CITY OF FOREST PARK

CONTRACT DOCUMENTS
AND
TECHNICAL SPECIFICATIONS

FOREST PARK STARR PARK

PHASE I

PROJECT NO.: 02072023

FALCON DESIGN

*ENGINEERING * LAND PLANNING * SURVEYING *
*CONSTRUCTION MANAGEMENT * LANDSCAPE ARCHITECTURE*
WWW.FDC-LLC.COM

235 Corporate Center Drive, Suite 200, Stockbridge, GA 30281 / Phone: 770.389.8666
40 Green Way Court, Suite A, Newnan, GA 30256 / Phone: 770.755.7978
500 Pirkle Ferry Road, Suite C, Cumming, GA 30040 / Phone: 678.807.7100

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SECTION I
INVITATION TO BID

FOREST PARK STARR PARK
PHASE I

PROJECT NO.: 02072023

DATE: February 7th, 2023

Sealed unit price bids will be received by the City of Forest Park Georgia from prospective contractors for the City's "**Starr Park – Phase I**" project. The work consists of furnishing and installing all materials, labor, tools, equipment, and related services required for a complete project. This project includes but is not limited to providing the renovation of a complete City Park including a new walking track, walkways, playground, dog park, sports field, splash pad, as well as the construction of three new buildings, three new park pavilions and 347 additional square feet to an existing pool equipment room to provide a complete **"Starr Park – Phase I"** project in Forest Park Georgia.

The activity is proposed to be funded with local City of Forest Park funds. The selected contractor must comply with local and state laws including but not limited to provisions covering construction contracts.

Bidders must comply with the City of Forest Park's "Local, Small Business, Diversity Program". There is a participation goal for this project. The City wants to ensure that Bidders are non-discriminatory in their process of selecting sub-contractors. The City also wants to encourage Bidders to utilize local, veteran-owned, minority, women, and disadvantaged business enterprises whenever possible.

Complete sets of the Contract Documents, Technical Specifications and the Contract Drawings may be obtained from the Issuing Office from the City's preferred website: **https://www.forestparkga.gov/rfps**. Documents are also available at: **https://www.bidnetdirect.com/georgia/cityofforestpark** and at the Georgia Procurement Registry website located at: **https://ssl.doas.state.ga.us/PRSapp/PRindex.jsp**. Bidders are

solely responsible for maintaining a complete set of Contract Documents, Technical Specifications, Contract Drawings, and project Addenda or Modifications to assure that they possess all project changes and addendums prior to bidding. **Any project Addenda or modifications will be available only on the City's preferred website; https://www.forestparkga.gov/rfps.**

A **Mandatory Pre-Bid Conference** will be held on **Tuesday, February 14th 2023** at **11:00 AM (EST)** at the City of Forest Park City Hall, City Council Meeting Room located at 745 Forest Parkway, Forest Park GA, 30297. Attendance of this meeting is required. A site tour is scheduled immediately following the Pre-Bid Conference.

Any questions pertaining to the requirements of the Contract Documents and Technical Specifications, either procedural or technical, shall be in writing and are to be submitted to the City of Forest Park; Attention: Procurement Department, via email at **procurement@forestparkga.gov** by **12:00 PM (EST) Tuesday, February 28th 2023**, Reference: **"Starr Park – Phase I"**. Sealed Bids will be received by the City of Forest Park at Forest Park City Hall, City Council Meeting Room located at 745 Forest Parkway, Forest Park GA, 30297 until **Tuesday, March 21st 2023** at **2:00 PM (EST)** and then publicly opened and read aloud.

No bid may be modified, withdrawn, or canceled for a period of sixty (60) days after the time designated for the receipt of Bids or until the Bidder is notified by the City; whichever is sooner. The City reserves the right to accept or reject any and all bids and to waive irregularities, technicalities, and formalities.

Each bid shall be accompanied by a Bid Bond in an amount of not less than five percent (5%) of the total bid amount. The Bid Bond may be in the form of a bond issued by a surety acceptable to the City or a cashier's check made payable to the City of Forest Park, Georgia. The entire Bid Bond shall be forfeited to the City of Forest Park as liquidated damages if the bidder fails to execute the Contract and provide Performance and Payment Bonds within fifteen (15) days after being notified that he has been awarded the Contract.

The successful bidder will be required to furnish a contract Performance Bond and a Payment Bond, each in the sum of one hundred percent (100%) of the total amount of the Bid and provide insurance coverage as required in the Contract Documents.

Note: For more information, please refer to the Instruction to Bidders and the Contract Documents, which govern and supersede this Invitation to Bid.

SECTION II

INSTRUCTIONS TO BIDDERS

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SECTION II

ARTICLE 1 – DEFINED TERMS

1.01 Terms used in these Instructions to Bidders have the meanings indicated in the General Conditions and Supplementary Conditions. Additional terms used in these Instructions to Bidders have the meanings indicated below:

A. *Owner* - City of Forest Park, Georgia

B. *Issuing Office (City of Forest Park)* – The office from which the Bidding Documents are to be issued and where the bidding procedures are to be administered.

C. *Contract Bid Number* – The official number associated with the contract bid as determined by the date of release for the official bid by the City of Forest Park.

D. *Plan Holders List* – All Bidders who attend the Mandatory Prebid Conference to be included on the Plan Holders List. The City of Forest Park will maintain the official Plan Holders List for this project.

E. *Owner's Representative* – Falcon Design Consultants, LLC, an independent consulting engineering firm, is the City of Forest Park's appointed Owner's Representative for this project.

F. *Design Engineer* – Croft and Associates., an independent engineering design firm, is the design Engineer of record for this project.

ARTICLE 2 – COPIES OF BIDDING DOCUMENTS

2.01 **A.** Complete sets of the Bidding Documents in the number and for the amount stated in the Advertisement or Invitation to Bid are to be obtained from the Issuing Office. The Issuing Office will maintain the official Plan Holders List for this project

B. Complete sets of the Contract Documents, Technical Specifications and the Contract Drawings may be obtained from the Issuing Office from the City's preferred website: **https://www.forestparkga.gov/rfps**. Documents are also available at: **https://www.bidnetdirect.com/georgia/cityofforestpark** and at the Georgia Procurement Registry website located at: **https://ssl.doas.state.ga.us/PRSapp/PRindex.jsp**.

C. Bidders are solely responsible for maintaining a complete set of Contract Documents, Technical Specifications, Contract Drawings, and project Addenda or Modifications to assure that they possess all project changes and addendums prior to bidding.

D. All bid documents will be posted online at the sites shown in Article 2.01 – Paragraph B.

2.02 Complete sets of Bidding Documents shall be used in preparing Bids; neither Owner nor Engineer assumes any responsibility for errors or misinterpretations resulting from the use of incomplete sets of Bidding Documents.

2.03 Owner and Engineer, in making copies of Bidding Documents available on the above terms, do so only for the purpose of obtaining Bids for the Work and do not authorize or confer a license for any other use.

ARTICLE 3 – QUALIFICATIONS OF BIDDERS

3.01 To demonstrate Bidder's qualifications to perform the Work, Bidder shall submit written evidence with bid such as financial data, previous experience, present commitments, and such other data as may be called for below.

A. Required Bidder Qualification Statement with Supporting Data (Business License, Corporate Resolution to Bid, Financial Statement, Current Workload, etc.)

B. Georgia Contractor License

ARTICLE 4 – EXAMINATION OF BIDDING DOCUMENTS, OTHER RELATED DATA, AND SITE

4.01 *Subsurface and Physical Conditions*

A. The Supplementary Conditions identify:

1. Those reports known to Owner of explorations and tests of subsurface conditions at or contiguous to the Site, including but limited to a geotechnical report.

2. Those drawings known to Owner of physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities).

B. Copies of reports and drawings, if any, referenced in Paragraph 4.01.A will be made available by Owner to any Bidder upon written request. Those reports and drawings are not part of the Contract Documents, but the "technical data" contained therein as provided in Paragraph 4.02 of the General Conditions has been identified and established in Paragraph 4.02 of the Supplementary Conditions. Bidder is responsible for any interpretation or conclusion Bidder draws from any "technical data" or any other data, interpretations, opinions, or information contained in such reports or shown or indicated in such drawings.

4.02 *Underground Facilities*

A. Information and data shown or indicated in the Bidding Documents with respect to existing Underground Facilities at or contiguous to the Site is based upon information and data furnished to Owner and Engineer by owners of such Underground Facilities, including Owner, or others.

4.03 *Hazardous Environmental Condition*

A. The Supplementary Conditions identify any reports and drawings known to Owner relating to a Hazardous Environmental Condition identified at the Site.

B. Copies of reports and drawings referenced in Paragraph 4.03.A will be made available by Owner to any Bidder on request. Those reports and drawings are not part of the Contract Documents, but the "technical data" contained therein as provided in Paragraph 4.06 of the General Conditions has been identified and established in Paragraph 4.06 of the Supplementary Conditions. Bidder is responsible for any interpretation or conclusion Bidder draws from any "technical data" or any other data, interpretations, opinions, or information contained in such reports or shown or indicated in such drawings.

