Soil contractor shall place Approved Topsoil and Amended Soil Mix to a minimum compacted depth as follows:

1. Groundcover, and Shrub Planting Beds – 12” approved Topsoil with Amended Soil Mix elements added in after topsoil placement.

2. Individual Shrubs and Canopy and Flowering Trees – shall receive Amended Soil Mix as per planting details and planting specifications.

3. Raised Planters in West Courtyard – Fill planter to within 3” of top of planter.

B. Use Approved Topsoil and Amended Soil Mix in relatively dry state. Place during dry weather. Approved Topsoil or Amended soil mix shall not be placed while in a frozen or muddy condition, when the subgrade is excessively wet, or in a condition that may otherwise be detrimental to proper grading or proposed sodding or seeding.

C. The Approved Topsoil and Amended Soil Mix shall be loosely placed in horizontal layers so that the successive lifts will blend together. The maximum thickness per lift of compacted fill shall not exceed six (6) inches.

3.2 CLEAN UP

A. After the Approved Topsoil and Amended Soil Mix has been spread and the final grades approved, it shall be cleared of all grade stakes, surface trash and other objects that would
hinder maintenance. Paved areas over which hauling operations are conducted shall be kept clean, and any soil that is spilled upon the surface shall be promptly removed.

B. The wheels of all vehicles shall be kept clean to avoid tracking soil on the surfacing of roads, walks or other paved areas.

3.3 ACCEPTANCE

A. Acceptance for Planting Soil installation shall be given by the general contractor, owner, landscape architect, or agent, upon satisfactory completion of each section or area indicated on the drawings or as otherwise specified.

END OF SECTION 329113.19
SECTION 329200 - TURF AND GRASSES

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 preparation of soil and seeding of grass seed for areas shown on the plans.
   B. Related Requirements:
      1. Section 329113.19 "Planting Soil Mixing"
      2. Section 329300 “Plants”

1.3 DEFINITIONS
   A. Amended Soil: 6” of existing topsoil mixed with 2” of organic compost.
   B. Duff Layer: The surface layer of native topsoil that is composed of mostly decayed leaves,
      twigs, and detritus.
   C. Finish Grade: Elevation of finished surface of planting soil.
   D. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand
      with stabilized organic soil amendments to produce topsoil or planting soil.
   E. Organic Compost: Decomposed organic waste produced at an IEPA registered composting
      facility. Compost shall comply with the IEPA Standards for General Use Compost and be
      registered with the US Composting Seal of Testing Assurance program. It shall have an organic
      content of 35-65% as determined by the “loss on ignition” test method described in AASHTO T
      267. 100% of the compost material shall pass the ½” sieve.
   F. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a
      pest. Pesticides include insecticides, miticides, herbicides, fungicides, rodenticides, and
      molluscsicides. They also include substances or mixtures intended for use as a plant regulator,
      defoliant, or desiccant.
   G. Pests: Living organisms that occur where they are not desired or that cause damage to plants,
      animals, or people. Pests include insects, mites, grubs, mollusks (snails and slugs), rodents
      (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.
H. Planting Soil: Existing, on-site soil; imported soil; or manufactured soil that has been modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth. See Section 329113.19 “Planting Soil Mixing” and drawing designations for planting soils.

I. Subgrade: The surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For landscape Installer.

B. Product Certificates: For fertilizers, from manufacturer.

C. Pesticides and Herbicides: Product label and manufacturer's application instructions specific to Project.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: Recommended procedures to be established by Owner for maintenance of turf during a calendar year. Submit before expiration of required maintenance periods.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape installer whose work has resulted in successful turf establishment.

1. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.

B. Compost Testing: The results of compost analysis shall be provided by the compost supplier. Maturity testing should be performed on-site after the compost is delivered. Before delivery of the compost, the supplier must provide the following documentation:

1. Feedstock percentage in the final compost product.

2. A statement that the compost meets federal and state health and safety regulations

3. A statement that the composting process has met time and temperature requirements.

4. A copy of the lab analysis, less than four months old, performed by a Seal of Testing Assurance Certified Laboratory verifying that the compost meets the physical requirements as described (Test Methods for the Examination of Composting and Compost and the Standard Methods for the Examination of Water and Wastewater):

   a. pH 5.0-8.5 according to TMECC 4.11A

   b. Soluble Salt < 10dS/m according to TMECC 4.10-A

   c. Moisture 30-60% dry weight basis according to SMEWW 2540B
d. Organic Matter 30-60% dry weight basis according to TMECC 5.07-A

e. Particle Size 98-100% pass through the ½” sieve according to TMECC 2.02-B

f. Stability (Carbon Dioxide evolution rate) > 80% relative to positive control according to TMECC 5.08-B

g. Maturity (See emergence and seedling vigor) > 80% relative to positive control according to TMECC 5.05-A

h. Physical contaminants (manmade inerts) < 1% dry weight basis according to TMECC 3.08-A

i. Chemical contaminants Meet or exceed US EPA Class A standard, 40 CFR Section 503.13, Tables 1 and 3 levels:
   1. Arsenic < 41 ppm according to TMECC 4.06-AS
   2. Cadmium < 39 ppm according to TMECC 4.06-CD
   3. Copper < 1,500 ppm according to TMECC 4.06-CU
   4. Lead < 300 ppm according to TMECC 4.06-PB
   5. Mercury < 17 ppm according to TMECC 4.06-HG
   6. Molybdenum < 75 ppm according to TMECC 4.05-MO
   7. Nickel < 420 ppm according to TMECC 4.06-NI
   8. Selenium < 100 ppm according to TMECC 4.06-SE
   9. Zinc < 2,800 ppm according to TMECC 4.06-ZN

j. Biological contaminants (pathogens) meet or exceed US EPA Class A standard, 40 CFR Section 503.32(a) levels:
   1. Fecal coliform < 1,000 MPN per gram, dry weight basis according to TMECC 7.01
   2. Salmonella < 3 MPN per 4 grams, dry weight basis according to TMECC 7.02

1.7 DELIVERY, STORAGE, AND HANDLING

A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of compliance with state and Federal laws, as applicable.

B. Sod: Harvest, deliver, store, and handle sod according to requirements in "Specifications for Turfgrass Sod Materials" and "Specifications for Turfgrass Sod Transplanting and Installation" sections in TPI's "Guideline Specifications to Turfgrass Sodding." Deliver sod within 24 hours of harvesting and in time for planting promptly. Protect sod from breakage and drying.

C. Bulk Materials:

   1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.

   2. Provide erosion-control measures to prevent erosion or displacement of bulk materials; discharge of soil-bearing water runoff; and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
3. Accompany each delivery of bulk materials with appropriate certificates.

1.8 FIELD CONDITIONS

A. Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with initial maintenance periods to provide required maintenance from date of Substantial Completion.

   1. Spring Planting: April 1 to June 15.
   2. Fall Planting: September 15 to November 15.

B. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 SEED

A. Grass Seed: Fresh, clean, dry, new-crop seed complying with AOSA's "Rules for Testing Seeds" for purity and germination tolerances.

B. Seed Species:

   1. Quality: State-certified seed of grass species as listed below for solar exposure.
   2. Quality: Seed of grass species as listed below for solar exposure, with not less than 85 percent germination, not less than 95 percent pure seed, and not more than 0.5 percent weed seed:
   3. Grass-Seed Mix: Proportioned by weight as follows:
      a. 70 percent red fescue (Festuca rubra variety).
      b. 20 percent Kentucky bluegrass (Poa pratensis).
      c. 10 percent perennial ryegrass (Lolium perenne).

2.2 TURFGRASS SOD

A. Turfgrass Sod: Approved, complying with "Specifications for Turfgrass Sod Materials" in TPI's "Guideline Specifications to Turfgrass Sodding." Furnish viable sod of uniform density, color, and texture that is strongly rooted and capable of vigorous growth and development when planted.
B. Turfgrass Species: Sod of grass species as follows:
   1. Sun and Partial Shade: Proportioned by weight as follows:
      a. 70 percent turf type fescue (Festuca arundinacea)
      b. 30 percent Kentucky bluegrass (Poa pratensis)

2.3 MULCHES
A. Straw Mulch: Provide air-dry, clean, mildew- and seed-free, salt hay or threshed straw of wheat, rye, oats, or barley.

2.4 PESTICIDES
A. General: Pesticide, registered and approved by the EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.
B. Pre-Emergent Herbicide (Selective and Nonselective): Effective for controlling the germination or growth of weeds within planted areas at the soil level directly below the mulch layer.

PART 3 - EXECUTION

3.1 EXAMINATION
A. Examine areas to be planted for compliance with requirements and other conditions affecting installation and performance of the Work.
   1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
   2. Suspend planting operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
   3. Uniformly moisten excessively dry soil that is not workable, or which is dusty.
B. Proceed with installation only after unsatisfactory conditions have been corrected.
C. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Landscape Architect and replace with new planting soil.
3.2 PREPARATION

A. Protect structures; utilities; sidewalks; pavements; and other facilities, trees, shrubs, and plantings from damage caused by planting operations.
   1. Protect grade stakes set by others until directed to remove them.

3.3 SODDING

A. Lay sod within 24 hours of harvesting. Do not lay sod if dormant or if ground is frozen or muddy.

B. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod; do not stretch or overlap. Stagger sod strips or pads to offset joints in adjacent courses. Avoid damage to soil or sod during installation. Tamp and roll lightly to ensure contact with soil, eliminate air pockets, and form a smooth surface. Work sifted soil or fine sand into minor cracks between pieces of sod; remove excess to avoid smothering sod and adjacent grass.
   1. Lay sod across slopes exceeding 1:3.
   2. Anchor sod on slopes exceeding 1:6 with wood pegs or steel staples spaced as recommended by sod manufacturer but not less than two anchors per sod strip to prevent slippage.

C. Saturate sod with fine water spray within two hours of planting. During first week after planting, water daily or more frequently as necessary to maintain moist soil to a minimum depth of 1-1/2 inches below sod.

3.4 PESTICIDE APPLICATION

A. Apply pesticides and other chemical products and biological control agents according to requirements of authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.

3.5 CLEANUP AND PROTECTION

A. Promptly remove soil and debris created by turf work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.

B. Remove surplus soil and waste material, including excess subsoil, unsuitable soil, trash, and debris, and legally dispose of them off Owner's property.

C. Erect temporary fencing or barricades and warning signs as required to protect newly planted areas from traffic. Maintain fencing and barricades throughout initial maintenance period and remove after plantings are established.

END OF SECTION 329200
SECTION 329300 - PLANTS

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 preparation of soil and seeding of grass seed for areas shown on the plans.

B. Related Requirements:
   1. Section 329113.19 "Planting Soil Mixing"
   2. Section 329200 “Turfs and Grasses”

1.2 ACTION SUBMITTALS

A. As-Built Drawings: If there are any changes from the Drawings during construction, prepare and submit as-built drawings showing actual conditions.

1.3 QUALITY ASSURANCE

A. Landscape Installer: Company specializing in landscape planting installation with minimum five (5) years’ experience.

B. Plant Source: All plants shall be grown under climatic conditions as nearly approaching the site as possible.

C. Plant Condition: All Plants marked B & B shall be balled and burlapped or grown in containers according to standard modern practice. No plants shall be accepted when the ball of earth surrounding its roots has been cracked or broken prior to or during the process of planting.

D. Measurements: Plants shall conform to the measurements shown on the plant list. The caliper of tree trunks shall be the diameter of the trunk measured six (6) inches above the natural surface of the ground.

1.4 REGULATORY REQUIREMENTS
A. Comply with regulatory agencies for fertilizer composition.

1.5 ENVIRONMENTAL REQUIREMENTS

A. Seasons for Planting: The seasons for planting shall be from April 1 to May 15 and September 1 to October 30 for evergreen trees, evergreen and deciduous shrubs and ground covers. The seasons for planting shall be from March 15 to May 15 and September 1 to November 30 for deciduous trees. The actual planting shall be done, however, only during periods within the seasons which are normal for such Work as determined by weather conditions and by accepted practice in the locality of the project and which are approved by the Construction Manager. Only upon written instructions by the Construction Manager may planting begin earlier or continue later than the dates specified.

1.6 MAINTENANCE DATA

A. Submit maintenance data for continuing maintenance by the Owner.

B. Include maintenance instructions; types, application frequency, and recommended coverage of fertilizer.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site under provisions of Section 160000 Product Requirements.

B. Store and protect products under provisions of Section 160000 Product Requirements.

C. When burlapped plants cannot be planted immediately on delivery, set on the ground and cover the balls well with soil, mulch or other acceptable materials.

1.8 MAINTENANCE SERVICE

A. Maintain planting areas immediately after installation until end of one-year warranty period.

1.9 PLANTING AREAS

A. Areas to be planted are indicated on the Drawings.

PART 2 PRODUCTS

2.01 MATERIALS
A. Surface Mulch: Shredded bark mulch, the pieces to range from 1" to 2-1/2" long or the same in diameter.

B. Peat Moss: A pulverized type of peat with pH reading of 4.5 or higher, water absorbing capacity 1100-2000%, moisture content approximately 30%. There should be approximately 4 cubic feet or 6 bushels per 100 pounds of peat.

C. Backfill Soil Mix: Premixed as follows: 1 part peat moss, by volume, to 3 parts soil removed from hole, unless otherwise noted.

D. Starter Fertilizer (Trees and Shrubs): Slow-release, 3 year pellets. Install pellets into planting holes for all shrubs and trees at the rates recommended by the manufacturer.

E. Fertilizer (Ground Cover, Shrub and Flower Beds): Controlled release type of the following proportions: 18% nitrogen, 7% phosphoric acid, 10% soluble potash, plus iron. Apply to all ground cover, shrub and flower beds at recommended rate.

F. Tree Well Soil Mix: Premixed as follows: 1 part peat moss, by volume, to 3 parts topsoil, and 1 lb. of specified fertilizer (18-7-10) per cubic yard of soil mix.

G. Plant Material:

1. All plants to be of size, proportion, root size of ball, and of general character in accordance with standards as outlined by the publication: American Standard for Nursery Stock ANSI Z60.1 – 2014 or as shown on the plant schedule of the plan.

2. All plants shall conform to the varieties specified in the plant list. No substitutions will be permitted unless approved in writing by the Landscape Architect and then only if the material is unavailable to the extent that the completion of the project would be materially delayed.

3. All plants provided by the Contractor are subject to inspection and approval or rejection by the Landscape Architect. Rejected plants to be removed and replaced at Contractor's expense.

**PART 3 EXECUTION**

**3.01 INSPECTION**

A. Verify that prepared soil grade is ready to receive the Work of this Section.

B. Beginning of installation means acceptance of existing conditions.

**3.02 PREPARATION OF SUBSOIL**

A. Remove underground debris or other obstructions encountered; loosen subgrade and check for drainage. Notify Landscape Architect of all soil and drainage conditions, which the Contractor considers detrimental to plant.
3.03 LAYOUT

A. Locate plants as shown on plan or as directed by Construction Manager. Stake out location for all plants and outlines for planting areas on the ground and obtain approval before any excavation is made. Make adjustment in locations and outlines as directed.

3.04 PLANTING TREES AND SHRUBS

A. Dig holes for individual shrubs and trees circular with vertical sides and sufficient depth to provide for backfill soil below ball of roots. Pits for all trees and evergreens shall be at least two (2) feet wider and six (6) inches deeper than the spread of the roots or balls. Pits for shrubs shall be eighteen (18) inches wider and six (6) inches deeper than the spread of the roots.

B. Set plants so that after settling, the crown of the plant is at same level as surrounding finished grade. Deep plantings are not acceptable. Place each plant in center of an individual pit. Set plants vertically.

C. Place backfill soil mix in the bottom of all pits and compact to the depth necessary to receive the plant.

D. Install starter fertilizer pellets into planting hole at recommended rate.

E. When pit is 2/3's backfilled, cut ball ties at base of plant and remove burlap from top 1/3 of ball.

F. Thoroughly water each plant by open end hose at low pressure to firm earth and eliminate air pockets. Do not compact earth by tramping in or tamping.

G. Finish off the grade leaving a basin around each plant; size and depth of basins to be in proportion to plants. Plants to be vertical when planted, watered, and fully settled.

H. Trees and shrubs shall be pruned on the site to remove damaged branches, improve natural shape, thin out structure and remove not more than 15% of branches. Remove horizontal or low hanging branches of street and parking lot trees to a height of 6'-0".

I. All excess material from tree or shrub pit excavation shall be hauled off site and properly disposed, unless otherwise directed.

3.05 PLANTING GROUND COVER, SHRUB AND FLOWER BEDS

A. Loosen soil of entire bed area to a depth of 12 (twelve) inches.

B. Incorporate thoroughly with tiller to a depth of 6 inches the following materials per each 1000 sq. ft. of bed:
1. One cu. yd. compacted sphagnum peat moss

C. Apply fertilizer to bed area at recommended rate, incorporate thoroughly into top 2 inches of soil.

D. Smooth and level soil and install ground cover plants or shrubs at specified spacing.

3.07 MULCHING

A. After planting in planting bed, pit or trench area is completed and approved, spread a layer of specified surface mulch over the entire area to a minimum depth of three (3) inches for shrubs and trees, or a minimum depth of one and a half (1 1/2) inches for ground covers and flowers, unless shown otherwise on drawings. Do not spread mulch in raised planters of the west courtyard.

B. Thoroughly moisten mulch by sprinkling with clean water.

3.08 CLEAN UP

A. Upon completion of the work, clean ground of all debris, superfluous materials and equipment and remove them from the premises.

3.09 WARRANTY MAINTENANCE

A. Contractor shall provide a 100% guarantee for all plants outlined in this contract for one full year. The guarantee shall begin at the date of final acceptance of installation work. Installation work shall be reviewed for acceptance when the installation of all specified plant materials is complete and in a healthy condition.

B. All plants shall be kept in a healthy, growing condition by watering, weeding, cultivating, fertilizing, pruning, removal of dead material, spraying, resetting plants to proper grades or upright positions and restoration of the planting saucer and any other necessary operations.

C. The Contractor shall replace as soon as weather conditions permit, all dead plants and all plants not in a vigorous, thriving condition, during and at the end of the guarantee period.

D. The plants shall be free of dead or dying branches and branch tips shall bear foliage of a normal density, size and color.

E. Replacements shall closely match adjacent specimens of the same species. Replacements shall be subject to all requirements stated in this specification.

END OF SECTION 329300
SECTION 334100 - STORM UTILITY DRAINAGE 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. Storm Sewer Drainpipe
      2. Flat Drains
      3. Inlets and Manholes
      4. Ductile Iron Frame and Grates

1.3 RELATED WORK
   A. Specified elsewhere:
      1. Division Section "Earth Moving" for excavation, trenching, and backfilling utilities.
      2. Division Section “Site Clearing” for temporary erosion control.

1.4 ACTION SUBMITTALS
   A. Product Data: For each type of product indicated.
   B. Shop Drawings:
      1. Inlets and Manholes. Include plans, elevations, sections, details, frames, covers, and grates.
      2. Trench Drain: Include plans, elevations, sections, details, frames, covers, and grates.
   C. Product Certificates: For each type of cast-iron frame and grate from manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING
   A. Do not store plastic manholes, pipe, and fittings in direct sunlight.
B. Protect manholes, pipe, pipe fittings, and seals from dirt and damage.

C. Handle inlets and manholes according to manufacturer's written rigging instructions.

1.6 PROJECT CONDITIONS

A. Interruption of Existing Storm Drainage 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 Owner no fewer than two days in advance of proposed interruption of service.
2. Contractor shall develop a plan to convey storm drainage during the interruption.
3. Contractor shall indicate the planned duration of the interruption.
4. Do not proceed with interruption of service without Owner's written permission.

1.7 QUALITY ASSURANCE

A. Contractor is responsible to construct improvements to the lines, grades, and elevations as shown on the Plans and Specifications. The Engineer will provide the initial survey control, but the Contractor shall perform their own survey and layout work.

B. Comply with the applicable requirements of the Missouri Standard Specifications for Highway Construction, latest edition and Metropolitan St. Louis Sewer District (MSD) Standard Construction Specifications for Sewer and Drainage Facilities, latest edition except as noted:

1. Measurement and payment provisions included in the Standard Specifications do not apply to this work.

PART 2 - PRODUCTS

2.1 PE PIPE AND FITTINGS

A. Corrugated PE Drainage Pipe and Fittings NPS 3 to NPS 10 AASHTO M 252M, Type S, with smooth waterway for coupling joints.

1. Watertight Couplings.

B. Corrugated PE Pipe and Fittings NPS 12 to NPS 60 AASHTO M 294M, Type S, with smooth waterway for coupling joints.

1. Watertight Couplings:

2.2 PVC PIPE AND FITTINGS

A. PVC Corrugated Sewer Piping according to Article 1040.03 of the Illinois Department of Transportation’s “Standard Specifications for Road and Bridge Construction”.
2.3 FLAT DRAIN TILE

A. Drain tile shall be 12-inch width, with a compressive strength of 11,400 pounds per square foot, and water flow rate of 21 gallons per minute per foot-width at 1,500 pounds per square foot and a 0.1 gradient.

2.4 MANHOLES

A. Manholes: Shall confirm to MSD Standard Detail for Precast Concrete Manhole.


PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavation, trenching, and backfilling are specified in Section 312000 "Earth Moving."

3.2 PIPING INSTALLATION

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.

C. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

D. Install gravity-flow, nonpressure drainage piping according to the following:

1. Install piping pitched down in direction of flow.
2. Install piping NPS 6 and larger with restrained joints at tee fittings and at changes in direction. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place concrete supports or anchors.
3. Install PVC sewer piping according to ASTM D 2321 and ASTM F 1668.

3.3 PIPE JOINT CONSTRUCTION

A. Join gravity-flow, nonpressure drainage piping according to the following:
1. Join PVC corrugated sewer piping according to ASTM D 2321 for elastomeric-seal joints.
2. Join dissimilar pipe materials with nonpressure-type flexible couplings.

3.4 MANHOLE INSTALLATION

3.5 CONNECTIONS
A. Make connections to existing piping and underground manholes.
   1. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe; install wye fitting into existing piping; and encase entire wye fitting, plus 6-inch overlap, with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.
   2. Make branch connections from side into existing piping, NPS 4 to NPS 20. Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.
   3. Protect existing piping, manholes, and structures to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

B. Pipe couplings and expansion joints with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
   1. Use nonpressure-type flexible couplings where required to join gravity-flow, nonpressure sewer piping unless otherwise indicated.
      a. Unshielded flexible couplings for same or minor difference OD pipes.

3.6 IDENTIFICATION
A. Materials and their installation are specified in Section 312000 "Earth Moving." Arrange for installation of green warning tape directly over piping and at outside edge of underground structures.
   1. Use warning tape or detectable warning tape over ferrous piping.
   2. Use detectable warning tape over nonferrous piping and over edges of underground structures.

3.7 FIELD QUALITY CONTROL
A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.
1. Submit separate reports for each system inspection.
2. Defects requiring correction include the following:
   a. Alignment: Less than full diameter of inside of pipe is visible between structures.
   b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
   c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
   d. Infiltration: Water leakage into piping.
   e. Exfiltration: Water leakage from or around piping.
3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
4. Reinspect and repeat procedure until results are satisfactory.

B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
   1. Do not enclose, cover, or put into service before inspection and approval.
   2. Test completed piping systems according to requirements of authorities having jurisdiction.
   3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
   4. Submit separate report for each test.
   5. Gravity-Flow Storm Drainage Piping: Test according to requirements of authorities having jurisdiction, UNI-B-6, and the following:
      a. Exception: Piping with soiltight joints unless required by authorities having jurisdiction.
      b. Option: Test plastic piping according to ASTM F 1417.

C. Leaks and loss in test pressure constitute defects that must be repaired.

D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

END OF SECTION 334100
Geotechnical Report

MSB NATURE PARK (E1703-01)
ST. LOUIS, MISSOURI

August 2019

MISSOURI SCHOOL FOR THE BLIND
Owner

OATES ASSOCIATES, INC.
Civil Engineer/Surveyor

SCI No. 2015-0067.10, Task 100
August 20, 2019

Mr. Travis Helmkamp  
Oates Associates, Inc.  
Eastport Plaza Drive  
100 Lanter Court, Suite 1  
Collinsville, Illinois  62234-6124

RE:  Geotechnical Report  
MSB Nature Park (E1703-01)  
St. Louis, Missouri  
SCI No. 2015-0067.10, Task 100

Dear Mr. Helmkamp:

Attached is our Geotechnical Report, dated August 2019. It should be read in its entirety, and our recommendations applied to the design and construction of the project. Selected excerpts from the report are highlighted below:

- Existing fill was encountered at each test location to depths ranging from 2 to 5 feet. Based on the results of the field and laboratory testing, the majority of the fill material encountered appears to have been placed and compacted in a controlled manner. Based on the age of the fill and the results of field and laboratory testing, the risk of supporting the proposed improvements on the fill is judged to be low with proper proofrolling and treatment.

- Fat clays were not observed in the depths explored. However, Atterberg limits testing within the existing fill and native soils suggest that lean clays with moderate swell potential (45 < LL < 50) are present on site. As such, these soils should not be allowed to dry out as the risk for volume change increases as the soils dry out. Dry soils should be removed and replaced with compacted structural fill. Fat clay soils could be encountered between the widely-spaced borings. If the bearing soils consist of fat clay, we recommend that they be removed to minimum depths of 2 feet beneath the bearing level of the footings and 3 feet beneath the bottom of the floor slab.

- Groundwater will influence any excavations extending below a depth of 8.5 feet. Groundwater below this depth will likely contribute to an unstable subgrade at the base of the overexcavation. A mud mat or crushed rock could be considered at the base of the overexcavation to create a stable working platform. A series of pumps can be used to remove the groundwater from the excavation prior to backfilling with select materials.
- Shallow spread footing foundations may be designed for a maximum net allowable soil bearing pressure of 2,000 pounds per square foot for strip footings and isolated column footings, as discussed in the report.

- Infiltration tests were conducted in Hand Augers I-1 and I-2 at a depth of 3 feet and resulted in average infiltration rates of 20.5 and 1.5 inches per hour, respectively. The value obtained from I-2 appears more representative of the soils encountered at the site as variable fill conditions, some containing rubble, were observed closer to I-1.

- Site Class C should be used for the project, with seismic design parameters as follows: $F_s = 1.30$, $F_v = 1.50$, $S_{DS} = 0.39$, and $S_{D1} = 0.16$. The Seismic Design Category for the site is C for Occupancy Categories I, II, and III.

We appreciate the opportunity to be of service and look forward to working with you during the construction phase of the project. SCI should participate in a meeting prior to construction. Such meetings are valuable in reviewing and clarifying project requirements and responsibilities.

If you have any questions or comments, please call.

Respectfully,

SCI ENGINEERING, INC.

Curtis J. Connor, E.I.
Staff Engineer

Julie A. Miller, P.E.
Senior Engineer

CJC/JAM/hmm

Enclosure
Geotechnical Report

C: Mr. Tom Cissell, Oates Associates, Inc.
Mr. Joseph Hagerty, Oates Associates, Inc.
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August 2019 SCI No. 2015-0067.10
FIGURES

Figure 1 - Vicinity and Topographic Map
Figure 2 - Aerial Photograph
Figure 3 - Site Plan

APPENDICES

Appendix A - CPTu Log Legend and Nomenclature, CPTu Logs
Appendix B - Boring Log Legend and Nomenclature, Hand Auger Logs
1.0 INTRODUCTION
At the request of Mr. Tom Cissell of Oates Associates, Inc., SCI Engineering, Inc. (SCI) conducted a geotechnical exploration for the proposed site improvements. The purpose of our exploration was to characterize and evaluate the subsurface conditions, provide recommendations for foundations, and address other geotechnical aspects. Our services were provided in general accordance with our proposal, dated March 28, 2019, and authorized by Mr. Joseph Hagerty of Oates Associates, Inc. on April 29, 2019 in the Subconsultant Agreement, dated May 6, 2019.

2.0 SITE AND PROJECT DESCRIPTION
Site improvements are currently being planned for Missouri School for the Blind located at 3815 Magnolia Avenue in the City of St. Louis, Missouri. The location of the site is shown on the Vicinity and Topographic Map, Figure 1. Improvements are planned within the existing east and west courtyards on campus. Currently, the east courtyard houses sidewalks, grass-covered areas, occasional trees, and a playground on the northern-half of the courtyard. The west courtyard houses sidewalks, some trees, mostly grass-covered areas, and some gardening areas. The buildings on the edges of the courtyards appear to be performing satisfactorily with no significant cracking that was visible from the exterior. The existing conditions are shown on the Aerial Photograph, Figure 2.

Based on the preliminary civil, structural, and architectural plans provided to SCI on July 11 through July 15, 2019, the improvements in the east courtyard will consist of an entrance canopy, an elevated catwalk, and new playground equipment featuring synthetic turf and a zipline. In the west courtyard, the planned improvements consist of a greenhouse and associated planters. Shallow bio-swales will be located in the lawn areas on the south side of the courtyards. In the east courtyard, the top and the bottom of the storage bed will be 30 inches below the finished grade at an elevation of 517.00. The bottom of the storage bed elevation in the west courtyard is 515.40. The proposed construction is shown on the Site Plan, Figure 3.
Grading plans indicate cuts and fills of 1-foot are planned for the improvements with the bio-retention basin extending up to 2.5 feet below the existing grade. Structural loads were not provided at the time of this report; however, we anticipate that the structures will be lightly-loaded with column loads of less than 100 kips.

SCI previously provided asbestos air monitoring and clearance at the school during the removal of asbestos-containing materials from March 4 through March 11, 2015 and February 28 through April 3, 2017. We have not reviewed, nor are we aware of, any previous studies on this specific site, by SCI or others, that would affect the preparation of this report.

3.0 SUBSURFACE CONDITIONS

Two piezocone penetration test (CPTu) soundings and adjacent hand augers (B-1 and B-2) and five additional hand augers (B-3, I-1, and I-2) were performed at the approximate locations shown on the Site Plan. The test locations were staked in the field by SCI personnel utilizing a global positioning system and measuring from existing site features. The ground surface elevations at the test locations were interpolated from available light detection and ranging (LiDAR) data and should be considered approximate. Detailed information regarding the nature and thickness of the soils encountered, and the results of the field sampling and laboratory testing are shown on the CPTu and Hand Auger Logs contained in Appendix A and Appendix B, respectively.

3.1 Existing Fill

Existing fill was encountered in each sounding/hand auger to the depths shown in Table 3.1, below. The fill consisted of lean clay with trace amounts of sand, gravel, and crushed brick. Interpretations of CPTu data indicate the fill was generally medium stiff to stiff in consistency. Shear strengths recorded in the fill in B-3 via a field vane ranged from 2.6 to 10.4 kips per square foot. Moisture contents in the fill ranged from 21 to 26 percent. An Atterberg limits test on samples of the fill from B-3 yielded a liquid limit (LL) of 49, classifying the soils as a lean clay. We anticipate the fill was likely placed during construction of the existing school; however, we are not aware of documentation regarding the placement or compaction of the fill.
Table 3.1 – Existing Fill Summary

<table>
<thead>
<tr>
<th>Sounding/Hand Auger</th>
<th>Approximate Surface Elevation (feet)</th>
<th>Existing Fill Depth (feet)</th>
<th>Approximate Bottom of Existing Fill Elevation (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>B-1</td>
<td>520</td>
<td>2</td>
<td>511</td>
</tr>
<tr>
<td>B-2</td>
<td>520</td>
<td>2.5</td>
<td>517.5</td>
</tr>
<tr>
<td>B-3</td>
<td>518</td>
<td>5</td>
<td>513</td>
</tr>
<tr>
<td>I-1</td>
<td>521</td>
<td>≥3</td>
<td>≤518</td>
</tr>
<tr>
<td>I-2</td>
<td>518</td>
<td>≥3</td>
<td>≤515</td>
</tr>
</tbody>
</table>

3.2 Native Soil Profile
The native soils predominately consisted of lean clay (CL in accordance with the Unified Soil Classification System and ASTM D 2488-09a), which extended to the sounding termination depth of 15 feet. Interpretations of CPTu data indicate the native soils were generally soft to medium stiff in consistency. Moisture contents in the native soils ranged from 20 to 32 percent. An Atterberg limits test on samples of the fill from B-3 yielded a LL of 49, classifying the soils as a lean clay.

3.3 Bedrock Geology
Documented geology, including the Bedrock Geologic Map of the St. Louis Quadrangle, Missouri and Illinois, indicates that bedrock at the site consists of the Cherokee Group, which typically consists of cycles of sandstone, siltstone, shale, clay, and coal. It is mapped only in Missouri and can be as much as 100 feet thick. Based on our experience with projects in the area and data available from the Missouri Department of Natural Resources (MDNR) Geological Survey Geosciences Technical Resource Assessment Tool site https://dnr.mo.gov/geostrat/, limestone bedrock is typically present at depths between 20 and 25 feet below the ground surface.

3.4 Groundwater
Interpretations of CPTu data and observations made during hand augering indicate groundwater was encountered in B-1 through B-3 at the depths shown in Table 3.2, below. Groundwater was not observed in Hand Auger Borings I-1 and I-2.
Table 3.2 – Groundwater Summary

<table>
<thead>
<tr>
<th>Sounding/Hand Auger</th>
<th>Approximate Surface Elevation (feet)</th>
<th>Groundwater Depth (feet)</th>
<th>Approximate Groundwater Elevation (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>B-1</td>
<td>520</td>
<td>11</td>
<td>509</td>
</tr>
<tr>
<td>B-2</td>
<td>520</td>
<td>10</td>
<td>510</td>
</tr>
<tr>
<td>B-3</td>
<td>518</td>
<td>8.5</td>
<td>509.5</td>
</tr>
</tbody>
</table>

The groundwater level depends on seasonal and climatic variations, and may be present at different depths in the future. In addition, without extended periods of observation, accurate groundwater level measurements may not be possible, particularly in low permeability soils. Groundwater will influence any excavations extending below a depth of 8.5 feet.

4.0 DESIGN RECOMMENDATIONS

4.1 Existing Fill

Existing fill was encountered at each test location to depths ranging from 2 to 5 feet. Presently, there are no records to document that the existing fill was placed and compacted in a controlled manner. Therefore, the engineering properties and performance of the existing fill cannot be predicted with certainty and there is some risk of settlement or other performance problems if the foundations or floor slab are supported on the fill material. To eliminate the risk associated with the fill, all the existing fill would have to be excavated and either recompacted or replaced.

However, based on the results of the field and laboratory testing, the majority of the fill material encountered appears to have been placed and compacted in a controlled manner. Based on the age of the fill and the results of field and laboratory testing, the risk of supporting the proposed improvements on the fill is judged to be low with proper proofrolling and treatment as discussed in Sections 4.2, 5.1, and 5.2.

SCI personnel should check the fill at the footing bearing elevations and floor slab subgrade. We anticipate that isolated, soft, unsuitable layers of existing fill may be encountered between our widely-spaced test locations and will require remediation. Any soft or otherwise unsuitable fill should be selectively undercut and replaced with engineered fill in accordance with Sections 5.1 and 5.2. Where the fill consists of expansive soils within a zone of 2 feet below the bearing elevation of the footings or 3 feet below the bearing elevation of the floor slab, it should be remediated as discussed in Section 4.2.
4.2 Expansive Clay Remediation

Fat clays were not observed in the depths explored. However, Atterberg limits testing within the existing fill and native soils suggest that lean clays with moderate swell potential (45 < LL < 50) are present on site. As such, these soils should not be allowed to dry out as the risk for volume change increases as the soils dry out. Dry soils should be removed and replaced with compacted structural fill.

Fat clay soils could be encountered between the widely-spaced borings. If the bearing soils consist of fat clay, we recommend that they be removed to minimum depths of 2 feet beneath the bearing level of the footings and 3 feet beneath the bottom of the floor slab. The overexcavation should extend at least 2 feet beyond the outside edge of the footings and building footprint to facilitate uniform compaction of the replacement materials and may require additional widening at the building corners to allow equipment access for proper compaction. The overexcavation, however, should not undermine the existing footings. The overexcavation should be backfilled with properly compacted low plastic soil or one-inch minus crushed limestone. As an alternate, the footing overexcavation may be backfilled with lean concrete. With this option, widening of the footing excavation is not required. If clean rock is used as backfill material, it must be drained to daylight or to a sump with a pump. The footings and floor slab would then be constructed on the newly placed fill.

The method of treatment described above are based on generally accepted standards in the local engineering community; however, swell pressures and volume change potential are greater than can be mitigated by these methods may exist. Consequently, the owner should recognize that there is an inherent, but reduced risk that foundation and floor slab damage may occur, even after remedial treatment of the subgrade soil.

4.3 Groundwater

Groundwater will influence any excavations extending below a depth of 8.5 feet. Groundwater below this depth will likely contribute to an unstable subgrade at the base of the overexcavation. A mud mat or crushed rock could be considered at the base of the overexcavation to create a stable working platform. A series of pumps can be used to remove the groundwater from the excavation prior to backfilling with select materials.

4.4 Shallow Foundations

Shallow spread footing foundations bearing in suitable existing fill, native lean clay, remediated fat clay, or newly placed low plastic structural fill are appropriate for support of the proposed structures. Based on the soils encountered during our exploration, shallow foundations can be sized for a maximum net allowable
bearing pressure of 2,000 pounds per square foot (psf) for continuous wall footings and isolated column footings. We anticipate that some localized areas of inadequate bearing materials may be encountered during construction; therefore, we recommend that an allowance be made in the construction budget for selected footing overexcavations.

Exterior footings and foundations in unheated areas of the greenhouse should be provided with at least 30 inches of soil cover for frost protection. Interior footings in heated areas can be located at nominal depths below the finished floor. For footings designed and constructed in accordance with our recommendations, total settlement should be less than 1-inch, and differential settlement between adjacent footings should be less than ¾-inch.

Special attention must be given to designing the foundations immediately adjacent to the existing improvements. It is advisable to place the foundations for the proposed addition at the same level as those of the existing building. If the footings of the new structures bear at a different elevation, either the new or existing footing walls, whichever are deeper, should be structurally checked to evaluate whether they could accommodate the external stresses imposed by the shallower adjacent existing structure or new footings. In spite of these precautions, some minor settlement of the existing building adjacent to the proposed structures should be expected. Accordingly, we recommend that construction joints be provided and other measures be taken, as needed, between the existing building and the proposed structures. Even so, small differential movements may occur and future leveling of the floor slab between the existing and new construction may be necessary.