4.04 Provisions concerning responsibilities for the adequacy of data furnished to prospective Bidders with respect to subsurface conditions, other physical conditions, and Underground Facilities, and possible changes in the Bidding Documents due to differing or unanticipated subsurface or physical conditions appear in Paragraphs 4.02, 4.03, and 4.04 of the General Conditions. Provisions concerning responsibilities for the adequacy of data furnished to prospective Bidders with respect to a Hazardous Environmental Condition at the Site, if any, and possible changes in the Contract Documents due to any Hazardous Environmental Condition uncovered or revealed at the Site which was not shown or indicated in the Drawings or Specifications or identified in the Contract Documents to be within the scope of the Work, appear in Paragraph 4.06 of the General Conditions. On request, Owner will provide Bidder access to the Site to conduct such examinations, investigations, explorations, tests, and studies as Bidder deems necessary for submission of a Bid. Bidder shall fill all holes and clean up and restore the Site to its former condition upon completion of such explorations, investigations, tests, and studies. Bidder shall comply with all applicable Laws and Regulations relative to excavation and utility locates.

4.05 It is the responsibility of each Bidder before submitting a Bid to:

A. examine and carefully study the Bidding Documents, and the other related data identified in the Bidding Documents;

B. visit the Site and become familiar with and satisfy Bidder as to the general, local, and Site conditions that may affect cost, progress, and performance of the Work;

C. become familiar with and satisfy Bidder as to all federal, state, and local Laws and Regulations that may affect cost, progress, and performance of the Work;

D. consider the information known to Bidder; information commonly known to contractors doing business in the locality of the Site; information and observations obtained from visits to the Site; the Bidding Documents; and the Site-related reports and drawings identified in the Bidding Documents, with respect to the effect of such information, observations, and documents on (1) the cost, progress, and performance of the Work; (2) the means, methods, techniques, sequences, and procedures of construction to be employed by Bidder, including applying any specific means, methods, techniques, sequences, and procedures of construction expressly required by the Bidding Documents; and (3) Bidder's safety precautions and programs;

E. agree at the time of submitting its Bid that no further examinations, investigations, explorations, tests, studies, or data are necessary for the determination of its Bid for performance of the Work at the price(s) bid and within the times required, and in accordance with the other terms and conditions of the Bidding Documents;

F. become aware of the general nature of the work to be performed by Owner and others at the Site that relates to the Work as indicated in the Bidding Documents;

G. promptly give Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder discovers in the Bidding Documents and confirm that the written resolution thereof by Engineer is acceptable to Bidder;

H. determine that the Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for the performance of the Work; and

I. refer to the submittal checklist and submit bid documents in the order according to the submittal checklist.

4.06 The submission of a Bid will constitute an incontrovertible representation by Bidder that Bidder has complied with every requirement of this Article 4, that without exception the Bid is premised upon performing and furnishing the Work required by the Bidding Documents and applying any specific means, methods, techniques, sequences, and procedures of construction that may be shown or indicated or expressly required by the Bidding Documents, that Bidder has given Engineer written notice of all conflicts, errors, ambiguities, and discrepancies that Bidder has discovered in the Bidding Documents and the written resolutions thereof by Engineer are acceptable to Bidder, and that the Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performing and furnishing the Work.

ARTICLE 5 – PRE-BID CONFERENCE

5.01 A **MANDATORY PRE-BID CONFERENCE** will be held on **Tuesday, February 14th 2023** at **11:00 AM (EST)** at the City of Forest Park City Hall, City Council Meeting Room located at 745 Forest Parkway, Forest Park GA, 30297. A site tour is scheduled immediately following the Pre-Bid Conference. Representatives of Owner and Engineer will be present to discuss the Project. Bidders are required to attend and participate in the conference. Engineer will transmit to all prospective Bidders such Addenda as Engineer considers necessary in response to questions arising at the conference. Oral statements may not be relied upon and will not be binding or legally effective.

ARTICLE 6 – SITE AND OTHER AREAS

6.01 The Site is identified in the Bidding Documents. Easements for permanent structures or permanent changes in existing facilities are to be obtained and paid for by Owner unless otherwise provided in the Bidding Documents. All additional lands and access thereto required for temporary construction facilities, construction equipment, or storage of materials and equipment to be incorporated in the Work are to be obtained and paid for by Contractor.

ARTICLE 7 – INTERPRETATIONS AND ADDENDA

7.01 All questions pertaining to the requirements of the Contract Documents and Technical Specifications, either procedural or technical, shall be in writing and are to be submitted to the City of Forest Park; Attention: Procurement Department via email at

procurement@forestparkga.gov. Interpretations or clarifications considered necessary by the City in response to such questions will be issued by Addenda to all parties recorded by Issuing Office on the Plan Holders List as having attended the Mandatory Prebid Conference. Questions received after **12:00 PM (EST) Tuesday, February 28th 2023** may not be answered. Only questions answered by Addenda will be binding. Oral and other interpretations or clarifications will be without legal effect.

7.02 Addenda may be issued to clarify, correct, or change the Bidding Documents as deemed advisable by Owner or Engineer and all Addenda will be transmitted to all bidders listed on the Plan Holders List.

ARTICLE 8 – BID SECURITY

8.01 A Bid must be accompanied by Bid security made payable to Owner in an amount of 5 percent of Bidder's maximum Bid price and in the form of a certified check, bank money order, or a Bid bond (on the form attached) issued by a surety meeting the requirements of Paragraphs 5.01 and 5.02 of the General Conditions.

8.02 The Bid security of the Successful Bidder will be retained until such Bidder has executed the Contract Documents, furnished the required contract security and met the other conditions of the Notice of Award, whereupon the Bid security will be returned. If the Successful Bidder fails to execute and deliver the Contract Documents and furnish the required contract security within 15 days after the Notice of Award, Owner may consider Bidder to be in default, annul the Notice of Award, and the Bid security of that Bidder will be forfeited. Such forfeiture shall be Owner's exclusive remedy if Bidder defaults. The Bid security of other Bidders whom Owner believes to have a reasonable chance of receiving the award may be retained by Owner until the earlier of even days after the Effective Date of the Agreement or 61 days after the Bid opening, whereupon Bid security furnished by such Bidders will be returned.

8.03 Bid security of other Bidders whom Owner believes do not have a reasonable chance of receiving the award will be returned within seven days after the Bid opening.

ARTICLE 9 – CONTRACT TIMES

9.01 The number of consecutive calendar days within which, or the dates by which, the Work is to be substantially completed and ready for final payment are set forth in the Agreement.

ARTICLE 10 – LIQUIDATED DAMAGES

10.01 Provisions for liquidated damages, if any, are set forth in the Agreement.

ARTICLE 11 – SUBSTITUTE AND "OR-EQUAL" ITEMS

11.01 The Contract, if awarded, will be on the basis of materials and equipment specified or described in the Bidding Documents, or those substitutes or "or-equal" materials and equipment approved by Engineer and identified by Addendum. The materials and equipment described in the Bidding Documents establish a standard of required type, function and quality to be met by any proposed substitute or "or-equal" item. No item of

material or equipment will be considered by Engineer as a substitute or "or-equal" unless written request for approval has been submitted by Bidder and has been received by Engineer at least 10 days prior to the date for receipt of Bids. Each such request shall conform to the requirements of Paragraph 6.05 of the General Conditions. The burden of proof of the merit of the proposed item is upon Bidder. Engineer's decision of approval or disapproval of a proposed item will be final. If Engineer approves any proposed item, such approval will be set forth in an Addendum issued to all prospective Bidders. Bidders shall not rely upon approvals made in any other manner.

ARTICLE 12 – SUBCONTRACTORS, SUPPLIERS AND OTHERS

12.01 If the Supplementary Conditions require the identity of certain Subcontractors, Suppliers, individuals, or entities to be submitted to Owner in advance of a specified date prior to the Effective Date of the Agreement, the apparent Successful Bidder, and any other Bidder so requested, shall within five days after Bid opening, submit to Owner a list of all such Subcontractors, Suppliers, individuals, or entities proposed for those portions of the Work for which such identification is required. Such list shall be accompanied by an experience statement with pertinent information regarding similar projects and other evidence of qualification for each such Subcontractor, Supplier, individual, or entity if requested by Owner. If Owner or Engineer, after due investigation, has reasonable objection to any proposed Subcontractor, Supplier, individual, or entity, Owner may, before the Notice of Award is given, request apparent Successful Bidder to submit a substitute, without an increase in the Bid.

12.02 If apparent Successful Bidder declines to make any such substitution, Owner may award the Contract to the next lowest Bidder that proposes to use acceptable Subcontractors, Suppliers, individuals, or entities. Declining to make requested substitutions will not constitute grounds for forfeiture of the Bid security of any Bidder. Any Subcontractor, Supplier, individual, or entity so listed and against which Owner or Engineer makes no written objection prior to the giving of the Notice of Award will be deemed acceptable to Owner and Engineer subject to revocation of such acceptance after the Effective Date of the Agreement as provided in Paragraph 6.06 of the General Conditions.

12.03 Contractor shall not be required to employ any Subcontractor, Supplier, individual, or entity against whom Contractor has reasonable objection.

ARTICLE 13 – LOCAL, SMALL BUSINESS, DIVERSITY PROGRAM

13.01 The City of Forest Park has implemented a Local, Small Business, Diversity Program to promote full and open competition in all city contracts. LSBD participation goals are set on a contract-by-contract basis for each specific prime contract with subcontracting possibilities. The City wants to ensure that Proponents are non-discriminatory in their process of selecting sub-contractors. The City also wants to encourage Proponents to utilize local, veteran-owned, minority, women, and disadvantaged business enterprises whenever possible.

Included in this RFQB are subcontracting/subconsultant forms that all Bidders will be required to complete along with their Bids (in addition to general contractor forms). All forms included in this solicitation must be completed for Bidder to be considered

responsive.

Each Bidder must propose to achieve the LSBD participation goal that is equal or greater than the percentage required. Each Bidder will be required to submit evidence demonstrating that "good faith efforts" were made if you cannot meet the goal.