4.5 Seismic Considerations

Ground shaking at the foundation of structures and liquefaction of the soil under the foundation are the principle seismic hazards to be considered in design of earthquake-resistant structures. Liquefaction occurs when a rapid buildup in water pressure, caused by the ground motion, pushes sand particles apart, resulting in a loss of strength and later densification as the water pressure dissipates. This loss of strength can cause bearing capacity failure, while the densification can cause excessive settlement. Potential earthquake damage can be mitigated by structural and/or geotechnical measures or procedures common to earthquake resistant design.
4.5.1 Design Earthquake

According to International Building Code (2018 edition) (IBC 2018), structures such as those proposed for this project are required to be designed to a design earthquake with a 2 percent Probability of Exceedance over a 50-year exposure period (i.e. a 2,475-year design earthquake). The design earthquake has a Moment Magnitude (Mw) of 7.7 and a Peak Ground Acceleration of 0.16g, as determined from data provided by the IBC 2018 and the United States Geological Survey National Seismic Hazard Mapping Project.

4.5.2 International Building Code Site Classification

Based on procedures outlined in the IBC 2018 and our geotechnical explorations for the subject site, including the borings through predominantly medium stiff near surface cohesive soil and the anticipated depth to bedrock, the site can be classified as Site Class C. Using the procedures outlined in Section 1613 of the IBC 2018, the calculated weighted average undrained shear strength ($s_u$) is in excess of the 2,000 psf required to be classified as Site Class C. Seismic design parameters for the site are as follows: $F_u = 1.30$, $F_v = 1.50$, $S_{DS} = 0.39$, and $S_{D1} = 0.16$. The Seismic Design Category for the site is C for Occupancy Categories I, II, or III.

4.5.3 Liquefaction Potential Analysis

The liquefaction potential analysis for the site was conducted using data from the field exploration and laboratory test results and the techniques outlined in the National Center for Earthquake Engineering (NCEER) Technical Report NCEER-97-0022.

Based on our analyses, the majority of the soils have sufficient strength and/or a plasticity index that make the threat of liquefaction minimal during the design earthquake.

While the amount of the seismically-induced settlement is dependent on the magnitude and distance from the seismic event, we estimate that the settlements from the design earthquake will be negligible so liquefaction mitigation techniques are not required.

4.6 Floor Slab

We recommend that the floor slab be designed using a modulus of subgrade reaction ($k$) of 150 pounds per square inch per inch of deflection if bearing on suitable existing fill, native lean clay, remediated fat clay, or newly placed low plastic structural fill. The floor slab should be supported on a minimum 4-inch-thick
layer of crushed stone. This will help to distribute concentrated loads and equalize moisture conditions beneath the slab.

It is generally preferable to maintain structural separation between the floor slab and the foundation walls and column pads using isolation joints. We also suggest that joints be placed in the floor slab on no more than 15-foot intervals in any direction. Such joints permit slight movements of the independent elements and help reduce random cracking that might otherwise be caused by restraint of shrinkage, slight rotations, heave, or settlement.

Where occupied space or moisture sensitive floor coverings are planned, we recommend a 6-mil-thick polyethylene sheeting be placed immediately beneath the floor slabs and above the crushed rock or gravel, to reduce the transfer of capillary moisture to the slabs. However, without careful attention to curing of the floor slabs, the polyethylene sheeting can cause excessive shrinkage cracking and "curling."

The precautions listed below should be followed for construction of slab-on-grade pads. These details will not reduce the amount of movement, but are intended to reduce potential damage should some settlement of the supporting subgrade take place. Some increase in moisture content is inevitable as a result of development and associated landscaping. However, extreme moisture content increases can be largely controlled by proper and responsible site drainage, building maintenance and irrigation practices.

- Cracking of slab-on-grade concrete is normal and should be expected. Cracking can occur not only as a result of heaving on compression of the supporting soil and/or bedrock material, but also as a result of concrete curing stresses. The occurrence of concrete shrinkage cracking, and problems associated with concrete curing may be reduced and/or controlled by limiting the slump of the concrete, proper concrete placement, finishing, and curing, and by the placement of crack control joints at frequent intervals, particularly where re-entrant slab corners occur. The American Concrete Institute recommends a maximum panel size (in feet) equal to approximately three times the thickness of the slab (in inches) in both directions. For example, joints are recommended at a maximum spacing of 12 feet based on having a 4-inch slab. SCI also recommends that the slab be independent of the foundation walls.

- Areas supporting slabs should be properly moisture conditioned and compacted. Backfill in all interior and exterior water and sewer line trenches should be carefully compacted to reduce the shear stress in the concrete extending over these areas.

Exterior slabs should be isolated from the building. These slabs should be reinforced to function as independent units. Movement of these slabs should not be transmitted to the building foundation or superstructure.
4.7 Below-Grade Walls

Below-grade walls required at this site may include retaining walls designed to accommodate surface grade changes around the structures and paved areas. The maximum toe pressure for below-grade walls should not exceed the bearing pressure previously given for continuous strip footings. Retaining walls may be designed with an ultimate coefficient of friction between the base of the concrete footing and the soil subgrade of 0.3.

Below-grade walls should also be designed to withstand lateral earth pressures caused by the weight of the backfill, including slopes behind the walls; and any surcharge, such as adjacent floor loads. We recommend the equivalent fluid unit weights tabulated below for lateral earth pressures, in pounds per cubic foot (pcf), be used in the design of below-grade walls. The indicated values assume that positive drainage is provided to prevent buildup of hydrostatic pressure. Expansive soils should not be used to backfill the wall excavations. Values for granular material should only be used if the granular backfill extends upwards and outwards the full height of the wall at a slope of 45 degrees or flatter from its base. In this case, exterior granular backfill should be capped with approximately 2 feet of cohesive soil to reduce the potential for surface water infiltration into the granular backfill. With clean granular backfill, filter fabric, such as Mirafi 140N, should be placed along the interface between the soil and granular backfill to reduce the potential for infiltration of the soil into the granular material.

<table>
<thead>
<tr>
<th>Backfill Type</th>
<th>Equivalent Fluid Unit Weights</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>At-Rest Earth Pressures (pcf)</td>
</tr>
<tr>
<td>Cohesive Soil</td>
<td>70</td>
</tr>
<tr>
<td>Granular Material (1-inch minus)</td>
<td>60</td>
</tr>
<tr>
<td>Free-Draining Granular Material (1-inch clean)</td>
<td>50</td>
</tr>
</tbody>
</table>

At-rest earth pressures should be used for restrained or fixed-head walls that are restricted from rotation, such as basement walls connected to floor joists or beams, or a wing wall attached to a basement wall. Active earth pressures should be used for free-head walls where the base remains fixed and deflection at the top of the wall of approximately 1-inch for each 10 feet of wall height is allowed, such as a retaining wall.

The above values are applicable when the surface of the backfill behind the wall is horizontal. Upward sloped or loaded backfill will result in increased values. In addition to lateral earth pressures, below-grade walls should be designed to resist any surcharge loads, including shallow building foundations and traffic. These surface loads can be modeled as uniform lateral loads, equivalent to one-half of the surface load, acting at the halfway point on the wall.
A passive soil resistance modeled by an equivalent fluid unit weight of 250 pcf may be used for native soil against the face of the exterior base or a key below the base of the wall. The upper 2 feet of soil backfilled against the exterior face of the walls and uncontrolled backfill soils should be ignored when calculating the lateral resistance. Lower passive pressure should be used if the ground surface slopes downward away from the face of the wall.

We recommend that all below-grade walls be provided with a drainage system. A minimum 4-inch diameter, perforated drainpipe should be used, and placed at foundation level. Granular drainage material, consisting of 1-inch clean crushed rock, classified as GP by ASTM D 2487-11, with less than 5 percent of the rock passing the No. 200 sieve, should be placed a minimum of 6 inches in all directions around the drainage pipe. Synthetic filter fabric, such as Mirafi 140N or equivalent, should encapsulate the drainpipe and granular drainage material. The pipe should be sloped to drain by gravity or through weepholes located on approximately 10-foot centers for above-grade retaining walls, or to a sump with a pump for below-grade walls where positive drainage by gravity cannot be achieved. Alternately, drainage can be provided directly through the weepholes without a drain pipe, provided that filter fabric is used or other measures are taken to prevent the granular backfill from migrating out through the weepholes. Any interior sumps must be isolated “watertight” from the interior subgrade to prevent the movement of moisture from the sump into the underlying soils.

When information is available regarding specific wall locations, configurations and heights, SCI should be retained to evaluate global stability for walls taller than 5 feet, based on developed strength parameters for the subsurface soils and backfill. At your request, we can provide the global stability study, or we can work with your wall designer to provide coordinated internal and global stability studies. These services are beyond our current scope.

4.8 Site Grading and Drainage

Positive site drainage should be provided to reduce surface water infiltration around the perimeter of the improvements and beneath the greenhouse’s floor slab. All grades should be sloped away from the improvements. Roof and surface drainage should be collected and discharged such that water is not permitted to infiltrate the backfill of the proposed structures.
Large trees and shrubs should be planted away from exterior footings as they may cause drying and shrinkage of the foundation soils and, with the passage of time, potentially detrimental settlement of the floor slab and foundations. A minimum distance of 20 feet or the mature tree’s dripline, whichever is greater, is suggested.

We recommend that all final slopes have a maximum inclination of 3 horizontal to 1 vertical (3H:1V), and that a crest of at least 10 feet in width or a distance equivalent to the total height of the slope, whichever is less, be provided around the building before the surface slopes down and away. Cut slopes of less than 15 feet in total height and properly compacted fill slopes up to about 25 feet in total height should perform satisfactorily at this inclination, or flatter. We do not anticipate that steeper or taller slopes will be required. However, if they are proposed, the slopes should be brought to our attention and individually addressed and evaluated by SCI on a case-by-case basis.

4.9 Underground Utilities

Underground utilities can provide a pathway for water to migrate below the floor slab. Drain and utility pipes beneath floors should have tight joints to prevent leakage. If utility excavations are backfilled with free-draining granular materials, then cutoffs should be provided at the exterior walls to reduce the potential for water to migrate beneath the proposed structures. Impermeable cutoffs may consist of a 3-foot-long “plug” of cohesive soil or bentonite soil mix, or a 1-foot-long plug of lean concrete. Soil may be used for the balance of the backfill.

Except for individual service lines to the improvements that intersect foundations perpendicularly, below-grade utilities should not be located within the stress influence zone of the building foundations. Accordingly, below-grade utilities should be located outside a zone extending 45 degrees downward and outward from the edge of the footings.

4.10 Bio-Swales and Porous Pavements

Shallow bio-swales, approximately 2 to 3 feet in depth, and porous pavements will be constructed within the vicinity of I-1 and I-2. These hand auger borings encountered existing fill, consisting of lean clay with trace amounts of sand, gravel, and crushed brick, to the termination depth of 3 feet. Infiltration tests were conducted in I-1 and I-2 in general accordance with Appendix D.1 of Maryland Stormwater Design Manual, dated October 2000, as adopted by the State of Missouri for general stormwater management practices. Infiltration testing data is shown below in Table 4.2, below.
Table 4.2 – Infiltration Test Summary

<table>
<thead>
<tr>
<th>Hand Auger</th>
<th>Approximate Ground Surface Elevation (feet)</th>
<th>Depth of Infiltration Test (feet)</th>
<th>Approximate Infiltration Test Elevation (feet)</th>
<th>Average Infiltration Rate (inches/hour)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I-1</td>
<td>521</td>
<td>3</td>
<td>518</td>
<td>20.5</td>
</tr>
<tr>
<td>I-2</td>
<td>518</td>
<td>3</td>
<td>515</td>
<td>1.5</td>
</tr>
</tbody>
</table>

A minimum required infiltration rate of 0.52 in/hr, as specified by the *Maryland Stormwater Design Manual*, was met at the test locations. It should be noted, that the infiltration rate measured at I-1 may be artificially raised because of the present variable rubble fill in the area. Where soils with less sand and gravel content are present, we anticipate significantly lower infiltration rates. Therefore, the value obtained from I-2, appears more representative of the soils encountered at the site.

We have assumed that the bio-swales are not designed with a permanent normal pool elevation. Based on the near surface soils encountered across the site, we anticipate that the basin bottom and embankments will consist of lean clay existing fill.

The upstream and downstream embankment slopes of the bio-swales should be no steeper than 3H:1V. We recommend that the crest be at least 8 feet wide to provide access for maintenance. The embankments of the bio-swales should consist of cohesive soils with a plasticity index (PI) of at least 20. The lean clay fill appears suitable for construction of the bio-swales. However, the fill material will vary between the borings. As such, SCI should observe the excavation for areas of unsuitable materials. Rocky, sandy, organic soils, or high silt-content soils are not suitable for the construction of bio-swale embankments because of their potential for erosion and piping.

Rock bedding should not be used for the outlet piping of the bio-swales. Instead, the outlet pipe should be placed on a cohesive soil subgrade, shaped to fit the pipe barrel, and the trench backfilled with properly compacted cohesive soil. Alternately, the trench can be backfilled to the springline of the pipe with lean concrete or flowable fill. Concrete anti-seepage collars should also be used to reduce seepage around the pipe.
5.0 SITE DEVELOPMENT AND CONSTRUCTION CONSIDERATIONS

5.1 Site Preparation

Within the construction area, existing structures and related below-grade components to be abandoned must be properly demolished and the debris removed from the site. Existing foundation walls and footings, floor slabs, pavements, cisterns, and utilities, as well as their associated backfill, should be removed from below and at least 10 feet beyond the proposed footprint for the proposed improvements. As an exception, deep utilities may be grouted in-place rather than being removed. However, the existing backfill associated with deep utilities should be removed and replaced or recompacted. Outside this area, existing foundation walls and footings deeper than 3 feet below the proposed subgrade may be left in place. Excavations resulting from the removal of existing site improvements should be backfilled with properly compacted fill.

Areas to be cut, or to receive fill, should be stripped of any surface vegetation or organic topsoil. The stripping’s should be removed and stockpiled for later placement in landscaped or common ground areas, as appropriate. Topsoil can be reused as fill, if thoroughly mixed with other, acceptable, non-organic fill materials, as approved by SCI.

After stripping and removal of the existing improvements, the site should be proofrolled by systematically passing over the subgrade to achieve complete coverage with proper compaction or loaded construction equipment, and observing the subgrade for pockets of excessively soft, wet or disturbed soil, or otherwise unacceptable materials. In particular, soft areas within the existing fill to remain in place should be identified during this process. Soft areas or otherwise unacceptable materials, if encountered, should be removed and replaced with structural fill or stabilized prior to placing additional fill.

5.2 Fill Materials and Compaction

Prior to fill placement and compaction, the upper 8 inches of the exposed subgrade should be scarified, moisture conditioned and recompacted. Structural fill should be placed in maximum 8-inch-thick loose lifts and mechanically compacted in accordance with Table 5.1, below. We recommend that any fill placed in building areas have a LL less than 45 and a PI less than 25. If higher plasticity soils are placed within 3 feet of the floor slab subgrade, or 2 feet of the bottom of the footings, then remediation will be required. Acceptable non-organic fill soils include materials designated CL, ML, CL-ML, SP, SW, GP, and GW by ASTM D 2487-11. Pavement broken to less than 4 inches in maximum dimension may be used as fill, if properly blended with acceptable soil and placed as approved by SCI.
Table 5.1 - Typical Compaction Requirements for Fill

<table>
<thead>
<tr>
<th>Material Tested</th>
<th>Proctor Type</th>
<th>Minimum Percentage Dry Density</th>
</tr>
</thead>
<tbody>
<tr>
<td>Structural Fill (Cohesive)</td>
<td>Modified (ASTM D 1557)</td>
<td>90</td>
</tr>
<tr>
<td></td>
<td>Standard (ASTM D 698)</td>
<td>95</td>
</tr>
<tr>
<td>Structural Fill (Granular)</td>
<td>Modified</td>
<td>95</td>
</tr>
<tr>
<td></td>
<td>Standard</td>
<td>98</td>
</tr>
<tr>
<td>Landscaped Areas (non-load bearing)</td>
<td>Modified</td>
<td>88</td>
</tr>
<tr>
<td></td>
<td>Standard</td>
<td>92</td>
</tr>
<tr>
<td>Utility Trench Backfill</td>
<td>Modified</td>
<td>90</td>
</tr>
<tr>
<td></td>
<td>Standard</td>
<td>95</td>
</tr>
</tbody>
</table>

Prior to compaction, the soil may require moisture adjustment. During warm weather, moisture reduction can generally be accomplished by diskling or otherwise aerating the soil. When air drying is not feasible, a moisture reducing chemical additive, such as hydrated lime, could be incorporated into the soil. During dry weather, some addition of moisture may be required to facilitate compaction. This should also be done in a controlled manner using a tank truck with a spray bar. The moistened soil should be thoroughly blended with a disk or pulverizer to produce a uniform moisture content. If construction is performed during the winter season, fill materials should be carefully observed to see that no frozen soil is placed as fill or remains in the base materials upon which fill is placed.

Backfill for foundation walls may consist of lean clay, one-inch minus crushed limestone, or controlled low strength material. We advise performing field density tests on at least every other lift to monitor compaction. As an alternate, we suggest using one-inch clean crushed limestone to provide improved drainage and to reduce lateral pressures on the walls. Due to a slight risk of migration of soil fines into the clean rock, a synthetic filter fabric, such as Mirafi 140N or equivalent, should be placed between the soil face of the excavation and the crushed limestone. If clean rock is used, it may be placed in 2-foot-thick lifts and tamped or tracked to achieve adequate densification. Exterior clean rock backfill should be capped with cohesive soil to reduce the potential for surface water infiltration.
Backfill placed next to walls should be compacted with hand operated equipment and not large self-propelled or machine operated equipment, which could result in potential overcompaction and higher lateral pressures. Compaction should be reduced within approximately one-foot of the walls, and the walls should be observed periodically for signs of movement. If movement is detected, it may be necessary to provide bracing and/or change backfill procedures.

In addition to the minimum density requirements listed above, the soil must be stable, i.e., not “pumping” or rutting excessively under construction traffic, prior to placing additional fill or constructing foundations, floor slabs, or pavements. Field density tests should be performed on each lift of fill to document that proper compaction is achieved.

5.3 Shallow Foundation Excavations

SCI should observe all footing and floor slab excavations for problem areas, such as soft zones or areas of desiccated lean clay, fat clay or unsuitable existing fill, prior to placing concrete. Excessive disturbance of silty soils in footing excavations should be avoided and could complicate construction. The potential for such disturbance will increase during wetter times of the year. Footing excavations that have been excessively disturbed should be overdeepened to approved undisturbed soils. Overexcavation and replacement with structural fill should be performed where inadequate bearing materials are present in footing excavations.

During construction, existing footings must not be undercut, i.e. no excavation should encroach within an area extending 45 degrees downward and outward from the outside edge of the existing foundations. If this is required, then SCI should be retained to provide specific recommendations to maintain support of the existing foundations and lateral support of the excavations.

The base of all excavations should be clean, free of loose soil or uncompacted fill, relatively dry, and maintained near their optimum moisture content. Excavations should be protected from extreme temperatures, precipitation, and construction disturbances. To reduce the possibility of desiccation or saturation of the foundation soils, we recommend that the concrete be placed as soon as possible after excavations are made.
Groundwater is not anticipated to be encountered in the footing excavations but could be encountered if excavations extend below a depth of 8.5 feet. However, in most situations, small amounts of groundwater seepage into the excavations can be handled by means of gravity ditching and a sump pump. If greater flows are experienced, SCI should be retained to provide additional consultation.