These forms are requirements under the City of Forest Park's Local, Small Business, Diversity Program, and it is a requirement to comply with making the "good faith effort" to achieve the goal. Failure to complete these forms will deem you non- responsive.

The participation goal for this procurement is 25 percent (25%)

A business is considered Local if they meet the following:

1. The business or supplier must operate and maintain a regular place of business within the geographical boundaries of the city;

2. The business or supplier must provide a copy of a current occupational tax certificate;

3. The business or supplier must have paid all real and personal taxes (if any) owed the city and not otherwise owe the city any funds; and

4. The business or supplier must certify its compliance with the Georgia Security and Immigration Act.

A Small Business means a locally based business whose average annual gross receipts or number of employees averaged over the past five years must not exceed the size standards as defined pursuant to 15 C.F.R § 121.201 et al., who demonstrates that individual owner's personal net worth and does not exceed $750,000.00, exclusive of the individual's ownership interest in their primary residence and the value of the LSBD.

13.02 LSBD Required Forms –

To be submitted with Bid:

1. LSBD-1 Covenant of Non-Discrimination: The signed agreement stating that the firm will not discriminate on the basis of a firm's size (revenue or employee count) with regard to prime contracting, subcontracting, or partnering opportunities.

2. LSBD-2 Sub-Contractor Contact Form: A list of all firms contacted to participate as LSBD sub-contractors/suppliers on a contract.

3. LSBD-3 LSBD Sub-Contractor/Supplier Utilization Form: A list of all firms procured as LSBD sub-contractors/suppliers to be utilized on a contract.

4. LSBD-4 Statement of Good Faith Efforts (Including the Checklist): Documented efforts to seek and procure the utilization of LSBD's as sub-

contractors/suppliers on a contract where a goal is required.

To be submitted post-award:

5. LSBE-5 Post Award Monthly LSBD Participation Report – Contract Goal: Report detailing percentage of LSBD participation (work performed) and payments to VOB/MBE/WBE/DBE subcontractors on a monthly basis.

6. LSBD-6 Request for Subcontractor Removal/Substitution Form: Required to fill out and obtain approval if a LSBD subcontractor is being substituted following post bid.

13.03 Supplements

1. Form LSBD-1, Covenant of Non-Discrimination
2. Form LSBD-2, Sub-Contractor Contact Form – Contract Goal
3. Form LSBD-3, Local, Small Business, Diversity Project Participation Plan
4. Form LSBD-4, Statement of Good Faith Efforts
5. Form LSBD-5, Post-Award-Monthly LSBD Participation Report Contract Goal
6. Form LSBD-6, Subcontractor Removal/Substitution Form

SECTION II

FORM LSBD-1

COVENANT OF NON-DISCRIMINATION

The undersigned understands that it is the policy of the City of Forest Park (COFP) to promote full and equal business opportunity for all persons doing business with the City. The undersigned covenants that we have not discriminated on the basis of a firm's revenue, employee count, social or economic disadvantages, minority, gender, or veteran status, with regard to prime contracting, subcontracting or partnering opportunities. The undersigned further covenants that we have completed truthfully and fully the required forms LSBD-2, LSBD-3 and LSBD-4. Set forth below is the signature of an officer of the Bid entity with the City of Forest Park to bind the entity.

I, _____(Name, Title), on behalf of _____ (Company), by my signature below, do hereby promise:

1. To adopt the policies of the City of Forest Park relating to equal opportunity in contracting on projects and contracts funded, in whole or in part, with funds of COFP;
2. Not to otherwise engage in discriminatory conduct; To provide a discrimination-free working environment;
3. That this Covenant of Non-Discrimination shall be continuing in nature and shall remain in full force and effect without interruption; and
4. That this Covenant of Non-Discrimination shall be incorporated by reference into any contract or portion thereof which we may hereafter obtain.

We understand that our failure to satisfactorily discharge any of the promises of non-discrimination as made and set forth herein shall constitute a material breach of contract.

By:_____

Title:_____

Sworn to and subscribed before me the_____day of_____,
_____.

Notary Public:_____

My Commission Expires:_____

[SEAL]

SECTION II

FORM LSBD-2

SUB-CONTRACTOR CONTACT FORM – CONTRACT GOALS

Instructions to Contractors

The prime contractor must complete and sign the sub-contractor **contact form** and submit the completed and signed form with the bid. **Failure to submit this form will result in being deemed nonresponsive.**

1. Name of contractor/supplier: Provide name of the contractor or supplier you contacted to perform on the task order.

2. Contact Name, Address and Phone Number: Provide the contact information of the contractor/supplier you contacted.

3. City of Forest Park Business License: State if the contractor/supplier you contacted is a City of Forest Park Licensed business.

4. Type or work solicited for: Describe the type of work for which you are soliciting from the contractor/supplier.

5. Business Ownership (Enter Code): State whether the contractor/supplier you contacted is an MBE – Minority Business Enterprise, DBE – Disadvantaged Business Enterprise, WBE – Women Business Enterprise, or VOB – Veteran Owned Business (if applicable)

6. Results of Contact: Describe the results of your contact.

7. Sign and date the form.

SECTION II

FORM LSBD-2

CITY OF FOREST PARK

SUBCONTRACTOR CONTACT FORM

List all subcontractors or suppliers *(LSBE and Non-LSBD)* that were **contacted** regarding this project

Name of Sub-Contractor/Supplier	Company Name, Address, Email, and Phone Number	City of Forest Park Business License? (Yes or No)	Type of Work Solicited For	Business Ownership (Enter Code)	Results of Contact
John Smith	Company ABC 123 Main Street Morrow, GA 30260 jsmith@email.com 770-123-4698	Yes	Hauling	DBE	Will perform as sub

Diversity Code: MBE – Minority Business Enterprise, DBE – Disadvantaged Business Enterprise, WBE – Women Business Enterprise, VOB – Veteran Owned Business

Sample

SECTION II

FORM LSBD-2

CITY OF FOREST PARK

SUBCONTRACTOR CONTACT FORM

List all subcontractors or suppliers *(LSBE and Non-LSBD)* that were **contacted** regarding this project

Name of Sub-Contractor/Supplier	Company Name, Address, and Phone Number	City of Forest Park Business License? (Yes or No)	Type of Work Solicited For	Business Ownership (Enter Code)	Results of Contact

Diversity Code: MBE – Minority Business Enterprise, DBE – Disadvantaged Business Enterprise, WBE – Women Business Enterprise, VOB – Veteran Owned Business

SECTION II

FORM LSBD-2

SUB-CONTRACTOR CONTACT FORM – Cont'd

List all sub-contractors or suppliers (LSBD and Non-LSBD) that were contacted regarding this project

Name of Sub-Contractor/Supplier	Company Name, Address, Email, and Phone Number	City of Forest Park Business License? (Yes or No)	Type of Work Solicited For	Business Ownership (Enter Code)	Results of Contact

Bidder's Name: _____ Project Name: _____ FC#: _____

Signature: _____ Contact No: _____ Date: _____

Local, Small Business, Diversity Form (Page 2 of 2)

SECTION II

FORM LSBD-3

LOCAL, SMALL BUSINESS, DIVERSITY OPPORTUNITY SUBCONTRACTOR PROJECT PLAN

SUBCONTRACTOR/SUPPLIER UTILIZATION

Instructions to Contractors

The Bidder must complete the project participation plan for sub-contractor/supplier utilization and **submit the form with the Bid**. **Failure to submit this form will result in a Bid being deemed "nonresponsive".** Each project participation plan for sub-contractor/supplier must include the following:

1. Name of subcontractor/supplier: Provide name of the subcontractor or supplier contacted to perform work on the project.

2. Contact Name, Address & Phone Number: Provide contact information of the subcontractor/supplier contacted.

3. City of Forest Park Business License: State if the subcontractor/supplier contacted is a City of Forest Park licensed business.

4. Type or Scope of Work to be Performed: Describe the type or scope of work subcontractor/supplier will perform.

5. Certification of Business Owner: Provide minority code/classification (if applicable). Examples include, but not limited to: Minority Business Enterprise (MBE), Disadvantaged Business Enterprise (DBE), Women Business Enterprise (WBE), Veteran Owned Business (VOB), etc.

6. Estimated Dollar Value of Work: Provide an estimated dollar value for the work to be performed by subcontractor/supplier within the project scope.

7. Percentage of Total Bid Amount: Provide an estimated percentage of the total Bid amount that will be paid to the subcontractor/supplier.

8. Signature of Bidder: All LSBD Participation Plans must be signed and dated by Bidders.

Estimated Dollar Value of the Work / Total Bid Amount = % of Total Bid Amount

SECTION II

FORM LSBD-3

CITY OF FOREST PARK LOCAL, SMALL BUSINESS, DIVERSITY OPPORTUNITY SUBCONTRACTOR PROJECT PLAN SUBCONTRACTOR/SUPPLIER UTILIZATION

List all subcontractors/suppliers, including lower tiers, **to be used** on this project.