5.4 Subgrade Considerations
The floor slab subgrade may be subjected to construction traffic and exposure to weather for an extended period and significant problems may be incurred. It may be necessary to proofroll the subgrade, in both cut and fill areas, and recompress the subgrade immediately prior to placing base rock for the floor slab. In addition, subgrades covered with base rock may be very slow to dry if precipitation occurs after placing the base rock. Therefore, we recommend that proofrolling and placement of the base rock be done as close to the time of pouring the floor slab as is practical. Proofroll passes should be limited, particularly on silty subgrades, to reduce the potential for pumping of moisture from deeper within the soil profile.

Special measures may be required to facilitate construction during wet or cold weather, or where excessive areas of soft soils are identified. These measures may include, but are not limited to, the addition of lime to the subgrade soils for drying purposes, or the removal of soft spongy soils and their replacement with crushed limestone. Soft areas should be selectively undercut and backfilled with properly compacted cohesive soil. A geotextile, such as Mirafi 600X, or geogrid, such as Tensar TriAx-140, or equivalents, may be used to help stabilize particularly soft areas. Where possible, the subgrade should be sloped to provide drainage.

5.5 Excavation Bracing Requirements
In the Federal Register, Volume 54, No. 209 (October 1989), the United States Department of Labor, Occupational Safety and Health Administration (OSHA) amended its "Construction Standards for Excavations, 29 CFR, Part 1926, Subpart P." This document was issued to provide for the safety of workers entering excavations, including utility trenches, basements, footings, and others. All operations should be performed under the supervision of qualified site personnel in accordance with OSHA regulations.

The contractor is solely responsible for designing and constructing stable, temporary excavations and should shore, slope, or bench the sides of the excavations as required to maintain stability of both the excavation sides and bottom. The contractor’s “responsible person”, as defined in 29 CFR Part 1926,
should evaluate the soil exposed in the excavations as part of the contractor’s safety procedures. In no case should slope height, sloped inclination, or excavation depth, including utility trench excavation depth, exceed those specified in local, state, and federal safety regulations.

SCI is providing this information solely as a service to our client. SCI does not assume responsibility for construction site safety or the contractor’s or other party’s compliance with local, state, and federal safety or other regulations.

5.6 Erosion Control and Land Disturbance Monitoring Program
Appropriate erosion and sediment control measures, such as proper contouring during site grading activities, the installation of siltation fences, and/or inlet protection, should be used during construction to keep eroded materials from being carried onto adjacent properties or waterbodies. Depending on the length of time the subgrade is exposed and the amount of siltation that occurs, it may be necessary to periodically remove materials collected by the sediment control systems. Timely sodding and/or seeding of sloped surfaces will help reduce this potential problem.

SCI recommends following the procedures detailed in the Stormwater Pollution Prevention Plan (SWPPP). Any site disturbing more than one acre of ground must obtain a Land Disturbance Permit from the MDNR. As part of the permit compliance procedures, weekly and rain-event site observations must be performed to document the changing site conditions and maintenance of control measures.

6.0 CONSTRUCTION MONITORING PROGRAM
The following list summarizes SCI’s recommendations for a construction monitoring program. These services are recommended to provide quality assurance in assessing design assumptions and to document earth-related construction procedures for compliance with plans, specifications, and good engineering practice. SCI should be retained to:

- Review the final development and grading plans to assess the need for additional or revised recommendations or additional exploration;
- Participate in a formal preconstruction meeting with the Owner’s Representative, Civil Engineer, and Contractor, prior to construction at the site;
- Observe site preparation activities prior to construction, including removal of the existing improvements, stripping and proofrolling;
- Conduct and document weekly and rain-event observations at the site, maintain and update on-site paperwork, and provide submittals required by the SWPPP and Land Disturbance Permit;
- Assess the suitability of potential fill materials, including both on-site and off-site sources;
- Monitor placement and compaction of structural fill and backfill;
- Observe foundation excavations and the floor slab subgrade to assess the impact of desiccated lean clay, potential fat clay, and existing fill, and to recommend the extent of remedial measures;
- Observe footing excavations for adequacy of bearing materials;
- Observe the floor slab subgrade prior to placing base rock;
- Observe backfilling of below-grade utility excavations;
- Observe pavement subgrade preparation and provide observation and testing services for the base course and pavement section;
- Check the thickness of pavement sections and, for asphaltic concrete, its density; and
- Provide quality assurance testing of structural concrete and pavement materials.

7.0 LIMITATIONS
The recommendations provided herein are for the exclusive use of Oates Associates, Inc. and Missouri School for the Blind, and their respective successors and assigns. It is imperative that SCI be contacted by any third-party interests to evaluate the applicability of this report relative to use by anyone other than Oates Associates, Inc. and Missouri School for the Blind, and their respective successors and assigns. Our recommendations are specific only to the project described and are not meant to supersede more stringent requirements of local ordinances. They are based on subsurface information obtained at two specific CPTu sounding locations and five hand auger borings within the project area; our understanding of the project as presented in Section 2.0, “Site and Project Description”; and geotechnical engineering practice consistent with the standard of care. No other warranty is expressed or implied. SCI should be contacted if conditions encountered are not consistent with those described.

We should also be provided with a set of final development plans, once they are available, to review whether our recommendations have been understood and applied correctly, and to assess the need for additional exploration or analysis. Failure to provide these documents to SCI may nullify some or all of the recommendations provided herein. In addition, any changes in the planned project or changed site conditions may require revised or additional recommendations on our part.
The final part of our geotechnical service should consist of direct observation during construction, to observe that conditions actually encountered are consistent with those described in this report, and to assess the appropriateness of the analyses and recommendations contained herein. SCI cannot assume responsibility or liability for the adequacy of its recommendations without being retained to observe construction.
Appendix A
The CPTu logs show the corrected Tip Resistance (qt), Friction (ft), Porewater Pressure (U2), SPT N60 correlation (N60), and the Soil Behavior interpretation results. The corrected cone tip resistance (qt) is measured as the maximum force over the projected area of the cone tip. It is a point stress related to the bearing capacity of the soil. The measured uncorrected tip value (qt) must be corrected for porewater pressure effects (Lunne et al., 1997), especially in clays and silts where porewater pressures typically vary greatly from hydrostatic. The sleeve friction (fs) is used as a measure of soil type and can be expressed by friction ratio (Rf) which is used in the soil behavior classification. The U2 position element is required for the measurement of penetration porewater pressures and the correction of tip resistance. Calculations of qt, Rf, and the SPT N60 calculation are discussed below.

The estimated stratigraphic profiles included in the CPTu logs are based on relationships between qt, ft, and U2 as shown graphically in the figure below.

### Derivation of Values from CPT

**Corrected cone resistance:** \( q_t = q_c + U_2(1-a) \)

**Friction ratio:** \( R_f = (f_t/q_t) \times 100\% \)

\[
\frac{(q_t/p_a)}{N_{60}} = 8.5 \times \left( 1 - \frac{I_c}{4.6} \right)
\]

Where \( I_c = (3.47 - \log Q_{dr})2 + (\log R_f + 1.22)0.5 \)

And \( Q_{dr} = ((q_t - sv_0)/p_a) \times (p_a/(sv_0)n, \) and recalculate \( I_c, \) then iterate for \( n: \)

\[
n = 0.381 	imes I_c + 0.05 \times \left( \frac{sv_0}{p_a} \right) - 0.15
\]

Iterate until the change in \( n, \Delta n < 0.01 \)

### Equivalent SPT N60, (blows/ft) Lunne et al. (1997)

\( \text{P_a = atmospheric pressure} = 100 \text{ kPa} = 1 \text{ tsf} \)
Appendix B
BORING LOG LEGEND AND NOMENCLATURE

**Depth** is in feet below ground surface. **Elevation** is in feet mean sea level, site datum, or as otherwise noted.

**Sample Type**
- **SS** Split-spoon sample, disturbed, obtained by driving a 2-inch-O.D. split-spoon sampler (ASTM D 1586).
- **NX** Diamond core bit, nominal 2-inch-diameter rock sample (ASTM D 2113).
- **ST** Thin-walled (Shelby) tube sample, relatively undisturbed, obtained by pushing a 3-inch-diameter, tube (ASTM D 1587).
- **CS** Continuous sample tube system, relatively undisturbed, obtained by split-barrel sampler in conjunction with auger advancement.
- **SV** Shear vane, field test to determine strength of cohesive soil by pushing or driving a 2-inch-diameter vane, and then shearing by torquing soil in existing and remolded states (ASTM D 2573).
- **BS** Bag sample, disturbed, obtained from cuttings.

**Recovery** is expressed as a ratio of the length recovered to the total length pushed, driven, cored.

**Blows** Numbers indicate blows per 6 inches of split-spoon sampler penetration when driven with a 140-pound hammer falling freely 30 inches. The number of total blows obtained for the second and third 6-inch increments is the N value (Standard Penetration Test or SPT) in blows per foot (ASTM D 1586). Practical refusal is considered to be 50 or more blows without achieving 6 inches of penetration, and is expressed as a ratio of 50 to actual penetration, e.g., 50/2 (50 blows for 2 inches).

For analysis, the N value is used when obtained by a cathead and rope system. When obtained by an automatic hammer, the N value may be increased by a factor of 1.3.

**Vane Shear Strength** is expressed as the peak strength (existing state) / the residual strength (remolded state).

**Description** indicates soil constituents and other classification characteristics (ASTM D 2488) and the Unified Soil Classification (ASTM D 2487). Secondary soil constituents (expressed as a percentage) are described as follows:

<table>
<thead>
<tr>
<th>Trace</th>
<th>Few</th>
<th>With</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;5</td>
<td>5-15</td>
<td>&gt;15-30</td>
</tr>
</tbody>
</table>

**Stratigraphic Breaks** may be observed or interpreted, and are indicated by a dashed line. Transition between described materials may be gradual.

**Laboratory Test Results**
- Natural moisture content (ASTM D 2216) in percent.
- Dry density in pounds per cubic foot (pcf).
- Hand penetrometer value of apparently intact cohesive sample in kips per square foot (ksf).
- Unconfined compressive strength (ASTM D 2166) in kips per square foot (ksf).
- Liquid and Plastic Limits (ASTM D 4318) in percent.

**RQD (Rock Quality Designation)** is the ratio between the total length of core segments 4 inches or more in length and the total length of core drilled. RQD (expressed as a percentage) indicates insitu rock quality as follows:

<table>
<thead>
<tr>
<th>Excellent</th>
<th>Good</th>
<th>Fair</th>
<th>Poor</th>
<th>Very Poor</th>
</tr>
</thead>
<tbody>
<tr>
<td>90 to 100</td>
<td>75 to 90</td>
<td>50 to 75</td>
<td>25 to 50</td>
<td>0 to 25</td>
</tr>
</tbody>
</table>
**HAND AUGER LOG**

**PROJECT** MSB Nature Park (E1703-01)  
**LOCATION** St. Louis, Missouri  
**DRILLER** SCI Engineering, Inc.  
**EQUIPMENT** Hand Auger  
**ELEVATION** 520+  
**DATE DRILLED** 05/16/19

<table>
<thead>
<tr>
<th>DEPTH (ft)</th>
<th>SAMPLE</th>
<th>DESCRIPTION (UNIFIED SOIL CLASSIFICATION)</th>
<th>GRAPHIC</th>
<th>LABORATORY TEST RESULTS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>FILL: Brown, lean clay, trace fine sand,</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>trace roots</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>BS</td>
<td>LEAN CLAY (CL): Brown, trace fine sand</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>BS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>BS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>BS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>BS</td>
<td>Hand auger terminated at 5 feet.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**WATER LEVEL:**  
X NONE OBSERVED WHILE DRILLING  
ft WHILE DRILLING  
ft HRS AFTER DRILLING  
ft DAYS AFTER DRILLING

**REMARKS:**
## HAND AUGER LOG

**PROJECT**  MSB Nature Park (E1703-01)  
**LOCATION**  St. Louis, Missouri  
**DRILLER**  SCI Engineering, Inc.  
**EQUIPMENT**  Hand Auger  
**BORING NUMBER**  B-2  
**PROJECT NO.**  2015-0067.10  
**ELEVATION**  520+  
**DATE DRILLED**  05/16/19

<table>
<thead>
<tr>
<th>DEPTH (ft)</th>
<th>SAMPLE</th>
<th>DESCRIPTION (UNIFIED SOIL CLASSIFICATION)</th>
<th>GRAPHIC</th>
<th>LABORATORY TEST RESULTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>SS</td>
<td>FILL: Brown, lean clay, trace fine sand,</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>trace fine gravel, trace roots</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>SS</td>
<td>LEAN CLAY (CL): Brown, trace fine sand</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>SS</td>
<td></td>
<td></td>
<td></td>
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<td>4</td>
<td>SS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>SS</td>
<td>Hand auger terminated at 5 feet.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td>9</td>
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<td>10</td>
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<td>12</td>
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<tr>
<td>14</td>
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<tr>
<td>16</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>17</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>18</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**WATER LEVEL:**  
- None observed while drilling  
- ft while drilling  
- ft 6 HRS after drilling  
- ft x DAYS after drilling  

**REMARKS:**
<table>
<thead>
<tr>
<th>DEPTH (ft)</th>
<th>NUMBER</th>
<th>TYPE</th>
<th>DESCRIPTION (UNIFIED SOIL CLASSIFICATION)</th>
<th>GRAPHIC</th>
<th>MOISTURE CONTENT (%)</th>
<th>DRY DENSITY (pcf)</th>
<th>PENETROMETER (kPa)</th>
<th>UNCONFINED COMPRESSIVE STRENGTH (kPa)</th>
<th>FIELD VANE STRENGTH (kPa)</th>
<th>LIQUID LIMIT</th>
<th>PLASTICITY INDEX</th>
<th>ELEVATION (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>BS</td>
<td>(\frac{1}{2})&quot; TOPSOIL: Brown, lean clay, trace fine sand, trace roots</td>
<td>No roots</td>
<td>23</td>
<td>23</td>
<td>4.9</td>
<td>5.8</td>
<td>10.4</td>
<td>2.6</td>
<td></td>
<td>516</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>BS</td>
<td>Trace crushed brick</td>
<td></td>
<td>23</td>
<td>23</td>
<td>4.9</td>
<td>5.8</td>
<td>10.4</td>
<td>2.6</td>
<td></td>
<td>513</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>BS</td>
<td>LEAN CLAY (CL): Brown, trace fine sand</td>
<td></td>
<td>27</td>
<td>27</td>
<td>4.2</td>
<td>46</td>
<td>46</td>
<td>2.6</td>
<td></td>
<td>510</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td>BS</td>
<td>Becomes gray, with organics</td>
<td></td>
<td>32</td>
<td>27</td>
<td>4.8</td>
<td>8.4</td>
<td>8.4</td>
<td>6.6</td>
<td></td>
<td>507</td>
</tr>
<tr>
<td>5</td>
<td>5</td>
<td>BS</td>
<td>No organics</td>
<td></td>
<td>30</td>
<td>30</td>
<td>5.1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>504</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>BS</td>
<td>Hand auger terminated at 10 feet.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>501</td>
</tr>
</tbody>
</table>

WATER LEVEL:
- NONE OBSERVED WHILE DRILLING
- 8.5 ft WHILE DRILLING
- 10 HRS AFTER DRILLING
- 2 DAYS AFTER DRILLING

REMARKS:
<table>
<thead>
<tr>
<th>DEPTH (ft)</th>
<th>SAMPLE</th>
<th>DESCRIPTION (UNIFIED SOIL CLASSIFICATION)</th>
<th>GRAPHIC</th>
<th>LABORATORY TEST RESULTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>BS</td>
<td>FILL: Brown, lean clay, trace fine sand,  trace fine roots</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>BS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>BS</td>
<td>Hand auger terminated at 3 feet.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

WATER LEVEL: X NONE OBSERVED WHILE DRILLING ft WHILE DRILLING ft HRS AFTER DRILLING ft DAYS AFTER DRILLING

REMARKS:
<table>
<thead>
<tr>
<th>DEPTH (ft)</th>
<th>SAMPLE</th>
<th>DESCRIPTION (UNIFIED SOIL CLASSIFICATION)</th>
<th>GRAPHIC</th>
<th>SEEPAGE NUMBER</th>
<th>MOISTURE CONTENT (%)</th>
<th>DRY DENSITY (pgf)</th>
<th>PENETROMETER (kPa)</th>
<th>UNCONFINED COMPRESSIVE STRENGTH (kPa)</th>
<th>FIELD VANE CONSISTENCY</th>
<th>LIQUID LIMIT (٪)</th>
<th>PLASTICITY INDEX</th>
<th>ELEVATION (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>BS</td>
<td>FILL: Brown, lean clay, trace fine sand, trace fine roots</td>
<td></td>
<td></td>
<td>26</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>516</td>
</tr>
<tr>
<td>2</td>
<td>BS</td>
<td>Trace crushed brick, trace fine to coarse gravel</td>
<td></td>
<td></td>
<td>25</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>513</td>
</tr>
<tr>
<td>3</td>
<td>BS</td>
<td>Hand auger terminated at 3 feet.</td>
<td></td>
<td></td>
<td>22</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>510</td>
</tr>
</tbody>
</table>

WATER LEVEL:

X NONE OBSERVED WHILE DRILLING
ft WHILE DRILLING
ft HRS AFTER DRILLING
ft DAYS AFTER DRILLING

REMARKS:
Important Information about Your
Geotechnical Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.
While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

Geotechnical Services Are Performed for Specific Purposes, Parsons, and Projects
Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared solely for the client. No one except you should rely on your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. And no one—not even you—should apply the report for any purpose or project except the one originally contemplated.

Read the Full Report
Serious problems have occurred because those relying on a geotechnical engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

A Geotechnical Engineering Report Is Based on A Unique Set of Project-Specific Factors
Geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typical factors include:
- the client’s goals, objectives, and risk management preferences,
- the nature of the structure involved, its size, and configuration,
- the location of the structure on the site, and other planned or existing site improvements,
- the function of the proposed structure, as when it is changed from a parking garage to an office building, or from a light industrial plant to a refrigerated warehouse.

Geotechnical engineers may not fulfill the needs of a construction contractor or even another civil engineer.

- elevation, configuration, location, orientation, or weight of the proposed structure,
- composition of the design team, or
- project ownership.

As a general rule, always inform your geotechnical engineer of project changes—ever minor ones—and request an assessment of their impact. Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.

Subsurface Conditions Can Change
A geotechnical engineering report is based on conditions that existed at the time the study was performed. Do not rely on a geotechnical engineering report whose adequacy may have been affected by the passage of time, by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. Always contact the geotechnical engineer before applying the report to determine if it is still reliable. A minor amount of additional testing or analysis could prevent major problems.

Most Geotechnical Findings Are Professional Opinions
Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ—sometimes significantly—from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A Report’s Recommendations Are Not Final
Do not rely on the construction recommendations included in your report. These recommendations are not final, because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations only by observing actual
subsurface conditions revealed during construction. The geotechnical engineer who developed your report can assume responsibility or liability for the report’s recommendations if that engineer does not perform construction observation.

A Geotechnical Engineering Report Is Subject to Misinterpretation

Other design team members’ misinterpretation of geotechnical engineering reports has resulted in costly problems. Lower that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team’s plans and specifications. Contractors can also misinterpret a geotechnical engineering report. Reduce that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing construction observation.