Name of Sub-Contractor/Supplier	Company Name, Address, Email, and Phone Number	City of Forest Park Business License? (Yes or no)	Type of Work to be Performed	Owner of Business (See code below)	Dollar ($) Value of Work	Percentage of Total Bid Amount
John Smith	Company ABC 123 Main Street Forest Park, GA 30297 jsmith@email.com 770-123-4698	Yes	Hauling	DBE	$4200	8.4%

Total Local Business, % _____ Total Small Business % _____ Total Minority Business % _____

Diversity Code: MBE – Minority Business Enterprise, DBE – Disadvantaged Business Enterprise, WBE – Women Business Enterprise, VOB – Veteran Owned Business

Proponent's Company Name: _____ Date: _____ FC#: _____

Proponent's Contact Number: _____ Project Name: _____

Signature: _____ _____

Sample

SECTION II

FORM LSBD-3

CITY OF FOREST PARK LOCAL, SMALL BUSINESS, DIVERSITY OPPORTUNITY SUBCONTRACTOR PROJECT PLAN SUBCONTRACTOR/SUPPLIER UTILIZATION

List all subcontractors/suppliers, including lower tiers, **to be used** on this project.

Name of Sub-Contractor/Supplier	Company Name, Address, Email, and Phone Number	City of Forest Park Business License? (Yes or no)	Type of Work to be Performed	Owner of Business (See code below)	Dollar ($) Value of Work	Percentage of Total Bid Amount

Total Local Business, % _____ Total Small Business % _____ Total Minority Business % _____

Diversity Code: MBE – Minority Business Enterprise, DBE – Disadvantaged Business Enterprise, WBE – Women Business Enterprise, VOB – Veteran Owned Business

Proponent's Company Name: _____ Date: _____ FC#: _____

Proponent's Contact Number: _____ Project Name: _____

Signature: _____ _____

SECTION II

FORM LSBD-4

STATEMENT OF GOOD FAITH EFFORTS

Instructions:

If you will not meet the Local Small Business Diversity (LSBD) goal set forth in the RFQB, in addition to the information included on the LSBD Form 2 Sub-contractors Contact Form submitted with your bid, please provide a narrative explanation of why you cannot meet the LSBD goal and the steps taken to include LSBDs in your bid. Describe specific actions (i.e. phone calls, etc.). Please provide copies of any solicitation notices sent, whether by email, fax or mail, and the amount of time given for response. Describe efforts to follow up initial communications. Identify the individuals from your organization who performed these activities. Attach additional pages as needed.

CERTIFICATION OF GOOD FAITH EFFORTS

I hereby attest that I have exercised good faith efforts to meet the Local Small Business Diversity goal for this bid. Despite such good faith efforts, I have not been able to meet the LSBD goal for this bid.

_____
(Name of Organization)

_____ _____
(Print Name) (Title)

_____ _____
(Signature) (Date)

SECTION II

FORM LSBD-4 (Cont'd)
STATEMENT OF GOOD FAITH EFFORTS
Checklist

All Bidders are required to demonstrate that they have made "good faith efforts" and provide proof to meet COFP's LSBD participation goal. Please indicate whether or not any of the following actions were taken:

	Yes	No	
1.	❑	❑	Attendance at a pre-bid meeting, if any, scheduled by COFP to inform LSBDs of subcontracting opportunities under a given solicitation; Advertisement for solicitation of LSBDs in general circulation media, trade association publications, and minority- focus media, to provide notice of subcontracting opportunities.
2.	❑	❑	Advertisement in general circulation media at least seven (7) days prior to Bid or Bid opening any and all Sub-contractor opportunities. Proof of advertisement must be submitted with the Bid or Bid.
3.	❑	❑	Provided interested LSBDs with timely, adequate information about the plans specifications, and other such requirements of the Contract to facilitate their quotation and conducted follow up to initial solicitations.
4.	❑	❑	Provided written notice to LSBDs that their interest in subcontracting opportunities or furnishing supplies is solicited. Provided a contact log showing the name, address, email and contact number (phone or fax) used to contact the proposed certified sub- contractors, nature of work requested for quote, date of contact, the name and title ofthe person making the effort, and the amount of the quoted price if one was obtained.
5.	❑	❑	Efforts were made to divide the work for LSBD subcontracting in areas likely to be successful and identify portions of work available to LSBDs consistent with their availability. Include a list of divisions of work not subcontracted and the corresponding reasons for not including them. The ability or desire of a Bidder/Bidder to perform thework of a contract with its own organization does not relieve it of the responsibility to make good faith efforts on all scopes of work subject to subcontracting.
6.	❑	❑	Efforts were made to assist potential LSBD sub-contractors to meet bonding, insurance or other governmental contracting requirements. Where feasible, facilitatingthe leasing of supplies or equipment when they are of such a specialized nature that an LSBD could not readily and economically obtain them in the marketplace.
7.	❑	❑	Utilization of services of available minority community organizations, minority contractor groups and other organizations that provide assistance in the recruitment and placement of LSBDs.
8.	❑	❑	Communication with the COFP Procurement Department seeking assistance in identifying available LSBDs.
9.	❑	❑	Exploration of joint venture opportunities with LSBDs.
10.	❑	❑	Other actions (specify):

Please explain any "no" answers listed above (by number):

This list is a guideline and by no means exhaustive. The City of Forest Park will review these efforts, along with other documents, towards assessing the Bidder/Bidder's efforts to meet COFP's LSBD goal. If you require assistance in identifying certified LSBDs, please contact the Procurement Department at ageeter@forestparkga.gov or at 404-366-4720.

SECTION II

FORM LSBD-5

POST AWARD MONTHLY LSBD PARTICIPATION REPORT – CONTRACT GOAL

Instructions to Contractors

The prime contractor must complete the **participation report** and submit the form with each pay application to the COFP Department Project Manager in charge of the contract. **Failure to submit this form will result in payment application being deemed incomplete.**

1. Report Number: Reports must be consecutively numbered. It will only be necessary to submit a report in a period when the approved VOB/MBE/WBE/DBE has performed a portion of the work that has been designated for the contract.

2. Date: Actual date of the report.

3. Pay application period end date: Reports must acknowledge the end date for the period for which is being reported.

4. VOB/MBE/WBE/DBE Amount: The amount of the contract for which the VOB/MBE/WBE/DBE will earn.

5. Prior Earned Pay Application Amount: The amount previously submitted for payment on pay application.

6. Current Earned Pay Application Amount: The amount submitting with current payment application.

7. Earnings To-Date: The actual amount that each VOB/MBE/WBE/DBE has earned to-date under the contract.

8. Percent of Contract: This percentage is calculated using the contract amount and the total VOB/MBE/WBE/DBE earnings-to-date. Divide the total contract amount by the total VOB/MBE/WBE/DBE earnings-to-date.

9. Certification: The contractor's authorized representative must sign this form prior to submittal.

GENERAL INFORMATION

When the approved VOB/MBE/WBE/DBE is to provide materials, goods or services, this completed form must be submitted to the COFP Department Project Manager. The prime contractor must notify COFP of any changes to VOB/MBE/WBE/DBE firms.

When the prime contractor is an approved LSBD, it will only be necessary to complete the total LSBD earnings to-date. Joint ventures between non-LSBD and certified LSBD: Only that portion of the work for which the LSBD is responsible may be used to satisfy the requirement.

It is not necessary to complete this form if there are no subcontracting opportunities available for the use of VOB/MBE/WBE/DBE firms.

SECTION II

FORM LSBD-5

POST AWARD – LSBD PARTICIPATION REPORT – CONTRACT GOAL

PROJECT NO. (S): _____

REPORT NO.: _____

CONTRACTOR: _____

DATE: _____

CONTRACT AMOUNT: $_____

PAY APPLICATION PERIOD END DATE: _____

Check if final payment >>> ❍ FINAL PAYMENT

% LSBD GOAL_____

VOB/MBE/WBE/DBE AMOUNT $: _____

NAME OF APPROVED VOB/MBE/WBE/DBE	DESCRIPTION OF WORK	PRIOR EARNED PAY APPLICATION AMOUNT	CURRENT EARNED PAY APPLICATION AMOUNT	EARNINGS TO-DATE

TOTAL VOB/MBE/WBE/DBE EARNINGS TO-DATE: _____

% CONTRACT: _____

I HEREBY CERTIFY THAT THE ABOVE STATEMENT IS TRUE AND CORRECT AND SUPPORTING DOCUMENTATION IS ON FILE AND IS AVAILABLE FOR INSPECTION BY COFP AT ANY TIME.

SIGNED_____
CONTRACTOR

REMARKS_____

_____

FOR DEPARTMENT USE ONLY:

THIS DOCUMENT HAS BEEN REVIEWED AT THAT PROJECT LEVEL BY:

SIGNED_____ TITLE _____

THIS DOCUMENT HAS BEEN REVIEWED AT THE PROGRAM LEVEL BY:

SIGNED_____TITLE_____

SECTION II

FORM LSBD-6

Request for Subcontractor Removal/Substitution

Prior to submitting this form to the Procurement Department you must notify the LSBD in writing of your intent and allow the LSBD five (5) days to respond.

Request Date:	Contract/Project #:	
Contract Value:	LSBD Contract Amount:	Amount Paid to LSBD:
Prime Contractor Name:		
Prime Contractor Address:		
Prime Contact Name:	Prime Contact Email:	Prime Contact Phone:
Name of LSBD Firm:	LSBD Contact Name:	
LSBD Firm Address:	LSBD Email:	LSBD Phone:

Was LSBD firm given five (5) days written notice of intent? ☐ Yes or ☐ No If yes, please attach written notice.
Will the LSBD goal for the project still be met? ☐ Yes or ☐ No or ☐ N/A

Reason(s) for removal/substitution. **Check all that apply**

☐ **The listed LSBD** is no longer in business.

☐ **The listed LSBD** requested removal.

☐ **The listed LSBD** failed or refused to perform under the terms of the contract or failed to furnish the listed materials.

☐ The work performed by **the listed LSBD** was unsatisfactory and was not in accordance with the scheduled specifications.

Name/Address of Substitution Contractor:	Is the substituted contractor an LSBD? ☐ Yes or ☐ No
Fully describe the type of work the substitute subcontractor will perform:	

Prime Authorized Signature:	**Date:**
Approved ☐ Rejected ☐	**Reason for rejection:**
Procurement Manager Authorized Signature:	**Date:**

This form should be completed and submitted (with all required documentation) to:

City of Forest
Attention: Arthur Greeter
745 Forest Parkway
Forest Park GA, 30297

SECTION II

ARTICLE 14 – PREPARATION OF BID

14.01 The Bid Form is included with the Bidding Documents. Additional copies may be obtained from Engineer.

14.02 All blanks on the Bid Form shall be completed in ink and the Bid Form signed in ink. Erasures or alterations shall be initialed in ink by the person signing the Bid Form. A Bid price shall be indicated for each section listed therein.

14.03 A Bid by a corporation shall be executed in the corporate name by the president or a vice-president or other corporate officer accompanied by evidence of authority to sign. The corporate seal shall be affixed and attested by the secretary or an assistant secretary. The corporate address and state of incorporation shall be shown.

14.04 A Bid by a partnership shall be executed in the partnership name and signed by a partner (whose title must appear under the signature), accompanied by evidence of authority to sign. The official address of the partnership shall be shown.

14.05 A Bid by a limited liability company shall be executed in the name of the firm by a member and accompanied by evidence of authority to sign. The state of formation of the firm and the official address of the firm shall be shown.

14.06 A Bid by an individual shall show the Bidder's name and official address.

14.07 A Bid by a joint venture shall be executed by each joint venturer in the manner indicated on the Bid Form. The official address of the joint venture shall be shown.

14.08 All names shall be printed in ink below the signatures**.**

14.09 The Bid shall contain an acknowledgment of receipt of all Addenda, the numbers of which shall be filled in on the Bid Form in addition to submitting the Acknowledgement of Addenda Form 11.

14.10 Postal and e-mail addresses and telephone number for communications regarding the Bid shall be shown.

14.11 The Bid shall contain evidence of Bidder's authority and qualification to do business in the state where the Project is located, or Bidder shall covenant in writing to obtain such authority and qualification prior to award of the Contract and attach such covenant to the Bid. Bidder's state contractor license number, if any, shall also be shown on the Bid Form.

ARTICLE 15 – BASIS OF BID; COMPARISON OF BIDS

15.01 *Unit Price*

A. Bidders shall submit a Bid on a unit price basis for each item of Work listed in the Bid schedule.

B. The value of items required by the Contract Documents but not show in the line items on the Bid Form shall be included in the unit price of the line item that relates to this work.

C. The total of all estimated prices will be the sum of the products of the estimated quantity of each item and the corresponding unit price. The final quantities and Contract Price will be determined in accordance with Paragraph 11.03 of the General Conditions.

D. Discrepancies between the multiplication of units of Work and unit prices will be resolved in favor of the unit prices. Discrepancies between the indicated sum of any column of figures and the correct sum thereof will be resolved in favor of the correct sum.

15.02 *Allowances*

A. A project contingency allowance of **10%** is included into the total base bid for this project. This allowance is for additional work as directed by the Owner. Monies not utilized by the Owner for this project will be removed from the final contract price at the completion of the project by use of a Change Order.

ARTICLE 16 – SUBMITTAL OF BID

16.01 With each copy of the Bidding Documents, a Bidder is furnished one separate unbound copy of the Bid Form, and, if required, the Bid Bond Form. The unbound copy of the Bid Form is to be completed and submitted with the Bid security and the following documents. Please refer to the submittal checklist to track the preparation and order of submittal of certain required information with the Bid.:

A. Required Bid security;

B. LSBD Forms 1-4 ;

C. List of 5 Project References;

D. Evidence of authority to do business in the state of the Project; or a written covenant to obtain such license within the time for acceptance of Bids;

E. Copy of Contractor's License *[or]* Evidence of Bidder's ability to obtain a State Contractor's License and a covenant by Bidder to obtain the following said license within the time for acceptance of Bids.

F. Georgia Department of Transportation Prequalification Certification for Roads

G. Certificate of Insurance (listing Forest Park as the Certificate Holder);

H. Contractor Affidavit and Agreement;

I. Subcontractor Affidavit;

J. Contractor's Statement of Legal Status and Financial Capability;

SECTION II

K. Certification Regarding Debarment, Suspension, and Other Matters;

L. Non-Collusion Affidavit;

M. Bidder's Contact Directory;

N. Acknowledgment of Addenda;

O. Required Bidder Qualification Statement with Supporting Data for the following:

1. Organizational Structure/Key Personnel and Resumes: The Bidder's Organizational Structure Section should introduce the proposed Bidder team by:

   1.1. Provide the Bidder's Management Organizational Chart both graphically and in narrative format. The Organizational chart and narrative should provide a description of the Bidder's views on how it will organizationally provide the Services.

   1.2. Provide a description of how the organizational structure will facilitate managing the Services requested and how an efficient flow of information will be realized from the organizational structure.

   1.3. Provide resumes for key personnel you intend to assign to this Project for the following positions: Principal-in-charge, Project Manager and On-Site/Quality Assurance Supervisor. Submission of these names constitutes a commitment to use these individuals if the Bidder is awarded a Contract, and changes may be made only with the prior written consent of the City.

      1.3.1. Resumes should be organized as follows:
      1.3.2. Name and Title;
      1.3.3. Professional Background;
      1.3.4. Current and Past Relevant Employment;
      1.3.5. Education; and
      1.3.6. Certifications.

2. Overall Project Experience, Qualifications, and Performance on Previous Similar Projects

   2.1. Describe the Bidder company's history of experience providing general contracting services for a city or commercial property of similar size and scope including but not limited to fire stations or other government buildings, major shopping malls, office parks, major office complexes, hotels or convention facilities, government buildings, facilities or complexes, or major colleges/universities.

   2.2. Provide detail evidence that is currently providing general contracting services.

2.3. Provide the number of years responder has operated under current company name?

2.4. Provide a matrix of five (5) relevant projects within the last five (5) years of similar size and scope, including client name, project description, project value, role of the individual, project completion date, reference contact name, phone number and e-mail address. Refer to Section XVII- Form 5

3. Management and Staffing Plan

3.1. Describe how the project will be organized and managed, ensuring that staffing needs are met for the delivery of services and duties as outlined in Exhibit A. Clearly outline the estimated staffing for each service area.

3.2. Describe your processes, procedures and methodology for monitoring quality control and required outcome for services being provided. The plan should include the name and title of the inspector, frequency of each inspection, and all forms that will be used to document the inspections.

3.3. Describe your process for reporting capabilities and provide sample reports for this project, i.e., performance measures, quality of work, and deliverables.

3.4. Provide a list of resources and include a list of equipment with quantity of each.

4. Quality Control Plan Approach

4.1. Bidder must submit an executive level plan describing the management process the Bidder will implement to ensure all work and services performed are of the highest quality. The approach should include a description of the Bidder's process as it pertains to shop drawings, product and materials submittals, inspection of subcontractor/subconsultant work and materials, means and methods of conducting Quality Control testing, etc. Describe the Bidder's corrective action plan. Describe how the Bidder's organizational structure supports this plan and clearly identify responsible and accountable parties (Do not provide the Bidder's existing Quality Control Manual).

5. Procurement Plan

5.1. Bidder must submit an executive level approach (3 pages maximum) to the competitive and open procurement of subcontractors/subconsultants, materials, supplies and equipment required to complete a project. The plan must address the bonding requirements it will require of the subcontractors as well as any bonding assistance available to subcontractors. Include your ability to purchase material and supplies for this project to meet the construction schedule.

6. Safety Record and Experience

6.1. Each Bidder must demonstrate that it is committed to implementing a first-rate safety program and that it has an exceptional safety and environmental record. Each Bidder must submit their current Experience Modification Rate (EMR). If an EMR is not available, each Bidder and its proposed subcontractors/subconsultants must submit a written statement detailing each one's safety records on its last 5 projects listed in the Bidder's reference., Include contact names and phone numbers where the City can verify the safety record statement. Each Bidder must provide a Log and Summary of OSHA violations and any fines or settlements for the past 36 months. Attach OSHA Form 300A - Work Related Injuries and Illnesses, as required by the U. S. Department of Labor, for the past 36 months (Provide OSHA Recordable Incident Rate (Year 2017) and OSHA Lost Days Away Incident Rate (Year 2017). This is applicable to site construction and installation activities only. (Do not submit the Bidder's Safety Manual).

16.02 A Bid shall be submitted no later than the date and time prescribed and at the place indicated in the advertisement or Invitation To Bid and shall be enclosed in a plainly marked package with the Project title (and, if applicable, the designated portion of the Project for which the Bid is submitted), the name and address of Bidder, and shall be accompanied by the Bid security and other required documents. The Bidder's Georgia General Contractor's license number shall be clearly printed on the exterior of the envelope containing the sealed bid.

16.03 Bids may be mailed to the City of Forest Attention: A. Girard Greeter; 745 Forest Parkway, Forest Park GA, 30297**.**

16.04 The sealed envelope containing the Bid shall be enclosed in a separate package plainly marked on the outside with the notation "**BID ENCLOSED – FOREST PARK – STARR PARK – PHASE I";** The Bidder's Georgia General Contractor's license number shall be clearly printed on the exterior of the envelope containing the sealed bid.