Do Not Redraw the Engineer’s Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering report should never be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, but recognize that separating logs from the report can elevate risk.

Give Contractors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering report, but prefix it with a clearly written letter of transmittal. In that letter, advise contractors that the report was not prepared for purposes of bid development and that the report’s accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. Be sure contractors have sufficient time to perform additional study. Only then might you be in a position to give contractors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

Read Responsibility Provisions Closely

Some clients, design professionals, and contractors do not recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled “limitations” many of these provisions indicate where geotechnical engineers’ responsibilities begin and end, to help others recognize their own responsibilities and risks. Read these provisions closely. Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform a geoenvironmental study differ significantly from those used to perform a geotechnical study. For that reason, a geotechnical engineering report does not usually relate any geoenvironmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. Unanticipated environmental problems have led to numerous project failures. If you have not yet obtained your own geoenvironmental information, ask your geotechnical consultant for risk management guidance. Do not rely on an environmental report prepared for someone else.

Obtain Professional Assistance To Deal with Mold

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the express purpose of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, a number of mold prevention strategies focus on keeping buildings surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; none of the services performed in connection with the geotechnical engineer’s study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.

Rely, on Your ASFE-Member Geotechnical Engineer for Additional Assistance

Membership in ASFE/THG BEST PEOPLE ON EARTH exposes geotechnical engineers to a wide array of risk management techniques that can be of genuine benefit for everyone involved with a construction project. Contact with your ASFE-member geotechnical engineer for more information.

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September 26, 2019

Mr. Tom Cissell  
Oates Associates  
720 Olive Street, Suite 700  
St. Louis, Missouri  63101

RE: Asbestos Survey Activities  
Missouri School for the Blind - Catwalk  
St. Louis, Missouri  
SCI No. 2015-0067.20, Task 001

Dear Mr. Cissell:

INTRODUCTION

SCI Engineering, Inc. (SCI) is pleased to submit this report of the analytical test results for samples of suspect asbestos-containing materials (ACMs) collected during the survey performed on September 18, 2019. The survey was conducted by Mr. Brian Lieb, Missouri-Licensed Asbestos Inspector. A copy of Mr. Lieb’s asbestos inspector license is enclosed.

The purpose of this survey was to identify ACMs in accessible areas of the catwalks at the Missouri School for the Blind in St. Louis, Missouri. Additionally, the north exterior wall of the science building was surveyed. This survey is intended to satisfy the requirements for the asbestos National Emission Standard for Hazardous Air Pollutant for demolition and renovation as well as for Occupational Safety and Health Administration (OSHA) compliance.

The on-site catwalks total approximately 4,000 square-feet. The exterior of the catwalks was metal with metal windows and a thermoplastic polyolefin (TPO) roof.

ASBESTOS SURVEY

Thirty-three samples were collected from the on-site structure. Of these 33 samples, 42 layers were analyzed using a positive procedure. These samples were analyzed by Polarized Light Microscopy (PLM). Of the 42 samples/layers analyzed, no samples/layers were found to contain asbestos. Analytical test results and chain-of-custody documentation are enclosed. The results of the analysis of all samples are summarized in Table 1.

<table>
<thead>
<tr>
<th>Sample Number</th>
<th>Material Location</th>
<th>Material Description</th>
<th>Approx. Quantity</th>
<th>Result</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSB-1a</td>
<td>Girder Expansion Joint</td>
<td>Gray Caulk</td>
<td>-</td>
<td>None Detected</td>
<td></td>
</tr>
<tr>
<td>MSB-1b</td>
<td>Girder Expansion Joint</td>
<td>Gray Caulk</td>
<td>-</td>
<td>None Detected</td>
<td></td>
</tr>
<tr>
<td>MSB-1c</td>
<td>Girder Expansion Joint</td>
<td>Gray Caulk</td>
<td>-</td>
<td>None Detected</td>
<td></td>
</tr>
</tbody>
</table>
### Table 1 - Summary of Analytical Test Results (continued)

<table>
<thead>
<tr>
<th>Sample Number</th>
<th>Material Location</th>
<th>Material Description</th>
<th>Approx. Quantity</th>
<th>Result</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSB-2a</td>
<td>Catwalk/Brick</td>
<td>Light Gray Caulk (also around windows)</td>
<td>--</td>
<td>None Detected</td>
<td></td>
</tr>
<tr>
<td>MSB-2b</td>
<td></td>
<td></td>
<td></td>
<td>None Detected</td>
<td></td>
</tr>
<tr>
<td>MSB-2c</td>
<td></td>
<td></td>
<td></td>
<td>None Detected</td>
<td></td>
</tr>
<tr>
<td>MSB-3a</td>
<td>Roof Flashing</td>
<td>Gray Caulk</td>
<td>--</td>
<td>None Detected</td>
<td></td>
</tr>
<tr>
<td>MSB-3b</td>
<td></td>
<td></td>
<td></td>
<td>None Detected</td>
<td></td>
</tr>
<tr>
<td>MSB-3c</td>
<td></td>
<td></td>
<td></td>
<td>None Detected</td>
<td></td>
</tr>
<tr>
<td>MSB-4a</td>
<td>Roof Flashing</td>
<td>Old Light Gray Caulk</td>
<td>--</td>
<td>None Detected in Gray or Brown Caulk</td>
<td></td>
</tr>
<tr>
<td>MSB-4b</td>
<td></td>
<td></td>
<td></td>
<td>None Detected in Gray or Brown Caulk</td>
<td></td>
</tr>
<tr>
<td>MSB-4c</td>
<td></td>
<td></td>
<td></td>
<td>None Detected in Gray or Brown Caulk</td>
<td></td>
</tr>
<tr>
<td>MSB-5a</td>
<td>Catwalk</td>
<td>Gray Caulk</td>
<td>--</td>
<td>None Detected</td>
<td></td>
</tr>
<tr>
<td>MSB-5b</td>
<td></td>
<td></td>
<td></td>
<td>None Detected</td>
<td></td>
</tr>
<tr>
<td>MSB-5c</td>
<td></td>
<td></td>
<td></td>
<td>None Detected</td>
<td></td>
</tr>
<tr>
<td>MSB-6a</td>
<td>Catwalk Panel</td>
<td>White Caulk</td>
<td>18 lf/panel section</td>
<td>None Detected</td>
<td></td>
</tr>
<tr>
<td>MSB-6b</td>
<td></td>
<td></td>
<td></td>
<td>None Detected</td>
<td></td>
</tr>
<tr>
<td>MSB-6c</td>
<td></td>
<td></td>
<td></td>
<td>None Detected</td>
<td></td>
</tr>
<tr>
<td>MSB-7a</td>
<td>Roof Panel</td>
<td>Caulk</td>
<td>--</td>
<td>None Detected</td>
<td></td>
</tr>
<tr>
<td>MSB-7b</td>
<td></td>
<td></td>
<td></td>
<td>None Detected</td>
<td></td>
</tr>
<tr>
<td>MSB-7c</td>
<td></td>
<td></td>
<td></td>
<td>None Detected</td>
<td></td>
</tr>
<tr>
<td>MSB-8a</td>
<td>Catwalk Roofs</td>
<td>TPO Roofing</td>
<td>--</td>
<td>None Detected</td>
<td></td>
</tr>
<tr>
<td>MSB-8b</td>
<td></td>
<td></td>
<td></td>
<td>None Detected</td>
<td></td>
</tr>
<tr>
<td>MSB-8c</td>
<td></td>
<td></td>
<td></td>
<td>None Detected</td>
<td></td>
</tr>
<tr>
<td>MSB-9a</td>
<td>Runners</td>
<td>12” x 12” Red Floor Tile (on concrete)</td>
<td>--</td>
<td>None Detected in Floor Tile or Mastic</td>
<td></td>
</tr>
<tr>
<td>MSB-9b</td>
<td></td>
<td></td>
<td></td>
<td>None Detected in Floor Tile or Mastic</td>
<td></td>
</tr>
<tr>
<td>MSB-9c</td>
<td></td>
<td></td>
<td></td>
<td>None Detected in Floor Tile or Mastic</td>
<td></td>
</tr>
<tr>
<td>MSB-10a</td>
<td>Throughout Catwalk</td>
<td>12” x 12” White Floor Tile with Gray Specks (on concrete)</td>
<td>--</td>
<td>None Detected in Floor Tile or Mastic</td>
<td></td>
</tr>
<tr>
<td>MSB-10b</td>
<td></td>
<td></td>
<td></td>
<td>None Detected in Floor Tile or Mastic</td>
<td></td>
</tr>
<tr>
<td>MSB-10c</td>
<td></td>
<td></td>
<td></td>
<td>None Detected in Floor Tile or Mastic</td>
<td></td>
</tr>
<tr>
<td>MSB-11a</td>
<td>1st Floor Windows</td>
<td>Yellow/Tan Window Caulk</td>
<td>--</td>
<td>None Detected</td>
<td></td>
</tr>
<tr>
<td>MSB-11b</td>
<td></td>
<td></td>
<td></td>
<td>None Detected</td>
<td></td>
</tr>
<tr>
<td>MSB-11c</td>
<td></td>
<td></td>
<td></td>
<td>None Detected</td>
<td></td>
</tr>
</tbody>
</table>

If - linear feet
DEMOlITION/RENOVATION

According to the Missouri Department of Natural Resources (MDNR), any friable or potentially friable ACM equal to or greater than 260 linear feet or 160 square feet is classified as a regulated ACM (RACM) and must be removed prior to demolition or renovation which would significantly damage the material. However, no ACMs were identified within the materials collected.

The Occupational Safety & Health Administration also has regulations (29 CFR Parts 1910 et al, Occupational Exposure to Asbestos, August 10, 1994) regarding removal of asbestos-containing materials which must be followed.

REPORTING

Attached is Demolition and Renovation form which has been filled out to the extent possible by SCI. The remaining information must be completed by you.

This report, as well as the completed EPA Notification of Demolition and Renovation form, must be submitted to MDNR, Air Pollution Control, PO Box 176, Jefferson City, MO, 65102, Ms. Stephanie Hamilton.

It should be noted that following submittal of the notification form, there is a 10-day waiting period before demolition, renovation, or abatement activities can begin.

SCI's asbestos survey entailed visually assessing accessible areas only. If any other suspect asbestos materials are discovered during demolition or renovation, please contact SCI, and we will make arrangements for assessment of these materials. Areas behind walls, under subfloors and above fixed ceilings are considered non-accessible.

If this report is to be used for bidding purposes for asbestos abatement, SCI recommends the contractor visit the site to verify all conditions and quantities.

SCI appreciates the opportunity to be of service to you on this project, and we look forward to working with you in the future. Please contact us if you have any questions or comments regarding the information provided.

Respectfully,

SCI ENGINEERING, INC.

Brian L. Lieb
Missouri State Certified Asbestos Inspector
Certificate Number 7118051719MOIR16703

Jessica B. Keeven, CHMM
Project Scientist

BLL/JBK/rah

Enclosures
GENERAL INSTRUCTIONS

NOTE: There is a $100 review fee for this notification. Make checks payable to the department's Air Pollution Control Program or the appropriate local agency.

1. First-time notices = "Original." Amended projects = "Revision." Notice of cancellation = "Cancelled."

2. In the event that no asbestos removal was necessary, indicate "N/A" for asbestos removal contractor.

3. Indicate the type of project.

4. Mark the "YES" box if asbestos is present. In the next box, indicate what types of asbestos materials are present. Mark the "NO" box if no asbestos is present.

5. Failure to complete this section will result in an unapproved project. Include building uses, sizes and age. If you do not know the exact information, give your best estimate.

6. All regulated structures must be inspected by a certified asbestos inspector prior to renovation or demolition. Typically: "Certified asbestos inspector, with sample analysis by PLM." If other methods were used, explain.

7. All asbestos materials present in the building must be included here. Enter amounts (in ft², linear feet, or ft³) of material to be removed from or left in the building. For example, in the column "Nonfriable asbestos material to be removed," under subcolumn "CAT II" (on the "surface area" line) you might enter "5,200" and "transite" under the number. The inspection report, which must be attached to the notification, should reflect this information.

8. This line must be completed. Never enter a date that is not at least 10 working days after your postmark, unless you have been granted a waiver by the department. Missouri law requires notifications to be submitted at least 10 working days in advance of the project start date.

9. If applicable, enter the dates on which abatement will occur or has occurred.

10. Give a brief description of your demolition/renovation plans, including the scope of work to be performed and the methods used to perform the work. Use an additional page if necessary.

11. Describe how any asbestos-containing materials (ACM) involved will be removed prior to demolition/renovation. If ACM will be left in the building, then indicate precautions used to prevent ACM from being made friable. If all asbestos has been removed, "N/A."

12. Identify waste transporter.

13. Identify waste disposal site.

14. Complete this section only for ordered demolitions. Submit the order with the notification. For all others, "N/A."

15. Complete this section only for emergency renovation projects. For all other renovations, indicate "N/A."

16. Indicate what will be done in the event that friable asbestos or suspect materials are unexpectedly encountered.

17. For regulated asbestos abatement or demolition of an unsafe or damaged structure when a prior inspection has not been conducted, a person trained in the requirements of 40 CFR Part 61, Subpart M must be on site to supervise the asbestos abatement. In the event that no asbestos is present or has already been removed, mark "N/A."

18. Always sign and date this line. This form may be signed by the project owner or operator. The project approval letter will be mailed to the person who signs the notification form.

NOTE: For all regulated demolition and renovation projects, always include a complete copy of your asbestos inspection report with the notification form.

Send completed forms to:
Missouri Department of Natural Resources
APCP, Asbestos
PO Box 176
Jefferson City, MO 65102

If using priority mail, send to:
Missouri Department of Natural Resources
APCP, Asbestos
1659 E. Elm St.
Jefferson City, MO 65101
There is a $100 review fee for this notification. Processing will be delayed if notification is received without payment.

1. TYPE OF NOTIFICATION
   - O - ORIGINAL
   - C - CANCELLED
   - R - REVISION, WRITE REVISION NUMBER

2. FACILITY INFORMATION (IDENTIFY OWNER, REMOVAL CONTRACTOR AND OTHER OPERATOR)

   OWNERS NAME: [Field]
   CITY: [Field]
   STATE: [Field]
   ZIP CODE: [Field]
   EMAIL: [Field]
   PHONE NUMBER WITH AREA CODE: [Field]
   ASBESTOS REMOVAL CONTRACTOR:
   CITY: [Field]
   STATE: [Field]
   ZIP CODE: [Field]
   EMAIL: [Field]
   PHONE NUMBER WITH AREA CODE: [Field]
   DEMOLITION CONTRACTOR:
   CITY: [Field]
   STATE: [Field]
   ZIP CODE: [Field]
   EMAIL: [Field]
   PHONE NUMBER WITH AREA CODE: [Field]

3. TYPE OF OPERATION
   - D - DEMO
   - O - ORDERED DEMO
   - R - RENOVATION
   - E - EMERGENCY RENOVATION

4. IS ASBESTOS PRESENT?
   - YES
   - NO
   LIST TYPE(S) OF ASBESTOS MATERIAL TO BE REMOVED

5. FACILITY DESCRIPTION
   BUILDING NAME: [Field]
   ADDRESS: [Field]
   CITY: [Field]
   COUNTY: [Field]
   STATE: [Field]
   ZIP CODE: [Field]
   SITE LOCATION: [Field]
   BUILDING SIZE: [Field]
   NUMBER OF FLOORS: [Field]
   AGE IN YEARS: [Field]
   PRESENT USE: [Field]
   PRIOR USE: [Field]

6. PROCEDURE, INCLUDING ANALYTICAL METHOD, IF APPROPRIATE, USED TO DETECT THE PRESENCE OF ASBESTOS MATERIAL. INCLUDE A COPY OF THE ASBESTOS INSPECTION.

7. APPROXIMATE AMOUNT OF ASBESTOS, INCLUDING:
   A. REGULATED ACM (RACM)
   B. CATEGORY I ACM
   C. CATEGORY II ACM

   RACM TO BE REMOVED
   CAT I
   CAT II
   NONFRIABLE ASBESTOS MATERIAL TO BE REMOVED
   CAT I
   CAT II
   NONFRIABLE ASBESTOS MATERIAL NOT TO BE REMOVED
   CAT I
   CAT II

   PIPES (LINEAR FEET)
   SURFACE AREA (SQUARE FEET)
   VOL. RACM OFF FACILITY COMPONENT (CUBIC FEET)

MO 750-1023 (01-17)
8. SCHEDULED DATES DEMO/RENOVATION (MM/DD/YY)
START: 
COMPLETION: 

9. SCHEDULED DATES ASBESTOS REMOVAL (MM/DD/YY)
START: 
COMPLETION: 
WEEKDAY WORK HOURS 
WEEKEND WORK HOURS 

10. DESCRIPTION OF PLANNED DEMOLITION OR RENOVATION WORK AND METHOD(S) TO BE USED 

11. DESCRIPTION OF WORK PRACTICES AND ENGINEERING CONTROLS TO BE USED TO PREVENT EMISSIONS OF ASBESTOS AT THE DEMOLITION OR RENOVATION SITE.