16.05 Bid packages submitted shall include **one (1)** complete set of bid documents, as required by this section, with original signatures and seals as required and this document set shall be labeled "**Original**". Additionally, **two (2)** complete copy sets of the bid documents, as required by this section, labeled "**Copy**" shall be included in the bid package.

ARTICLE 17 – MODIFICATION AND WITHDRAWAL OF BID

17.01 A Bid may be modified or withdrawn by an appropriate document duly executed in the same manner that a Bid must be executed and delivered to the place where Bids are to be submitted prior to the date and time for the opening of Bids.

17.02 If within 24 hours after Bids are opened any Bidder files a duly signed written notice with Owner and promptly thereafter demonstrates to the reasonable satisfaction of Owner that there was a material and substantial mistake in the preparation of its Bid, that Bidder may withdraw its Bid, and the Bid security will be returned. Thereafter, if the Work is rebid, that Bidder will be disqualified from further bidding on the Work.

SECTION II

ARTICLE 18 – OPENING OF BIDS

18.01 Bids will be opened at the time and place indicated in the Advertisement or Invitation to Bid and, unless obviously non-responsive, read aloud publicly. A Bid Tabulation of the amounts of the Base Bids and major alternates, if any, will be made available to Bidders after the opening of Bids.

ARTICLE 19 – BIDS TO REMAIN SUBJECT TO ACCEPTANCE

19.01 All Bids will remain subject to acceptance for the period of time stated in the Bid Form, but Owner may, in its sole discretion, release any Bid and return the Bid security prior to the end of this period.

ARTICLE 20 – EVALUATION OF BIDS AND AWARD OF CONTRACT

20.01 Owner reserves the right to reject any or all Bids, including without limitation, nonconforming, nonresponsive, unbalanced, or conditional Bids. Owner further reserves the right to reject the Bid of any Bidder whom it finds, after reasonable inquiry and evaluation, to not be responsible.

20.02 More than one Bid for the same Work from an individual or entity under the same or different names will not be considered. Reasonable grounds for believing that any Bidder has an interest in more than one Bid for the Work may be cause for disqualification of that Bidder and the rejection of all Bids in which that Bidder has an interest.

20.03 In evaluating Bids, Owner will consider whether or not the Bids comply with the prescribed requirements, and such alternates, unit prices and other data, as may be requested in the Bid Form or prior to the Notice of Award.

20.04 In evaluating Bidders, Owner will consider the qualifications of Bidders and may consider the qualifications and experience of Subcontractors, Suppliers, and other individuals or entities proposed for those portions of the Work for which the identity of Subcontractors, Suppliers, and other individuals or entities must be submitted as provided in the Supplementary Conditions.

20.05 Owner may conduct such investigations as Owner deems necessary to establish the responsibility, qualifications, and financial ability of Bidders, proposed Subcontractors, Suppliers, individuals, or entities proposed for those portions of the Work in accordance with the Contract Documents.

20.06 If the Contract is to be awarded, Owner will award the Contract to the Bidder whose Bid is in the best interests of the Owner.

ARTICLE 21 – CONTRACT SECURITY AND INSURANCE

21.01 Article 5 of the General Conditions, as may be modified by the Supplementary Conditions, sets forth Owner's requirements as to performance and payment bonds and insurance.

When the Successful Bidder delivers the executed Agreement to Owner, it shall be accompanied by such bonds.

ARTICLE 22 – SIGNING OF AGREEMENT

22.01 When Owner issues a Notice of Award to the Successful Bidder, it shall be accompanied by the required number [SIX (6)] of unsigned counterparts of the Agreement along with the other Contract Documents which are identified in the Agreement as attached thereto. Within 15 calendar days thereafter, Successful Bidder shall sign and deliver the required number of counterparts of the Agreement and attached documents to Owner. Within ten calendar days thereafter, Owner shall deliver one fully signed counterpart to Successful Bidder with a complete set of the Drawings with appropriate identification.

SECTION II

SUBMITTAL CHECKLIST

This table is included for the Bidder's convenience and may be used to track the preparation and submittal of certain required information with its Bid.

Item #	Required Bid Submittal Check Sheet	Check (v)
Please combine the following required items in a section clearly labeled as Volume 1		
1	Required Bid Security	
2	Local, Small Business, Diversity Program Plan (LSBD Forms 1-4)	
3	List of 5 Project References (Form 5)	
4	State of Georgia Certificate of Existence	
5	Copy of Contractor's and/or Subcontractor's License	
6	Certificate of Insurance	
7	Contractor Affidavit and Agreement (Form 6a)	
8	Subcontractor Affidavit (Form 6b)	
9	Contractor's Statement of Legal Status and Financial Capability (Form 7)	
10	Certification Regarding Debarment, Suspension, and Other Matters (Form 8)	
11	Non-Collusion Affidavit (Form 9)	
12	Bidder's Contact Directory (Form 10)	
13	Acknowledgment of Addenda (Form 11)	
Please combine the following required items in a separate section labeled as Volume 2		
14	Organizational Structure/Key Personnel/Resumes	
9	Experience and Past Performance	
10	Management and Staffing Plan	
11	Quality Control Plan Approach	
12	Procurement Plan	
13	Safety Record and Experience	

SECTION II

FORM 7

Contractor's Statement of Legal Status and Financial Capability

For official and confidential use by the City of Forest Park, Georgia

Purpose/Instructions: The following information will be used by the City of ForestPark, Georgia in determining whether or not the identified **Contractor** has, in the opinion of the City of Forest Park, Georgia, the financial capability to successfully fulfill its obligations to the City.

If space on this form is inadequate for any requested information, please furnish on attached pages with a reference to the appropriate question number on this form.

A. Submission Information:

1. This Statement is being submitted as required by a FOREST PARK Solicitation:

   FOREST PARK Solicitation #:_____
   Project Name: _____

2. This information is current as of (date): _____

B. Contractor Information

1. Official Company/Entity Name:_____
   (hereinafter "Contractor")
2. Mailing Address:_____
   City/State/Zip: _____
3. If at this address less than 1 year, prior address:_____
   City/State/Zip:_____ _____
4. Primary contact regarding this information:_____
5. Telephone Number:_____
6. Email Address: _____

C. Development Entity. The Development entity named above is:

- □ A sole proprietorship ─ Soc. Sec. # _____
- □ A corporation ─ FID # _____
- □ A nonprofit or charitable institution or corporation ─ FID #_____
- □ A partnership_____ ─ FID # _____
- □ A business association or a joint venture ─ FID #_____
- □ A limited liability company ─ FID # _____
- □ A Federal, State, or local government or instrumentality thereof
- □ Other / explain: _____

SECTION II

D. Date and State of Organization. If the Contractor is not an individual or a government agency or instrumentality:

1. Date of organization: _____

2. State of organization: _____

E. Contractor Principals. Names of owners, officers, directors, trustees, and principal representatives of the development entity

Name, Title, Address, ZIPCode	Description of interest/relationship	% of Ownership Interest

F. Contractor Affiliations. Is the Contractor a subsidiary or parent of or affiliated with, any other corporation or corporations or any other firm or firms?

□ Yes □ No

If Yes, provide the following information:

Corporation/Firm	Relationship to Contractor	Common Officers/Directors/Owners/ Trustees/Representatives
Name Address		
Name Address		

If the Contractor is different than the parent corporation or firm, will the parent corporation or firm guarantee performance under this bid?

□ Yes □ No

SECTION II

G. Bankruptcy. Has the Contractor or the parent corporation (if any), or any subsidiary or affiliated corporation of the Contractor or said parent corporation, or any of the Contractor's officers or principal members, shareholders or investors filed for bankruptcy, either voluntary or involuntary, within the past 10 years?

□ Yes □ No

If Yes, provide the following information:

Name	Court	Date	Status

H. Loan Defaults. Has the Contractor or the parent corporation (if any), or any subsidiary or affiliated corporation of the Contractor or said parent corporation, or any of the Contractor's officers or principal members, shareholders or investors defaulted on a loan or other financial obligation? *(attach additional sheets if needed)*

□ Yes □ No

If Yes, explain: _____

I. Criminal Litigation. Is the Contractor or the parent corporation (if any), or any subsidiary or affiliated corporation of the Contractor or said parent corporation, or any of the Contractor's officers or principal members, shareholders or investors party to any past or pending criminal litigation?

□ Yes □ No

If Yes, provide the following information, and attach any additional information or explanation deemed necessary:

Date Filed	Court	Charge/Current Status

J. Civil Litigation. Is the Contractor or the parent corporation (if any), or any subsidiary or affiliated corporation of the Contractor or said parent corporation, or any of the Contractor's officers or principal members, shareholders or investors party to any pending civil litigation that could potentially impact the financial capability of the Contractor to complete the proposed development?

□ Yes □ No

If Yes, provide the following information, and attach any additional information or explanation deemed necessary:

SECTION II

Date Filed	Court	Current Status

K. Conflict of Interest. Does any member or employee of the City of Forest Park, Georgia have any direct or indirect personal interest in the Contractor or in the redevelopment or rehabilitation of the property being proposed by the Contractor?

□ Yes □ No

If Yes, explain:

L. Previous Forest Park Projects. Has the Contractor or its parent entity (if any),or any subsidiary or affiliated entity of the Contractor or said parent corporation, or any of the Contractor's officers or principal members, shareholders or investors had any previous contractual relationship with the City of Forest Park?