12. WASTE TRANSPORTER
NAME: 
ADDRESS: 
CITY: 
STATE: 
ZIP CODE: 
CONTACT PERSON: 
TELEPHONE NUMBER WITH AREA CODE: 

13. WASTE DISPOSAL SITE
NAME: 
LOCATION: 
CITY: 
STATE: 
ZIP CODE: 
TELEPHONE NUMBER WITH AREA CODE: 

14. IF DEMOLITION ORDERED BY A GOVERNMENT AGENCY, IDENTIFY THE AGENCY BELOW.
NAME: 
TITLE: 
AGENCY: 
DATE OF ORDER (MM/DD/YY): 
DATE ORDERED TO BEGIN (MM/DD/YY): 

15. FOR EMERGENCY RENOVATIONS
DATE AND HOUR OF EMERGENCY:
DESCRIPTION OF THE SUDDEN, UNEXPECTED EVENT:
EXPLANATION OF HOW THE EVENT CAUSED UNSAFE CONDITIONS OR WOULD CAUSE EQUIPMENT DAMAGE OR AN UNREASONABLE FINANCIAL BURDEN:

16. DESCRIPTION OF PROCEDURES TO BE FOLLOWED IN THE EVENT THAT UNEXPECTED ASBESTOS IS FOUND OR PREVIOUSLY NONFRIABLE ASBESTOS MATERIAL BECOMES CRUMBLED, PULVERIZED OR REDUCED TO POWDER:

17. I CERTIFY THAT AN INDIVIDUAL TRAINED IN THE PROVISIONS OF THIS REGULATION (40 CFR PART 61, SUBPART M) WILL BE ON-SITE DURING THE DEMOLITION OR RENOVATION AND EVIDENCE THAT THE REQUIRED TRAINING HAS BEEN ACCOMPLISHED BY THIS PERSON WILL BE AVAILABLE FOR INSPECTION DURING NORMAL BUSINESS HOURS (REQUIRED 1 YEAR AFTER PROMULGATION).
SIGNATURE OF OWNER/OPERATOR: 
DATE: 

18. I CERTIFY THAT THE ABOVE INFORMATION IS CORRECT.
SIGNATURE OF OWNER/OPERATOR: 
DATE: 

MO. 780-1923 (01-17)
# Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

<table>
<thead>
<tr>
<th>Sample</th>
<th>Description</th>
<th>Appearance</th>
<th>% Fibrous</th>
<th>% Non-Fibrous</th>
<th>Non-Asbestos</th>
<th>Asbestos % Type</th>
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<tbody>
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<td>100%</td>
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<tr>
<td>MSB-1B</td>
<td></td>
<td>Gray Non-Fibrous</td>
<td></td>
<td>100%</td>
<td>100% Non-fibrous (Other)</td>
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<tr>
<td></td>
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<tr>
<td>MSB-1C</td>
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<td>Gray Non-Fibrous</td>
<td></td>
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<td>100% Non-fibrous (Other)</td>
<td>None Detected</td>
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<td>4% Glass</td>
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<tr>
<td>MSB-4A-Caulk</td>
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<tr>
<td>MSB-4B-Caulk</td>
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<td>100% Non-fibrous (Other)</td>
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<tr>
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<tr>
<td>MSB-4C-Caulk</td>
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<td>4% Glass</td>
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<td>96%</td>
<td>96% Non-fibrous (Other)</td>
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<tr>
<td>MSB-4C-Caulk</td>
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<tr>
<td>MSB-5A</td>
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<tr>
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<td>Homogeneous</td>
<td></td>
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</tbody>
</table>
# Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

<table>
<thead>
<tr>
<th>Sample</th>
<th>Description</th>
<th>Appearance</th>
<th>% Fibrous</th>
<th>% Non-Fibrous</th>
<th>Asbestos % Type</th>
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<tr>
<td>MSB-5B</td>
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<td>100% Non-fibrous (Other)</td>
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<td>391909935-0014</td>
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<td>MSB-6A</td>
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<td>Inseparable coating layer included in analysis.</td>
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Initial report from: 09/23/2019 14:07:15

ASB_PLM_0008_0001 - 1.78 Printed: 09/23/2019 1:07 PM
## Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

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<thead>
<tr>
<th>Sample</th>
<th>Description</th>
<th>Appearance</th>
<th>% Fibrous</th>
<th>% Non-Fibrous</th>
<th>Asbestos % Type</th>
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<tbody>
<tr>
<td>MSB-10A-Adhesive</td>
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<td>Tan Non-Fibrous Homogeneous</td>
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<td>MSB-10B-F.T.</td>
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<td>Various Non-Fibrous Homogeneous</td>
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<tr>
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</tr>
</tbody>
</table>

---

**Analyst(s)**

Sue Ferrario (28)

Stuart Kinquist (12)

Sarah Kuper (2)

---

Jeff Siria, Laboratory Manager
or Other Approved Signatory

---

EMSL maintains liability limited to cost of analysis. The above analyses were performed in general compliance with Appendix E to Subpart E of 40 CFR (previously EPA 800/M4-82-020 “Interim Method”), but augmented with procedures outlined in the 1993 (“final”) version of the method. This report relates only to the samples reported above, and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities or analytical method limitations. Interpretation and use of test results are the responsibility of the client. All samples received in acceptable condition unless otherwise noted. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST or any agency of the federal government. EMSL recommends gravimetric reduction for all non-friable organically bound materials prior to analysis. Estimation of uncertainty is available on request.

Samples analyzed by EMSL Analytical, Inc. Saint Louis, MO NVLAP Lab Code 200742-0

---

Initial report from: 09/23/2019 14:07:15

Printed: 09/23/2019 1:07 PM
**Asbestos Chain of Custody**

**EMSL Order Number (lab use only):**

391909935

<table>
<thead>
<tr>
<th>Company Name</th>
<th>EMSL Customer ID</th>
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<tbody>
<tr>
<td>SCI Engineering, Inc.</td>
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<table>
<thead>
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<th>Street</th>
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<table>
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<th>State or Province:</th>
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<table>
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<tr>
<th>Report To (Name):</th>
<th>Email Address:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Brian Lieb</td>
<td><a href="mailto:blieb@sciengineering.com">blieb@sciengineering.com</a></td>
<td></td>
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<tr>
<th>Client Project ID:</th>
<th>EMSL Project ID (internal use only):</th>
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<tr>
<td>2015-006720 TOBJ</td>
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<th>State or Province Collected:</th>
<th>MO</th>
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<thead>
<tr>
<th>EMSL-Bill to:</th>
<th>Same</th>
<th>Different</th>
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</thead>
<tbody>
<tr>
<td>Same</td>
<td></td>
<td></td>
</tr>
</tbody>
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**Turnaround Time (TAT) Options Please Check**

- [ ] 3 Hr
- [ ] 4.5 Hr
- [X] 6 Hr
- [ ] 24 Hr
- [ ] 32 Hr
- [ ] 48 Hr
- [ ] 72 Hr
- [ ] 96 Hr
- [ ] 1 Week
- [ ] 2 Week

*32 Hour TAT available for select tests only; samples must be submitted by 11:30am.*

<table>
<thead>
<tr>
<th>PCM - Air</th>
<th>TEM - Air</th>
<th>TEM - Settled Dust</th>
</tr>
</thead>
<tbody>
<tr>
<td>NIOSH 7400</td>
<td>NIOSH 40 CFR, Part 763</td>
<td>Micravoc - ASTM D 5755</td>
</tr>
<tr>
<td>w/ OSHA 8hr. TWA</td>
<td>NIOSH 7402</td>
<td>Wipe - ASTM D6480</td>
</tr>
<tr>
<td>PLM - Bulk (reporting limit)</td>
<td>EPA Level II</td>
<td>Carpet Sonication (EPA 600/J-93/167)</td>
</tr>
<tr>
<td>PLM/EPA NOB Point Count (&lt;1%)</td>
<td>ISO 10312</td>
<td>Soil - Rock - Vermiculite (reporting limit)</td>
</tr>
<tr>
<td>Point Count</td>
<td>TEM EPA NOB</td>
<td>TEM EPA 600/R-93/116 with milling prep (&lt;0.25%)</td>
</tr>
<tr>
<td>400 (&lt;0.25%)</td>
<td>TEM EPA NOB</td>
<td>TEM EPA 600/R-93/116 with milling prep (&lt;0.1%)</td>
</tr>
<tr>
<td>Point Count w/Gravimetric</td>
<td>NY8 NOB 198.4 (non-friable-NY)</td>
<td>TEM Qualitative via Filtration Prep</td>
</tr>
<tr>
<td>400 (&lt;0.25%)</td>
<td>1000 (&lt;0.1%)</td>
<td>TEM Qualitative via Drop Mount Prep</td>
</tr>
<tr>
<td>NYS 198.1 (friable - NY)</td>
<td>NYS 198.4 (non-friable-NY)</td>
<td>Cincinnati Method EPA 600/R-04/004 - PLM/TEM</td>
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<tr>
<td>NYS 198.8 SOF-V</td>
<td>NYS 198.8 NOB (non-friable-NY)</td>
<td>'Lower reporting limits available on request</td>
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<tr>
<td>NIOSH 9002 (&lt;1%)</td>
<td>NIOSH 9002</td>
<td>Other test (please specify):</td>
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**Filter Pore Size (Air Samples):**

- [ ] 0.8μm
- [ ] 0.45μm

<table>
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<th>Sampler's Name:</th>
<th>Filter Pore Size (Air Samples):</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brian Lieb</td>
<td></td>
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</table>

<table>
<thead>
<tr>
<th>Sampler's Signature:</th>
<th>Filter Pore Size (Air Samples):</th>
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</thead>
<tbody>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Sample #</th>
<th>Sample Description/Location</th>
<th>Volume, Area or Homogenous Area</th>
<th>Date/Time Sampled</th>
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</thead>
<tbody>
<tr>
<td>MSB - 1ABC</td>
<td>Air in Expansion Joint, Gray Canuk</td>
<td></td>
<td>9/18/19</td>
</tr>
<tr>
<td>2ABC</td>
<td>Light Gray Catwalk/Brick Canuk (also around windows)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3ABC</td>
<td>Grey Root Flashing Canuk</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4ABC</td>
<td>Old light grey Root Flashing Canuk</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5ABC</td>
<td>Grey Catwalk/Catwalk Canuk</td>
<td></td>
<td></td>
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</table>

<table>
<thead>
<tr>
<th>Client Sample # (s):</th>
<th>Total # of Samples: 33</th>
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</thead>
<tbody>
<tr>
<td>MSB-1ABC - MSB-11ABC</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Relinquished by (Client):</th>
<th>Date:</th>
<th>Time:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>9/18/19</td>
<td>11:56 am</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Received by (Lab):</th>
<th>Date:</th>
<th>Time:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>9/18/19</td>
<td>12:00 am</td>
</tr>
</tbody>
</table>

**Comments/Special Instructions:**

Samples s/j SABC. OK to charge. B
<table>
<thead>
<tr>
<th>Sample #</th>
<th>Sample Description/Location</th>
<th>Volume/Area or Homogenous Area</th>
<th>Date/Time Sampled</th>
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</thead>
<tbody>
<tr>
<td>MSB - 6ABC</td>
<td>White catwalk panel caulk</td>
<td>181 ft²/panel section</td>
<td>9/18/19</td>
</tr>
<tr>
<td>7ABC</td>
<td>Roof panel caulk</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8ABC</td>
<td>TPO Roofing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>QABC</td>
<td>12x12 red F. T. on conc. &quot;Runners&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10ABC</td>
<td>12x12 white w/ grey specks F. T. on &amp; conc. T.O. catwalk</td>
<td></td>
<td></td>
</tr>
<tr>
<td>√ 11ABC</td>
<td>Yellow / Tan window caulking</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Comments/Special Instructions:
CERTIFICATION NUMBER:
7118051719MOIR16703

THIS CERTIFIES
Brian L Lieb
HAS COMPLETED THE CERTIFICATION
REQUIREMENTS FOR
Inspector

APPROVED: 05/29/2019
EXPIRES: 05/29/2020

TRAINING DATE: 05/17/2019

Director of Air Pollution Control Program
ASBESTOS MANAGEMENT PLAN
2018 REINSPECTIONS SURVEY REPORT

Project Location:
MISSOURI SCHOOL FOR THE BLIND BUILDING #16 – CD DORM
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 30, 2019

Prepared by:

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)
ASBESTOS PLAN

IDENTIFIED ACM LEGEND
- WINDOW GLAZING
- FLOOR TILE AND ASSOCIATED MASTIC
- CONTAINS MULTIPLE ACM MATERIALS
  (PLEASE REFER TO SECTION 4)

ASBESTOS BULK SAMPLE LEGEND
1 = SAMPLE CONTAINS ASBESTOS
1 = SAMPLE WAS NEGATIVE FOR ASBESTOS

ASBESTOS INSPECTION NOTES
1. ADDITIONAL ASBESTOS MATERIALS MAY BE PRESENT IN UNACCESSIBLE LOCATIONS.
IDENTIFIED ACM LEGEND
- WINDOW GLAZING
- FLOOR TILE AND ASSOCIATED MASTIC
- CONTAINS MULTIPLE ACM MATERIALS
  (PLEASE REFER TO SECTION 4)

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.
IDENTIFIED ACM LEGEND

- WINDOW GLAZING
- FLOOR TILE AND ASSOCIATED MASTIC
- CONTAINS MULTIPLE ACM MATERIALS
(PLEASE REFER TO SECTION 4)

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.
HM #10, Asbestos-Containing 9” x 9” Tan w/Brown and Cream Streaks Floor Tile and Mastic

HM #11, Asbestos-Containing 9” x 9” Beige w/Cream Streaks Floor Tile and Mastic

Client Name: State of Missouri
Project Name: CD Dorm
Location: St. Louis, Missouri
Date: November 13, 2018
HM #12, **Asbestos-Containing** 9” x 9” Brown w/Dark Brown and Cream Streaks Floor Tile and Mastic

HM #14, **Asbestos-Containing** 9” x 9” Red w/Gold and Cream Streaks Floor Tile and Mastic

---

**Client Name:** State of Missouri  
**Project Name:** CD Dorm  
**Location:** St. Louis, Missouri  
**Date:** November 13, 2018
HM #15, Asbestos-Containing 9” x 9” Light Brown w/Brown and Cream Streaks Floor Tile and Mastic

HM #16, Asbestos-Containing 9” x 9” Beige w/Brown and Cream Streaks Floor Tile and Mastic

Client Name: State of Missouri
Project Name: CD Dorm
Location: St. Louis, Missouri
Date: November 13, 2018
IIM #31, Asbestos-Containing White Pipe Wrap on Fiberglass Wrap
HM #32, Asbestos-Containing White Pipe Elbows

HM #33, Asbestos-Containing 9” x 9” Dark Red Floor Tile and Mastic

Client Name: State of Missouri
Project Name: CD Dorm
Location: St. Louis, Missouri
Date: November 13, 2018
HM #34, Asbestos-Containing 9” x 9” Burgundy Red Floor Tile and Mastic

HM #36, Asbestos-Containing White Fitting – Roof Drain

Client Name: State of Missouri
Project Name: CD Dorm
Location: St. Louis, Missouri
Date: November 13, 2018
Client Name: State of Missouri
Project Name: CD Dorm
Location: St. Louis, Missouri
Date: November 13, 2018
HM #40, Asbestos-Containing White Fitting – Condensate

HM #42, Asbestos-Containing White Duct Insulation

Client Name: State of Missouri
Project Name: CD Dorm
Location: St. Louis, Missouri
Date: November 13, 2018
HM #44, Asbestos-Containing Grey Misc Caulking Material

HM #58, Asbestos-Containing White Window Glaze

Client Name: State of Missouri
Project Name: CD Dorm
Location: St. Louis, Missouri
Date: November 13, 2018
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

No changes were noted during the 2018 reinspection. No additional materials were identified or sampled. Please refer to the 2004/2007/2013 AHERA Management Plan for additional information.

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: 3    Year Built: 1959    Total Square Footage: 13,050

Building Description/Comments:

Building is constructed of brick and mortar supported by metal I-beams on 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.

<table>
<thead>
<tr>
<th>Suspect Material</th>
<th>HM Number</th>
<th>Material Location(s)</th>
<th>Floor</th>
<th>Asbestos Present</th>
<th>Friable/ Non-Friable</th>
</tr>
</thead>
<tbody>
<tr>
<td>9x9 Tan with brown and cream streaks Floor Tile &amp; Mastic</td>
<td>FTM-10</td>
<td>Room 16-1S9</td>
<td>B</td>
<td>Yes</td>
<td>Non-Friable</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Room 16-2751</td>
<td>1</td>
<td>Yes</td>
<td>Non-Friable</td>
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<td></td>
<td></td>
<td>Room 16-2752</td>
<td>1</td>
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<td>Room 16-2755</td>
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<td>Non-Friable</td>
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<tr>
<td></td>
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<td>Room 16-2755C</td>
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<tr>
<td>9x9 Beige with cream streaks Floor Tile &amp; Mastic</td>
<td>FTM-11</td>
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<td>Yes</td>
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## Section 4 Material Information Tables

### Site Information
- **MSB CD Dorm (Site ID:MSB )**
- **Building:** 16
- **3815 Magnolia**
- **St. Louis, MO 63110**

### Client Information
- **State of Missouri**
- **301 W. High Street**
- **Jefferson City, MO 65102**

### Survey Performed By
- **OCCU-TEC, Inc.**
- **Inspector:** Clayton Goth
- **Inspection Date:** November 13, 2018
- **Job Number:** 918071

### Material Information Table 1

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<tr>
<th>Material Description</th>
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### Material Comments

#### Material Location(s)

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**Sample IDs/Location**

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**Sample IDs/Location**

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<th>Material Number</th>
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<tbody>
<tr>
<td>9 x 9 Beige w/ Brown &amp; Cream Floor Tile &amp; Mastic</td>
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<td>5</td>
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<td>NA</td>
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<td>Room 16-3H5 West By Water Fountain</td>
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<td>Room 16-3756</td>
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<td>Room 16-3S9</td>
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<td>FTM-11-3</td>
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### Material Description

**9 x 9 Brown w/ Dark Brown & Cream Streaks Floor Tile & Mastic**

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<td>Room 16-3758</td>
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<td>170</td>
<td>Good</td>
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<td>Room 16-3751</td>
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<tr>
<td>Room 16-3753</td>
<td>2</td>
<td>180</td>
<td>Good</td>
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<tr>
<td>Room 16-2751</td>
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<tbody>
<tr>
<td>FTM-12-1 Room 16-3759 North</td>
<td>2</td>
<td>Yes</td>
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<td>1) Floor Tile</td>
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<td></td>
<td></td>
<td></td>
<td>2) Mastic</td>
<td>10% Chrysotile</td>
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<td>FTM-12-2 Room 16-3759 North</td>
<td>2</td>
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<td>NA</td>
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<td>No</td>
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### Material Description

**9 x 9 Burgundy Red Floor Tile & Mastic**

<table>
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<tbody>
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<th>Unit of Measurement</th>
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<tr>
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<td>Operations &amp; Maintenance</td>
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<td>Yes</td>
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<td>1) Floor Tile</td>
<td>None Detect 8% Chrysotile</td>
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<td>2) Mastic</td>
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<tr>
<td>FTM-34-2 Room 16-2750 Middle of Room</td>
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<td>None Detected</td>
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<td>2) Mastic</td>
<td>NA</td>
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<tr>
<td>FTM-34-3 Room 16-2750 Middle of Room</td>
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<td>Yes</td>
<td>0%</td>
<td>1) Floor Tile</td>
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<td>Material Description</td>
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<td>9 x 9 Dark Red Floor Tile &amp; Mastic</td>
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<td>15%</td>
<td>1) Floor Tile 2) Mastic</td>
<td>15% Chrysotile 6% Chrysotile</td>
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<td>Room 16-2H5</td>
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**Sample IDs/Location**

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<td>10%</td>
<td>1) Floor Tile 2) Mastic</td>
<td>10% Chrysotile &lt;1% Chrysotile</td>
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<td>Yes</td>
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**Material Category**  
Flooring  

**Friable Classification**  
Non-Friable  

**EPA Category**  
Category I  

**Total Quantity**  
674  

**Unit of Measurement**  
Square Feet  

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**General Material Comments**

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<tr>
<td>Room 16-2750B</td>
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</tr>
<tr>
<td>Room 16-2750C</td>
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<td>121</td>
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<tbody>
<tr>
<td>FTM-14-1</td>
<td>2</td>
<td>Yes</td>
<td>10%</td>
<td>1) Floor Tile</td>
<td>10% Chrysotile</td>
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<tr>
<td>Room 16-3750A Southwest</td>
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<td>FTM-14-3</td>
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<td>9 x 9 Tan w/ Brown &amp; Cream Streaks Floor Tile &amp; Mastic</td>
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<tbody>
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<td>Room 16-3H5</td>
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<td>Room 16-3756</td>
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<td>Room 16-3S9</td>
<td>2</td>
<td>115</td>
<td>Good</td>
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<tr>
<td>Room 16-3751</td>
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<td>24</td>
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<td>Room 16-3753</td>
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<td>Room 126-3755</td>
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<td>Room 16-3755A</td>
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<td>Room 16-3754</td>
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<td>Room 16-3752</td>
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<td>463</td>
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<td>Room 16-2759</td>
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<td>Room 16-2756</td>
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<td>Room 16-2S7</td>
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<td>Room 16-2755C</td>
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<tbody>
<tr>
<td>FTM-10-1</td>
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<td></td>
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<td>1) Floor Tile</td>
<td>10% Chrysotile</td>
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<tr>
<td>Room 16-3756 Northwest</td>
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<td>Yes</td>
<td>10%</td>
<td>2) Mastic</td>
<td>10% Chrysotile</td>
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<td>FTM-10-1</td>
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<td>1) Floor Tile</td>
<td>10% Chrysotile</td>
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<td>NA</td>
<td>2) Mastic</td>
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<tr>
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<th>Asbestos Present</th>
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<tbody>
<tr>
<td>9 x 9 White Marbled Floor Tile &amp; Mastic</td>
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<th>Unit of Measurement</th>
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<tr>
<td>Flooring</td>
<td>Non-Friable</td>
<td>Category I</td>
<td>13</td>
<td>Square Feet</td>
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<th>Recommended Response</th>
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<tbody>
<tr>
<td>Good</td>
<td>Potential for Damage/No Damage</td>
<td>Operations &amp; Maintenance</td>
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</tbody>
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<table>
<thead>
<tr>
<th>Material Location(s)</th>
<th>Floor</th>
<th>Location Quantity</th>
<th>Location Condition</th>
<th>Material Comments (by location)</th>
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<tbody>
<tr>
<td>Room 16-2H5</td>
<td>1</td>
<td>3</td>
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<td>Room 16-2756</td>
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<th>Sample IDs/Location</th>
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<th>Overall Result</th>
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<th>Results by Layer</th>
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<tbody>
<tr>
<td>FTM-29-1</td>
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<td>1) Floor Tile</td>
<td>None Detected</td>
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<tr>
<td>Room 16-2H5 Middle</td>
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<td>5%</td>
<td>2) Mastic</td>
<td>5% Chrysotile</td>
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<td>1) Floor Tile</td>
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<td>0%</td>
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<td>FTM-29-3</td>
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<td>1) Floor Tile</td>
<td>None Detected</td>
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<td>Room 16-2H5 Middle</td>
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<td>Yes</td>
<td>0%</td>
<td>2) Mastic</td>
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<td>Material Description</td>
<td>Material Number</td>
<td>Asbestos Present</td>
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<td></td>
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<td>-----------------</td>
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<tr>
<td>White Window Glazing</td>
<td>WGLZ-58</td>
<td>Yes</td>
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<th>EPA Category</th>
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<th>Unit of Measurement</th>
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<tbody>
<tr>
<td>Windows</td>
<td>Non-Friable</td>
<td>Category II</td>
<td>1,954</td>
<td>Linear Feet</td>
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<thead>
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<th>Overall Material Assessment</th>
<th>Recommended Response</th>
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</thead>
<tbody>
<tr>
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<td>Potential for Damage/No Damage</td>
<td>Operations &amp; Maintenance</td>
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**General Material Comments**

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<thead>
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<th>Material Location(s)</th>
<th>Floor</th>
<th>Location Quantity</th>
<th>Location Condition</th>
<th>Material Comments (by location)</th>
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</thead>
<tbody>
<tr>
<td>Exterior, West</td>
<td>EXT</td>
<td>1038</td>
<td>Good</td>
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<tr>
<td>Exterior, East</td>
<td>EXT</td>
<td>916</td>
<td>Good</td>
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**Sample IDs/Location**

<table>
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<th>Layer(s) reported by lab</th>
<th>Results by Layer</th>
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<tbody>
<tr>
<td>EXT</td>
<td>Yes</td>
<td>Trace</td>
<td>1) Window Glazing</td>
<td>&lt;1% Chrysotile</td>
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<table>
<thead>
<tr>
<th>Material Description</th>
<th>Material Number</th>
<th>Asbestos Present</th>
</tr>
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<tbody>
<tr>
<td>Light Reflector Paper</td>
<td>LRP-62</td>
<td>Yes (Assumed)</td>
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<th>Unit of Measurement</th>
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<tbody>
<tr>
<td>Miscellaneous</td>
<td>Friable</td>
<td>Friable</td>
<td>7</td>
<td>Each</td>
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<th>General Condition</th>
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<th>Recommended Response</th>
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<tbody>
<tr>
<td>Good</td>
<td>Potential for Damage/No Damage</td>
<td>Operations &amp; Maintenance</td>
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**General Material Comments**

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<tbody>
<tr>
<td>Room 16-2750D</td>
<td>EXT</td>
<td>1038</td>
<td>Good</td>
<td></td>
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<tr>
<td>Room 16-2755D</td>
<td>EXT</td>
<td>914</td>
<td>Good</td>
<td></td>
</tr>
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<td>Room 16-3750C</td>
<td>EXT</td>
<td>915</td>
<td>Good</td>
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</tr>
<tr>
<td>Room 16-3754</td>
<td>EXT</td>
<td>916</td>
<td>Good</td>
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</table>
**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**
MSB CD Dorm (Site ID: MSB)
Building: 16
3815 Magnolia
St. Louis, MO 63110

**Client Information**
State of Missouri
301 W. High Street
Jefferson City, MO 65102

<table>
<thead>
<tr>
<th>Location</th>
<th>Suspect Material</th>
<th>HM</th>
<th>QTY.</th>
<th>Units</th>
<th>Removal Costs (low to High)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Room 16-2750</td>
<td>White Pipe Wrap on Fiberglass Wrap</td>
<td>31</td>
<td>10</td>
<td>Linear Feet</td>
<td>$200</td>
</tr>
<tr>
<td>Friable</td>
<td>White Pipe Elbow</td>
<td>32</td>
<td>4</td>
<td>Linear Feet</td>
<td>$200</td>
</tr>
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<td>Category I</td>
<td>9 x 9 Red w/ Gold &amp; Cream Streaks Floor Tile &amp; Mastic</td>
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<td>186</td>
<td>Square Feet</td>
<td>$372 to $930</td>
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<td>Category I</td>
<td>9 x 9 Dark Red Floor Tile &amp; Mastic</td>
<td>33</td>
<td>4</td>
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<td>$200</td>
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<td>Category I</td>
<td>9 x 9 Burgundy Red Floor Tile</td>
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<tbody>
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<td>Room 16-2750A</td>
<td>9 x 9 Red w/ Gold &amp; Cream Streaks Floor Tile &amp; Mastic</td>
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<td>12</td>
<td>Square Feet</td>
<td>$200</td>
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<td>Category I</td>
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<tr>
<td>Space Removal Costs</td>
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<td></td>
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<th>Location</th>
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<th>Units</th>
<th>Removal Costs (low to High)</th>
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<tbody>
<tr>
<td>Room 16-2750B</td>
<td>9 x 9 Red w/ Gold &amp; Cream Streaks Floor Tile &amp; Mastic</td>
<td>14</td>
<td>14</td>
<td>Square Feet</td>
<td>$200</td>
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<tr>
<td>Category I</td>
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<td></td>
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### Location
Room 16-2750B

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<th><strong>Units</strong></th>
<th><strong>Removal Costs (low to High)</strong></th>
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<tr>
<td>Category I</td>
<td>9 x 9 Red w/ Gold &amp; Cream Streaks Floor</td>
<td>14</td>
<td>121</td>
<td>Square Feet</td>
<td>$242 to $605</td>
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**Space Removal Costs**  
$242 to $605

### Location
Room 16-2751

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<th><strong>Units</strong></th>
<th><strong>Removal Costs (low to High)</strong></th>
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<tbody>
<tr>
<td>Friable</td>
<td>White Pipe Wrap on 5 x 9 Light Brown w/ Brown &amp; Cream Streaks Floor Tile &amp; Mastic</td>
<td>31</td>
<td>7</td>
<td>Linear Feet</td>
<td>$200</td>
</tr>
<tr>
<td>Friable</td>
<td>White Pipe Elbows</td>
<td>32</td>
<td>5</td>
<td>Linear Feet</td>
<td>$200</td>
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<tr>
<td>Category I</td>
<td>9 x 9 Tan w/ Brown &amp; Cream Streaks Floor Tile &amp; Mastic</td>
<td>15</td>
<td>8</td>
<td>Square Feet</td>
<td>$200</td>
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<tr>
<td>Category I</td>
<td>9 x 9 Tan w/ Brown &amp; Cream Streaks Floor Tile &amp; Mastic</td>
<td>10</td>
<td>24</td>
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<td>9 x 9 Brown w/ Dark Brown &amp; Cream Streaks Floor Tile &amp; Mastic</td>
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<td>Square Feet</td>
<td>$400 to $1,000</td>
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**Space Removal Costs**  
$1,200 to $1,800

### Location
Room 16-2752

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<th><strong>Units</strong></th>
<th><strong>Removal Costs (low to High)</strong></th>
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<td>White Pipe Wrap on Fiberglass Wrap</td>
<td>31</td>
<td>8</td>
<td>Linear Feet</td>
<td>$200</td>
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<td>Friable</td>
<td>White Pipe Elbow</td>
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<td>2</td>
<td>Linear Feet</td>
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<td>Category I</td>
<td>9 x 9 Tan w/ Brown &amp; Cream Streaks Floor Tile &amp; Mastic</td>
<td>10</td>
<td>16</td>
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**Space Removal Costs**  
$600

### Location
Room 16-2753

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<thead>
<tr>
<th><strong>EPA Category</strong></th>
<th><strong>Suspect Material</strong></th>
<th><strong>HM</strong></th>
<th><strong>QTY.</strong></th>
<th><strong>Units</strong></th>
<th><strong>Removal Costs (low to High)</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Category I</td>
<td>9 x 9 Light Brown w/ Brown &amp; Cream Streaks Floor Tile &amp; Mastic</td>
<td>15</td>
<td>2</td>
<td>Square Feet</td>
<td>$200</td>
</tr>
<tr>
<td>Category I</td>
<td>9 x 9 Brown w/ Dark Brown &amp; Cream Streaks Floor Tile &amp; Mastic</td>
<td>12</td>
<td>80</td>
<td>Square Feet</td>
<td>$200 to $400</td>
</tr>
<tr>
<td>Category I</td>
<td>9 x 9 Tan w/ Brown &amp; Cream Streaks Floor</td>
<td>10</td>
<td>180</td>
<td>Square Feet</td>
<td>$360 to $900</td>
</tr>
</tbody>
</table>

**Space Removal Costs**  
$760 to $1,500
### Location
Room 16-2755

<table>
<thead>
<tr>
<th>EPA Category</th>
<th>Suspect Material</th>
<th>HM</th>
<th>QTY.</th>
<th>Units</th>
<th>Removal Costs (low to High)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Category I</td>
<td>9 x 9 Light Brown w/ Brown &amp; Cream</td>
<td>15</td>
<td>1</td>
<td>Square Feet</td>
<td>$200</td>
</tr>
<tr>
<td>Category I</td>
<td>9 x 9 Brown w/ Dark Brown &amp; Cream</td>
<td>12</td>
<td>136</td>
<td>Square Feet</td>
<td>$272 to $680</td>
</tr>
<tr>
<td>Category I</td>
<td>9 x 9 Tan w/ Brown &amp; Cream Streaks Floor</td>
<td>10</td>
<td>34</td>
<td>Square Feet</td>
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</tr>
</tbody>
</table>

Space Removal Costs $672 to $1,080

### Location
Room 16-2755C

<table>
<thead>
<tr>
<th>EPA Category</th>
<th>Suspect Material</th>
<th>HM</th>
<th>QTY.</th>
<th>Units</th>
<th>Removal Costs (low to High)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Category I</td>
<td>9 x 9 Light Brown w/ Brown &amp; Cream</td>
<td>15</td>
<td>1</td>
<td>Square Feet</td>
<td>$200</td>
</tr>
<tr>
<td>Category I</td>
<td>9 x 9 Brown w/ Dark Brown &amp; Cream</td>
<td>12</td>
<td>136</td>
<td>Square Feet</td>
<td>$272 to $680</td>
</tr>
<tr>
<td>Category I</td>
<td>9 x 9 Tan w/ Brown &amp; Cream Streaks Floor</td>
<td>10</td>
<td>34</td>
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<td>$200</td>
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Space Removal Costs $672 to $1,080

### Location
Room 16-2756

<table>
<thead>
<tr>
<th>EPA Category</th>
<th>Suspect Material</th>
<th>HM</th>
<th>QTY.</th>
<th>Units</th>
<th>Removal Costs (low to High)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Category I</td>
<td>9 x 9 Beige w/ Cream Streaks Floor Tile &amp; Mastic</td>
<td>11</td>
<td>11</td>
<td>Square Feet</td>
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</tr>
<tr>
<td>Category I</td>
<td>9 x 9 Brown w/ Dark Brown &amp; Cream</td>
<td>15</td>
<td>8</td>
<td>Square Feet</td>
<td>$200</td>
</tr>
<tr>
<td>Category I</td>
<td>9 x 9 White Marbled Floor Tile &amp; Mastic</td>
<td>29</td>
<td>10</td>
<td>Square Feet</td>
<td>$200</td>
</tr>
<tr>
<td>Category I</td>
<td>9 x 9 Tan w/ Brown &amp; Cream Streaks Floor</td>
<td>10</td>
<td>211</td>
<td>Square Feet</td>
<td>$422 to $1,055</td>
</tr>
</tbody>
</table>

Space Removal Costs $1,022 to $1,655

### Location
Room 16-2757

<table>
<thead>
<tr>
<th>EPA Category</th>
<th>Suspect Material</th>
<th>HM</th>
<th>QTY.</th>
<th>Units</th>
<th>Removal Costs (low to High)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Category I</td>
<td>9 x 9 Beige w/ Cream Streaks Floor Tile &amp;</td>
<td>11</td>
<td>420</td>
<td>Square Feet</td>
<td>$840 to $2,100</td>
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Space Removal Costs $840 to $2,100

### Location
Room 16-2758

<table>
<thead>
<tr>
<th>EPA Category</th>
<th>Suspect Material</th>
<th>HM</th>
<th>QTY.</th>
<th>Units</th>
<th>Removal Costs (low to High)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Friable</td>
<td>White Pipe Wrap on Fiberglass Wrap</td>
<td>31</td>
<td>16</td>
<td>Linear Feet</td>
<td>$200</td>
</tr>
<tr>
<td>Friable</td>
<td>White Pipe Elbow</td>
<td>32</td>
<td>10</td>
<td>Linear Feet</td>
<td>$200</td>
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Space Removal Costs $600
### Location
Room 16-2759

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<tr>
<th>EPA Category</th>
<th>Suspect Material</th>
<th>HM</th>
<th>QTY.</th>
<th>Units</th>
<th>Removal Costs (low to High)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Friable</td>
<td>White Pipe Wrap on Fiberglass Wrap</td>
<td>31</td>
<td>7</td>
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<tr>
<td>Friable</td>
<td>White Pipe Elbows</td>
<td>32</td>
<td>1</td>
<td>Square Feet</td>
<td>$200</td>
</tr>
<tr>
<td>Category I</td>
<td>9 x 9 Brown w/ Dark Brown &amp; Cream</td>
<td>12</td>
<td>170</td>
<td>Square Feet</td>
<td>$200</td>
</tr>
<tr>
<td>Category I</td>
<td>9 x 9 Tan w/ Brown &amp; Cream Streaks Floor</td>
<td>10</td>
<td>16</td>
<td>Square Feet</td>
<td>$422 to $1,054</td>
</tr>
<tr>
<td>Category I</td>
<td>9 x 9 Tan w/ Brown &amp; Cream Streaks Floor</td>
<td>15</td>
<td>2</td>
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<td>$422 to $1,055</td>
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**Space Removal Costs**

$1,022 to $1,655

### Location
Room 16-2H5

<table>
<thead>
<tr>
<th>EPA Category</th>
<th>Suspect Material</th>
<th>HM</th>
<th>QTY.</th>
<th>Units</th>
<th>Removal Costs (low to High)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Category I</td>
<td>9 x 9 Tan with Brown &amp; Cream Streaks Floor Tile &amp; Mastic</td>
<td>10</td>
<td>463</td>
<td>Square Feet</td>
<td>$926 to $2,315</td>
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<tr>
<td>Category I</td>
<td>9 x 9 Light Brown w/ Brown and Cream Streaks Floor Tile &amp; Mastic</td>
<td>15</td>
<td>24</td>
<td>Square Feet</td>
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</tr>
<tr>
<td>Category I</td>
<td>9 x 9 White Marble Floor Tile &amp; Mastic</td>
<td>29</td>
<td>3</td>
<td>Square Feet</td>
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</table>

**Space Removal Costs**

$1,326 to $2,715

### Location
Room 16-2L9

<table>
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<th>Suspect Material</th>
<th>HM</th>
<th>QTY.</th>
<th>Units</th>
<th>Removal Costs (low to High)</th>
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</thead>
<tbody>
<tr>
<td>Friable</td>
<td>White Pipe Wrap on Fiberglass Wrap</td>
<td>31</td>
<td>6</td>
<td>Linear Feet</td>
<td>$200</td>
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<tr>
<td>Friable</td>
<td>White Pipe Elbows</td>
<td>32</td>
<td>3</td>
<td>Linear Feet</td>
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**Space Removal Costs**

$400

### Location
Room 16-2S7

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<th>HM</th>
<th>QTY.</th>
<th>Units</th>
<th>Removal Costs (low to High)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Category I</td>
<td>9 x 9 Tan with Brown &amp; Cream Streaks Floor Tile &amp; Mastic</td>
<td>10</td>
<td>115</td>
<td>Square Feet</td>
<td>$230 to $575</td>
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**Space Removal Costs**

$230 to $575
<table>
<thead>
<tr>
<th>Location</th>
<th>16-3750A</th>
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</thead>
<tbody>
<tr>
<td><strong>EPA Category</strong></td>
<td><strong>Suspect Material</strong></td>
</tr>
<tr>
<td>Category I</td>
<td>9 x 9 Red w/ Gold &amp; Cream Streaks Floor Tile &amp; Mastic</td>
</tr>
<tr>
<td></td>
<td><strong>Space Removal Costs</strong></td>
</tr>
</tbody>
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<table>
<thead>
<tr>
<th>Location</th>
<th>Room 16-3750B</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>EPA Category</strong></td>
<td><strong>Suspect Material</strong></td>
</tr>
<tr>
<td>Category I</td>
<td>9 x 9 Red w/ Gold &amp; Cream Streaks Floor Tile &amp; Mastic</td>
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<td></td>
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<table>
<thead>
<tr>
<th>Location</th>
<th>Room 16-3750C</th>
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<tr>
<td><strong>EPA Category</strong></td>
<td><strong>Suspect Material</strong></td>
</tr>
<tr>
<td>Category I</td>
<td>9 x 9 Red w/ Gold &amp; Cream Streaks Floor Tile &amp; Mastic</td>
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<td></td>
<td><strong>Space Removal Costs</strong></td>
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<table>
<thead>
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<th>Room 16-3751</th>
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<tbody>
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<td><strong>EPA Category</strong></td>
<td><strong>Suspect Material</strong></td>
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<tr>
<td>Category I</td>
<td>9 x 9 Light Brown w/ Brown &amp; Cream Streaks Floor Tile &amp; Mastic</td>
</tr>
<tr>
<td>Category I</td>
<td>9 x 9 Tan w/ Brown &amp; Cream Streaks Floor Tile &amp; Mastic</td>
</tr>
<tr>
<td>Category I</td>
<td>9 x 9 Brown w/ Dark Brown &amp; Cream Streaks Floor Tile &amp; Mastic</td>
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<tr>
<td></td>
<td><strong>Space Removal Costs</strong></td>
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<table>
<thead>
<tr>
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<th>Room 16-3752</th>
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<tbody>
<tr>
<td><strong>EPA Category</strong></td>
<td><strong>Suspect Material</strong></td>
</tr>
<tr>
<td>Category I</td>
<td>9 x 9 Tan w/ Brown &amp; Cream Streaks Floor Tile &amp; Mastic</td>
</tr>
<tr>
<td></td>
<td><strong>Space Removal Costs</strong></td>
</tr>
<tr>
<td>Location</td>
<td>EPA Category</td>
</tr>
<tr>
<td>--------------</td>
<td>--------------</td>
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<tr>
<td>Room 16-3753</td>
<td>Category I</td>
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<tr>
<td></td>
<td>Category I</td>
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<tr>
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<td></td>
</tr>
<tr>
<td>Room 16-3754</td>
<td>Category I</td>
</tr>
<tr>
<td></td>
<td>Category I</td>
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<tr>
<td></td>
<td></td>
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<td>Room 16-3755</td>
<td>Category I</td>
</tr>
<tr>
<td></td>
<td>Category I</td>
</tr>
<tr>
<td></td>
<td></td>
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<td>Room 16-3755A</td>
<td>Category I</td>
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<td>Category I</td>
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### Location
Room 16-3756