□ Yes □ No

Project Name	Description	Date

SECTION II

FORM 8

CERTIFICATION REGARDING DEBARMENT, SUSPENSION, AND OTHER MATTERS

The Bidder,_____, certifies to the best of its knowledge and belief, that it and its principals:

1. Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any Federal, State, or local department or agency;

2. Have not within a three-year period preceding this Bid been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State or local) transaction or Contract under a public transaction; violation of Federal or State antitrust statues or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;

3. Are not presently indicted for or otherwise criminally or civilly charged by a governmental entity (Federal, State, or local) with the commission of any of the offenses enumerated in paragraph (2) of this certification; and

4. Have not within a three-year period preceding this application/Bid had one or more public transactions (Federal, State, or local) terminated for cause or default.

Where the bidder is unable to certify to any of the statements in this certification, such bidder shall attach an explanation to this Bid.

The bidder certifies or affirms the truthfulness and accuracy of the contents of the statements submitted on or with this certification.

_____
Signature of Authorized Agent

_____
Name/Title of Authorized Agent

Before me, a Notary Public, personally appeared the above named and swore that the statements contained in the foregoing document are true and correct.

Subscribed and sworn to me this_____day of_____,_____.

_____
Notary Public Signature

My Commission Expires:_____[SEAL]

SECTION III

BID FORM

FOREST PARK
STARR PARK
PHASE - I

PROJECT NO.: 02072023

BID DATE: MARCH 21ST, 2023

BID TIME: 2:00 PM (EST)

SECTION III

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SECTION III

ARTICLE 1 – BID RECIPIENT

1.01 This Bid is submitted to:

City of Forest Park, Georgia

1.02 The undersigned Bidder proposes and agrees, if this Bid is accepted, to enter into an Agreement with the Owner in the form included in the Bidding Documents and to perform all Work as specified or indicated in the Bidding Documents for the prices and within the times indicated in this Bid and in accordance with the other terms and conditions of the Bidding Documents.

ARTICLE 2 – BIDDER'S ACKNOWLEDGEMENTS

2.01 Bidder accepts all of the terms and conditions of the Instructions to Bidders, including without limitation those dealing with the disposition of Bid security. This Bid will remain subject to acceptance for 60 days after the Bid opening, or for such longer period of time that Bidder may agree to in writing upon request of Owner.

ARTICLE 3 – BIDDER'S REPRESENTATIONS

3.01 In submitting this Bid, Bidder represents that:

A. Bidder has examined and carefully studied the Bidding Documents, other related data identified in the Bidding Documents, and the following Addenda, receipt of which is hereby acknowledged:

Addendum No.	Addendum Date
_____	_____
_____	_____
_____	_____

B. Bidder has visited the Site and become familiar with and is satisfied as to the general, local, and Site conditions that may affect cost, progress, and performance of the Work.

C. Bidder is familiar with and is satisfied as to all Laws and Regulations that may affect cost, progress, and performance of the Work.

D. Bidder has considered the information known to Bidder; information commonly known to contractors doing business in the locality of the Site; information and observations obtained from visits to the Site; the Bidding Documents; and the Site-related reports and drawings identified in the Bidding Documents, with respect to the effect of such information, observations, and documents on (1) the cost, progress, and performance of the Work; (2) the means, methods, techniques, sequences, and procedures of construction to be employed by Bidder, including applying the specific means, methods, techniques, sequences, and procedures of construction expressly required by the Bidding Documents; and (3) Bidder's safety precautions and programs.

E. Based on the information and observations referred to in Paragraph 3.01.D above, Bidder does not consider that further examinations, investigations, explorations, tests, studies, or data are necessary for the determination of this Bid for performance of the Work at the price(s) bid and

within the times required, and in accordance with the other terms and conditions of the Bidding Documents.

F. Bidder is aware of the general nature of work to be performed by Owner and others at the Site that relates to the Work as indicated in the Bidding Documents.

G. Bidder has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder has discovered in the Bidding Documents, and the written resolution thereof by Engineer is acceptable to Bidder.

H. The Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for the performance of the Work for which this Bid is submitted.

ARTICLE 4 – BIDDER'S CERTIFICATION

4.01 Bidder certifies that:

A. This Bid is genuine and not made in the interest of or on behalf of any undisclosed individual or entity and is not submitted in conformity with any collusive agreement or rules of any group, association, organization, or corporation;

B. Bidder has not directly or indirectly induced or solicited any other Bidder to submit a false or sham Bid;

C. Bidder has not solicited or induced any individual or entity to refrain from bidding; and

D. Bidder has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for the Contract. For the purposes of this Paragraph 4.01.D:

1. "Corrupt practice" means the offering, giving, receiving, or soliciting of anything of value likely to influence the action of a public official in the bidding process;

2. "fraudulent practice" means an intentional misrepresentation of facts made (a) to influence the bidding process to the detriment of Owner, (b) to establish bid prices at artificial non-competitive levels, or (c) to deprive Owner of the benefits of free and open competition;

3. "collusive practice" means a scheme or arrangement between two or more Bidders, with or without the knowledge of Owner, a purpose of which is to establish bid prices at artificial, non-competitive levels; and

4. "coercive practice" means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the bidding process or affect the execution of the Contract.

ARTICLE 5 – BASIS OF BID

5.01 Bidder will complete the Work in accordance with the Contract Documents for the following price(s). Any incomplete or illegible bid prices will make this bid subject to rejection by the Owner:

SECTION III

ITEM NO.	DESCRIPTION	UNITS	ESTIMATED QUANTITY	UNIT PRICE	TOTAL PRICE
1	BONDS, INSURANCE, MOBILIZATION	LS	1	$_____	$_____
2	TRAFFIC CONTROL (COMPLETE PER GDOT/MUTCD FOR PROJECT DURATION)	LS	1	$_____	$_____
3	DEMOLITION REMOVAL, DISPOSAL AND STORAGE (COMPLETE BUT NOT LIMITED TO VEGETTION, TREES, SAW CUTTING, PAVEMENTS, CONCRETE, STRUCTURES, SIGNAGE, TRAFFIC SIGNALS AND ALL RELATED APPURTENANCES)	LS	1	$_____	$_____
4	GIS “AS-BUILT” SURVEY OF COMPLETE PROJECT ON “GEORGIA STATE PLANE COORDINATES” FOR ALL WORK PERFORMED	LS	1	$_____	$_____
5	4” THICK 6’ WIDE CONCRETE SIDEWALK COMPLETE; CLASS “A” 3000 PSI AND ALL REQUIRED APPURTENANCES	SF	48,000	$_____	$_____
6	6” THICK CONCRETE PAVING COMPLETE; CLASS “A” 4000 PSI; INCLUDING 6” GAB COMPACTED BASE AND ALL REQUIRED APPURTENANCES	SF	10,500	$_____	$_____
7	ASPHALT PAVING; “HEAVY DUTY”; **COMPLETE FROM SUBGRADE TO SURFACE COURSE INCLUDING BUT NOT LIMITED TO** RECYCLED APHALTIC CONCRETE 12.5 MM SUPERPAVE, TYPE 1, GP 1 OR 2, INCLUDING BITUMINOUS MATERIL & “H” LIME 2” MIN. THICKNESS; TACK COAT; 2” RECYCLED APHALTIC	SY	500	$_____	$_____

	CONCRETE 19 MM SUPERPAVE PRIME COAT 2" MIN. THICKNESS, TYPE 1, GP 1 OR 2, INCLUDING BITUMINOUS MATERIAL & "H" LIME; 8" GAB, STANDARD PROCTOR COMPACTED SUBGRADE;				
8	ASPHALT PAVING; "LIGHT DUTY"; **COMPLETE FROM SUBGRADE TO SURFACE COURSE INCLUDING BUT NOT LIMITED TO** RECYCLED APHALTIC CONCRETE 9.5 MM SUPERPAVE, TYPE II INCLUDING BITUMINOUS MATERIL & "H" LIME, 1 ¼" MIN. THICKNESS; TACK COAT; 1 ¾" RECYCLED APHALTIC CONCRETE 19 MM SUPERPAVE PRIME COAT 2" MIN. THICKNESS, TYPE 1, GP 1 OR 2, INCLUDING BITUMINOUS MATERIAL & "H" LIME; PRIME COAT, 6" GAB, STANDARD PROCTOR COMPACTED SUBGRADE;	SY	400	$_____	$_____
9	RUBBERIZED TRACK SURFACE; COMPLETE INCLUDING BUT NOT LIMITED TO POURED IN PLACE RUBBERIZED TRAIL SURFACE, STANDARD PROCTOR GAB & STANDARD PROCTOR COMPACTED SUBGRADE AND ALL REQUIRED APPURTENANCES	SF	13,500	$_____	$_____
10	RUBBERIZED PLAYGROUND SURFACE SYSTEM; COMPLETE INCLUDING POURED IN PLACE RUBBERIZED SURFACE, FALL-SAFE PADDING, CONCRETE SLAB PER MANUFACTURER SPECS., DRAINAGE & STANDARD PROCTOR COMPACTED SUBGRADE AND ALL	SF	21,000	$_____	$_____