<table>
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<th>Suspect Material</th>
<th>HM</th>
<th>QTY.</th>
<th>Units</th>
<th>Removal Costs (low to High)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Category I</td>
<td>9 x 9 Brown w/ Dark Brown &amp; Cream Streaks Floor Tile &amp; Mastic</td>
<td>12</td>
<td>237</td>
<td>Square Feet</td>
<td>$474 to $1,185</td>
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<tr>
<td>Category I</td>
<td>9 x 9 Beige w/ Cream Streaks Floor Tile &amp; Mastic</td>
<td>11</td>
<td>3</td>
<td>Square Feet</td>
<td>$200</td>
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</table>

Space Removal Costs $674 to $1,385

### Location
Room 16-3757

<table>
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<th>Suspect Material</th>
<th>HM</th>
<th>QTY.</th>
<th>Units</th>
<th>Removal Costs (low to High)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Category I</td>
<td>9 x 9 Beige w/ Cream Streaks Floor Tile &amp; Mastic</td>
<td>11</td>
<td>420</td>
<td>Square Feet</td>
<td>$840 to $2,100</td>
</tr>
</tbody>
</table>

Space Removal Costs $840 to $2,100

### Location
Room 16-3758

<table>
<thead>
<tr>
<th>EPA Category</th>
<th>Suspect Material</th>
<th>HM</th>
<th>QTY.</th>
<th>Units</th>
<th>Removal Costs (low to High)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Category I</td>
<td>9 x 9 Brown w/ Dark Brown &amp; Cream Streaks Floor Tile &amp; Mastic</td>
<td>12</td>
<td>170</td>
<td>Square Feet</td>
<td>$340 to $850</td>
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Space Removal Costs $340 to $850

### Location
Room 16-3759

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<th>Suspect Material</th>
<th>HM</th>
<th>QTY.</th>
<th>Units</th>
<th>Removal Costs (low to High)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Category I</td>
<td>9 x 9 Brown w. Dark Brown &amp; Cream Streaks Floor Tile &amp; Mastic</td>
<td>12</td>
<td>170</td>
<td>Square Feet</td>
<td>$340 to $850</td>
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Space Removal Costs $340 to $850

### Location
Room 16-3H15

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<th>Suspect Material</th>
<th>HM</th>
<th>QTY.</th>
<th>Units</th>
<th>Removal Costs (low to High)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Category I</td>
<td>9 x 9 Light Brown w/ Brown &amp; Cream Streaks Floor Tile &amp; Mastic</td>
<td>15</td>
<td>9</td>
<td>Square Feet</td>
<td>$200</td>
</tr>
<tr>
<td>Category I</td>
<td>9 x 9 Beige w/ Brown &amp; Cream Streaks Floor Tile &amp; Mastic</td>
<td>5</td>
<td>5</td>
<td>Square Feet</td>
<td>$200</td>
</tr>
<tr>
<td>Category I</td>
<td>9 x 9 Tan w/ Brown &amp; Cream Streaks Floor Tile &amp; Mastic</td>
<td>10</td>
<td>476</td>
<td>Square Feet</td>
<td>$952 to $2,380</td>
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Space Removal Costs $1,352 to $2,780
## Location
Room 16-3S9

<table>
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<tr>
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<th>Suspect Material</th>
<th>HM</th>
<th>QTY.</th>
<th>Units</th>
<th>Removal Costs (low to High)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Category I</td>
<td>9 x 9 Beige w/ Cream Streaks Floor Tile &amp; Mastic</td>
<td>11</td>
<td>4</td>
<td>Square Feet</td>
<td>$200</td>
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<td>Category I</td>
<td>9 x 9 Tan w/ Brown &amp; Cream Streaks Floor Tile &amp; Mastic</td>
<td>10</td>
<td>114</td>
<td>Square Feet</td>
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Space Removal Costs $488 to $770

## Location
Room 16-1750

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<th>HM</th>
<th>QTY.</th>
<th>Units</th>
<th>Removal Costs (low to High)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Friable</td>
<td>White Fitting - Roof Drain</td>
<td>36</td>
<td>10</td>
<td>Linear Feet</td>
<td>$200</td>
</tr>
<tr>
<td>Friable</td>
<td>White Fitting - Domestic Cold Water</td>
<td>37</td>
<td>12</td>
<td>Linear Feet</td>
<td>$200</td>
</tr>
<tr>
<td>Friable</td>
<td>White Fitting - Steam</td>
<td>39</td>
<td>124</td>
<td>Linear Feet</td>
<td>$1,240 to $2,480</td>
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<tr>
<td>Friable</td>
<td>White Fitting - Condensate</td>
<td>40</td>
<td>52</td>
<td>Linear Feet</td>
<td>$520 to $1,040</td>
</tr>
<tr>
<td>Friable</td>
<td>White Pipe Wrap on Fiberglass Wrap</td>
<td>31</td>
<td>106</td>
<td>Linear Feet</td>
<td>$1,060 to $2,120</td>
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Space Removal Costs $3,220 to $6,040

## Location
Room 16-1750A

<table>
<thead>
<tr>
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<th>Suspect Material</th>
<th>HM</th>
<th>QTY.</th>
<th>Units</th>
<th>Removal Costs (low to High)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Friable</td>
<td>White Fitting - Steam</td>
<td>39</td>
<td>5</td>
<td>Linear Feet</td>
<td>$200</td>
</tr>
<tr>
<td>Friable</td>
<td>White Fitting - Condensate</td>
<td>40</td>
<td>5</td>
<td>Linear Feet</td>
<td>$200</td>
</tr>
<tr>
<td>Category II</td>
<td>Gray Misc Caulking Material</td>
<td>44</td>
<td>22</td>
<td>Linear Feet</td>
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Space Removal Costs $600

## Location
Room 16-1750B

<table>
<thead>
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<th>Suspect Material</th>
<th>HM</th>
<th>QTY.</th>
<th>Units</th>
<th>Removal Costs (low to High)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Friable</td>
<td>White Pipe Wrap on Fiberglass Wrap</td>
<td>31</td>
<td>15</td>
<td>Linear Feet</td>
<td>$200</td>
</tr>
<tr>
<td>Friable</td>
<td>White Fitting - Roof Drain</td>
<td>36</td>
<td>11</td>
<td>Linear Feet</td>
<td>$200</td>
</tr>
<tr>
<td>Friable</td>
<td>White Fitting - Domestic Cold Water</td>
<td>37</td>
<td>3</td>
<td>Linear Feet</td>
<td>$200</td>
</tr>
<tr>
<td>Friable</td>
<td>White Fitting - Steam</td>
<td>39</td>
<td>14</td>
<td>Linear Feet</td>
<td>$200</td>
</tr>
<tr>
<td>Friable</td>
<td>White Fitting - Condensate</td>
<td>40</td>
<td>7</td>
<td>Linear Feet</td>
<td>$200</td>
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<tr>
<td>Friable</td>
<td>White Duct Insulation</td>
<td>42</td>
<td>80</td>
<td>Linear Feet</td>
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Space Removal Costs $1,200
<table>
<thead>
<tr>
<th>Location</th>
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<th></th>
<th></th>
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<tbody>
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<td><strong>EPA Category</strong></td>
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<td><strong>Suspect Material</strong></td>
<td><strong>HM</strong></td>
<td><strong>QTY.</strong></td>
<td><strong>Units</strong></td>
<td><strong>Removal Costs (low to High)</strong></td>
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<td>31</td>
<td>41</td>
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**Space Removal Costs** $760 to $1,520

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<td><strong>HM</strong></td>
<td><strong>QTY.</strong></td>
<td><strong>Units</strong></td>
<td><strong>Removal Costs (low to High)</strong></td>
</tr>
<tr>
<td>Category I</td>
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<td>12 x 12 Tan w/ Brown &amp; Cream Streaks Floor Tile &amp; Mastic</td>
<td>51</td>
<td>324</td>
<td>Square Feet</td>
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**Space Removal Costs** $648 to $1,620

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<td><strong>Suspect Material</strong></td>
<td><strong>HM</strong></td>
<td><strong>QTY.</strong></td>
<td><strong>Units</strong></td>
<td><strong>Removal Costs (low to High)</strong></td>
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**Space Removal Costs** $240 to $600

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<td><strong>QTY.</strong></td>
<td><strong>Units</strong></td>
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<tr>
<td>Category II</td>
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<td>White Window Glazing</td>
<td>58</td>
<td>1954</td>
<td>Linear Feet</td>
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**Space Removal Costs** $14,655 to $17,586
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 re-inspections, 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.
d. A list of homogeneous areas identified as surfacing material, thermal system insulation, or miscellaneous material.

e. Assessments made of material, the name and signature of each inspector who made the assessments and accreditation number.
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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 ofDamaged 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: 7011011018MOill19584

THIS CERTIFIES
Clayton V Goth
HAS COMPLETED THE CERTIFICATION
REQUIREMENTS FOR
Inspector

APPROVED: 01/29/2018
TRAINING DATE: 01/10/2018

EXPIRES: 01/29/2019
Kyla L Moore
Director of Air Pollution Control Program
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

[Signature]
Director of Air Pollution Control Program
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
P.O. Box 480
Jefferson City, MO 65101

Prepared by:

OCCU-TEC
SAFETY AND ENVIRONMENTAL SOLUTIONS

6501 East Commerce Avenue, Suite 230
Kansas City, MO 64120

May 15, 2008
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**Appendices**

A. OCCUPANT NOTIFICATION AND ACKNOWLEDGEMENT FORM
B. CONTRACTOR'S ACKNOWLEDGEMENT FORM
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>
<thead>
<tr>
<th>AIRBORNE CONCENTRATION OF ASBESTOS OR CONDITION OF USE</th>
<th>REQUIRED RESPIRATOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>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.</td>
<td>Half-mask air purifying respirator other than a disposable respirator, equipped with high efficiency filters.</td>
</tr>
<tr>
<td>Not in excess of 5 f/cc (50 X PEL).</td>
<td>Full facepiece air-purifying respirator equipped with high efficiency filters.</td>
</tr>
<tr>
<td>Not in excess of 10 f/cc (100 X PEL).</td>
<td>Any powered air-purifying respirator equipped with high efficiency filters or any supplied air respirator operated in continuous flow mode.</td>
</tr>
<tr>
<td>Not in excess of 100 f/cc (1,000 X PEL).</td>
<td>Full facepiece supplied air respirator operated in pressure demand mode.</td>
</tr>
<tr>
<td>Greater than 100 f/cc (1,000 X PEL) concentration.</td>
<td>Full facepiece supplied air or unknown respirator operated in pressure demand mode, equipped with an auxiliary positive pressure self-contained breathing apparatus.</td>
</tr>
</tbody>
</table>

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
- 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 be 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.
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.


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 6 inches 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.

__________________________
Jay Hurst
Missouri Certified Asbestos Inspector / Management Planner
### TABLE 1 – OLD ADMIN BUILDING

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<th>Location</th>
<th>Temperature (degrees Fahrenheit)</th>
<th>Relative Humidity (Percent) (Recommended 30% to 50%)</th>
<th>Carbon Dioxide (ppm)* (Recommended &lt;1,000 ppm)</th>
<th>Carbon Monoxide (ppm) (Recommended &lt; 9 ppm)</th>
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*ppm = parts per million

Numbers in boldface indicate readings outside the recommended range.
**TABLE 1 – CONTINUED**

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<th>Carbon Dioxide (ppm)* (Recommended &lt;1,000 ppm)</th>
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Numbers in boldface indicate readings outside the recommended range.
### TABLE 1 – CONTINUED

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*ppm = parts per million
Numbers in boldface indicate readings outside the recommended range.
### TABLE 1 – CONTINUED

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<tr>
<th>Location</th>
<th>Temperature (degrees Fahrenheit)</th>
<th>Relative Humidity (Percent) (Recommended 30% to 50%)</th>
<th>Carbon Dioxide (ppm)* (Recommended &lt;1,000 ppm)</th>
<th>Carbon Monoxide (ppm) (Recommended &lt; 9 ppm)</th>
<th>Remarks</th>
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*ppm = parts per million

Numbers in boldface indicate readings outside the recommended range.
**TABLE 1 – CONTINUED**

<table>
<thead>
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<th>Location</th>
<th>Temperature (degrees Fahrenheit)</th>
<th>Relative Humidity (Percent)</th>
<th>Carbon Dioxide (ppm)*</th>
<th>Carbon Monoxide (ppm)</th>
<th>Remarks</th>
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</table>

*ppm = parts per million

Numbers in boldface indicate readings outside the recommended range.
<table>
<thead>
<tr>
<th>Location</th>
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<th>Carbon Dioxide (ppm)* (Recommended &lt;1,000 ppm)</th>
<th>Carbon Monoxide (ppm) (Recommended &lt; 9 ppm)</th>
<th>Remarks</th>
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</table>

*ppm = parts per million
Numbers in boldface indicate readings outside the recommended range.
### PHOTO LOG

#### PHOTO 1 – Annex Building

Several stained and buckled ceiling tiles were found throughout the building. All of the ceiling tiles tested negative on the moisture meter.

#### PHOTO 2 – Annex Building

Several old dorms that were unoccupied at the time of this assessment had similar tiles that tested high for lead and would require precaution removing to reduce lead dust contamination.
## Lead Sampling Table

<table>
<thead>
<tr>
<th>Sample #</th>
<th>Location (Int/Ext)</th>
<th>Room &amp; Description</th>
<th>Component Type</th>
<th>Color/Substrate</th>
<th>Paint Condition</th>
<th>Sample Type</th>
<th>Lead Level</th>
<th>Unit Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Interior</td>
<td>Admin</td>
<td>Floor</td>
<td>Grey Concrete</td>
<td>Deteriorated</td>
<td>XRF</td>
<td>0.01</td>
<td>mg/cm²</td>
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<tr>
<td>2</td>
<td></td>
<td>Laundry</td>
<td>Wall</td>
<td>Green Brick</td>
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<td></td>
<td>0.01</td>
<td>mg/cm²</td>
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<td></td>
<td></td>
<td>Wall</td>
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<td>mg/cm²</td>
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<td>Red Metal</td>
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<td></td>
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<td></td>
<td></td>
<td>Desk</td>
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<tr>
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Paint samples are deemed hazardous when values are equal to or greater than 1.0 mg/cm² if paint is deteriorated.

* mg/cm² = milligrams per centimeter square.
## Lead Sampling Table Continued

<table>
<thead>
<tr>
<th>Sample #</th>
<th>Location (Int/Ext)</th>
<th>Room &amp; Description</th>
<th>Component Type</th>
<th>Color/Substrate</th>
<th>Paint Condition</th>
<th>Sample Type</th>
<th>Sample Type</th>
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<th>Unit Size</th>
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<td>Bench</td>
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Paint samples are deemed hazardous when values are equal to or greater than 1.0 mg/cm² if paint is deteriorated.
* mg/cm² = milligrams per centimeter square.
铅采样表继续

| 样品编号 # | 位置 (内/外) | 房间及描述 | 组件类型 | 颜色/基材 | 涂料状况 | 样品类型 | 铅含量 | 单位
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<td>内部</td>
<td>Catwalk</td>
<td>天花板</td>
<td>瓷砖</td>
<td>完好</td>
<td>XRF</td>
<td>0.0</td>
<td>mg/cm²</td>
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</table>

**旧科学楼**

|       |       |             |         |          |           |         |       |       |
|-------|-------|-------------|---------|----------|-----------|---------|-------|
| 38    | 内部  | 黑板        | 绿色板石 | 完好      | XRF       | 2.9     | mg/cm²|
| 39    |       | 散热器      | 蓝色金属 | 损坏      | XRF       | 0.0     | mg/cm²|
| 40    | 内部  | 蓝色瓷砖    |           |           | XRF       | 2.2     | mg/cm²|
| 41    |       | 地板        | 红色     | 完好      | XRF       | 0.0     | mg/cm²|
| 42    | 内部  | 黑板        | 绿色板石 |           | XRF       | 3.2     | mg/cm²|
| 43    |       | 楼梯踏板   | 蓝色     | 损坏      | XRF       | 1.7     | mg/cm²|
| 44    |       | 100 HS      | 地板     | 瓷砖灰色 | XRF       | 0.0     | mg/cm²|

**旧校长官邸**

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油漆样品被视为有害当值等于或大于1.0 mg/cm²，如果油漆损坏。
* mg/cm² = 毫克每平方厘米
## Lead Sampling Table Continued

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**Collins Hall**

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**SE Hall**

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Paint samples are deemed hazardous when values are equal to or greater than 1.0 mg/cm² if paint is deteriorated.  
* mg/cm² = milligrams per centimeter square.
### Lead Sampling Table Continued

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<thead>
<tr>
<th>Sample #</th>
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<th>Unit Size</th>
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## Lead Sampling Table Continued

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Paint samples are deemed hazardous when values are equal to or greater than 1.0 mg/cm² if paint is deteriorated.  
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### Lead Sampling Table Continued

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**Old Admin Bldg**

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**INDOOR ENVIRONMENTAL QUALITY (IEQ) ASSESSMENT**  
**Missouri School for the Blind**  
3815 Magnolia Avenue  
St. Louis, MO 63110  
August 21-23, 2018

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### Admin 4L Proctor Hall

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<td>Basement</td>
<td>Subfloor Support</td>
<td>Metal</td>
<td>Intact</td>
<td>XRF</td>
<td>3.0</td>
<td>mg/cm²</td>
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<td>Wood</td>
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<tr>
<td><strong>Catwalk and East Building</strong></td>
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<td>Exterior</td>
<td>West Courtyard</td>
<td>Catwalk Support Post</td>
<td>White Post</td>
<td>Deteriorated</td>
<td>XRF</td>
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</tbody>
</table>

Paint samples are deemed hazardous when values are equal to or greater than 1.0 mg/cm² if paint is deteriorated.  
* mg/cm² = milligrams per centimeter square.
### Lead Sampling Table Continued

<table>
<thead>
<tr>
<th>Sample #</th>
<th>Location (Int/Ext)</th>
<th>Room &amp; Description</th>
<th>Component Type</th>
<th>Color/Substrate</th>
<th>Paint Condition</th>
<th>Sample Type</th>
<th>Lead Level</th>
<th>Unit Size</th>
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<td>Exterior</td>
<td>East Courtyard</td>
<td>Large Support Post</td>
<td>White Tile</td>
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</tbody>
</table>

Paint samples are deemed hazardous when values are equal to or greater than 1.0 mg/cm² if paint is deteriorated.

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