	REQUIRED APPURTENANCES				
11	PERMEABLE PAVER SYSTEM; COMPLETE INCLUDING PERMEABLE PAVERS, BEDDING AND DRAINAGE; AND ALL REQUIRED APPURTENANCES	SF	9,000	$_____	$_____
12	DOG PARK SURFACE SYSTEM; COMPLETE INCLUDING CLEAN SHREDDED HARDWOOD MULCH DYED BROWN, BEDDING AND DRAINAGE; AND ALL REQUIRED APPURTENANCES	SF	7,000	$_____	$_____
13	ATHLETIC COURT SURFACE SYSTEM; COMPLETE INCLUDING SPECIFIED SURFACES, EDGE RESTRAINT, CONCRETE PAVING AND STANDARD PROCTOR COMPACTION; AND ALL REQUIRED APPURTENANCES	SF	11,500	$_____	$_____
14	SAND VOLLEYBALL COURT SYSTEM; COMPLETE INCLUDING CLEAN BEACH SAND, ANCHORED RUBBER CURB, NON-WOVEN FILTER FABRIC, DRAINAGE AND COMPACTED SUBGRADE; AND ALL REQUIRED APPURTENANCES	SF	3,500	$_____	$_____
15	RIVERROCK SWALE; COMPLETE INCLUDING SUBGRADE PREP, WRAPPED 57 STONE AND 8” MIN – 16” MAX BROWN RIVER ROCK	SF	700	$_____	$_____
16	SYNTHETIC TURF SYSTEM; COMPLETE INCLUDING STANDARD PROCTOR COMPACTED SUBGRADE, DRAINAGE, STONE BASE, TOPPING STONE AND SYNTHETIC TURF SYSTEM;	SF	46,000	$_____	$_____

	AND ALL REQUIRED APPURTENANCES				
17	3000 PSI CONCRETE CURB AND GUTTER; COMPLETE INCLUDING ROLLBACK CURB, GDOT GAB ROAD BASE; MIN. 8" THICK x 30" WIDE UNDER CURB INCLUDING STANDARD PROVTOR COMPACTION AND GRADING AND ALL REQUIRED APPURTENANCES	LF	2,800	$_____	$_____
18	3000 PSI CONCRETE HEADER CURB (WITHOUT FENCING); COMPLETE INCLUDING EXPANSION MATERIAL WHERE REQUIRED, REBAR REINFORCEMENT AND STANDARD PROCTOR COMPACTION AND ALL REQUIRED APPURTENANCES	LF	4,300	$_____	$_____
19	3000 PSI CONCRETE HEADER CURB (WITH FENCING); COMPLETE INCLUDING EXPANSION MATERIAL WHERE REQUIRED, REBAR REINFORCEMENT, FENCING, AND STANDARD PROCTOR COMPACTION AND ALL REQUIRED APPURTENANCES	LF	1,300	$_____	$_____
20	CURB RAMP; GDOT ADA RAMP “TYPE A” COMPLETE INCLUDING ALL REQUIRED APPURTENANCES	EA	3	$_____	$_____
21	CURB RAMP; GDOT ADA RAMP “TYPE B” COMPLETE INCLUDING ALL REQUIRED APPURTENANCES	EA	6	$_____	$_____
22	CURB RAMP; GDOT ADA RAMP “TYPE D” COMPLETE INCLUDING ALL REQUIRED APPURTENANCES	EA	2	$_____	$_____
23	4’ TALL ORNAMENTAL METAL FENCING;	LF	1,200	$_____	$_____

	COMPLETE INCLUDING 3000 PSI CONCRETE FOOTINGS AND ALL MANUFACTURER REQUIRED APPURTENANCES				
24	8’ TALL ORNAMENTAL METAL FENCING; COMPLETE INCLUDING 3000 PSI CONCRETE FOOTINGS AND ALL MANUFACTURER REQUIRED APPURTENANCES	LF	500	$_____	$_____
25	4’ TALL CHAIN LINK FENCING; COMPLETE INCLUDING 3000 PSI CONCRETE FOOTINGS AND ALL MANUFACTURER REQUIRED APPURTENANCES	LF	800	$_____	$_____
26	10’ TALL CHAIN LINK FENCING; COMPLETE INCLUDING 3000 PSI CONCRETE FOOTINGS AND ALL MANUFACTURER REQUIRED APPURTENANCES	LF	600	$_____	$_____
27	CMU SEAT WALL; COMPLETE INCLUDING CAST STONE, DRIP EDGE, 2000 PSI GROUT, REBAR REINFORCEMENT, COLOR MATCH MORTAR, 3000 PSI CONCRETE FOOTING AND STANDARD PROCTOR SUBGRADE COMPACTION AND ALL REQUIRED APPURTENANCES	LF	140	$_____	$_____
28	CONCRETE RETAINING WALL; COMPLETE INCLUDING ALL REQUIRED APPURTENANCES	FF	4,900	$_____	$_____
29	ADA RAMP; CONCRETE RAMP WITH EDGE PROTECTION INCLUDING ALL REQUIRED APPURTENANCES	LF	40	$_____	$_____

30	PEDESTRIAN WATER FOUNTAIN; COMPLETE IN ACCORDANCE WITH MANUFACTURER SPECS INLCUDING ALL REQUIRED APPURTENANCES	EA	2	$_____	$_____
31	DOG WATER FOUNTAIN; COMPLETE IN ACCORDANCE WITH MANUFACTURER SPECS INCLUDING ALL REQUIRED APPURTENANCES	EA	1	$_____	$_____
32	PET WASTE STATION; COMPLETE IN ACCORDANCE WITH MANUFACTURER SPECS INCLUDING ALL REQUIRED APPURTENANCES	EA	2	$_____	$_____
33	LITTER RECEPTACLE; COMPLETE IN ACCORDANCE WITH MANUFACTURER SPECS INCLUDING ALL REQUIRED APPURTENANCES	EA	17	$_____	$_____
34	VOLLEYBALL COURT; COMPLETE INCLUDING NET SYSTEM, RUBBER CURB, FULL DEPTH FABRIC WRAP, CLEAN BEACH SAND, ANCHORING, GAB LEVELING, DRAINAGE AND STANDARD PROCTOR COMPACTION AND ALL REQUIRED APPURTENANCES	EA	1	$_____	$_____
35	BASKETBALL COURT; COMPLETE INSTALLED PER MANUFACTURER SPECS INCLUDING GOAL(S), SURFACING, STRIPING, EDGE RESTRAINT AND CONCRETE PAVING AND ALL REQUIRED APPURTENANCES	EA	1	$_____	$_____
36	TENNIS COURT; COMPLETE INSTALLED	EA	1	$_____	$_____

	PER MANUFACTURER SPECS INCLUDING NET SYSTEM, SURFACING, STRIPING, EDGE RESTRAINT AND CONCRETE PAVING AND ALL REQUIRED APPURTENANCES				
37	SHADE SAIL; INSTALLED COMPLETE IN ACCORDANCE WITH MAUFACTURER SPECS INCLUDING ALL REQUIRED APPURTENANCES	EA	1	$_____	$_____
38	BENCH; INSALLED COMPLETE IN ACCORDANCE WITH MANUFACTURER SPECS INCLUDING ALL REQUIRED APPURTENANCES	EA	24	$_____	$_____
39	RELOCATION OF FITNESS EQUIPMENT	EA	10	$_____	$_____
40	SPLASH PAD SYSTEM; COMPLETE INCLUDING BUT NOT LIMITED TO FEATURES, PLUMBING, MECHANICAL, GRADING, 6” THICK 3500 PSI CONCREST SLAB, REBAR REINFORCEMENT AND 3” GRAVEL BASE AND ALL REQUIRED APPURTENANCES	EA	1	$_____	$_____
41	48" DIAMETER HDPE STORM DRAIN; WATER TIGHT JOINT; COMPLETE INCLUDING BUT NOT LIMITED TO BEDDING, HAUNCHING, BACKFILL AND COMPACTION AND ALL REQUIRED APPURTENANCES	LF	1,110	$_____	$_____
42	48" DIAMETER RCP STORM DRAIN; CLASS "V"; RUBBER GASKET BELL & SPIGOT; COMPLETE INCLUDING BUT NOT LIMITED TO BEDDING, HAUNCHING, BACKFILL AND COMPACTION AND ALL	LF	40	$_____	$_____

	REQUIRED APPURTENANCES				
43	36" DIAMETER HDPE STORM DRAIN; WATER TIGHT JOINT; COMPLETE INCLUDING BUT NOT LIMITED TO BEDDING, HAUNCHING, BACKFILL AND COMPACTION AND ALL REQUIRED APPURTENANCES	LF	40	$_____	$_____
44	36" DIAMETER RCP STORM DRAIN; CLASS "V"; RUBBER GASKET BELL & SPIGOT; COMPLETE INCLUDING BUT NOT LIMITED TO BEDDING, HAUNCHING, BACKFILL AND COMPACTION AND ALL REQUIRED APPURTENANCES	LF	90	$_____	$_____
45	30" DIAMETER HDPE STORM DRAIN; WATER TIGHT JOINT; COMPLETE INCLUDING BUT NOT LIMITED TO BEDDING, HAUNCHING, BACKFILL AND COMPACTION AND ALL REQUIRED APPURTENANCES	LF	480	$_____	$_____
46	24" DIAMETER HDPE STORM DRAIN; WATER TIGHT JOINT; COMPLETE INCLUDING BUT NOT LIMITED TO BEDDING, HAUNCHING, BACKFILL AND COMPACTION AND ALL REQUIRED APPURTENANCES	LF	1,500	$_____	$_____
47	18" DIAMETER HDPE STORM DRAIN; WATER TIGHT JOINT; COMPLETE INCLUDING BUT NOT LIMITED TO BEDDING, HAUNCHING, BACKFILL AND COMPACTION AND ALL REQUIRED APPURTENANCES	LF	1,370	$_____	$_____
48	18" DIAMETER RCP STORM DRAIN; CLASS "V"; RUBBER GASKET BELL & SPIGOT; COMPLETE INCLUDING	LF	120	$_____	$_____

	BUT NOT LIMITED TO BEDDING, HAUNCHING, BACKFILL AND COMPACTION AND ALL REQUIRED APPURTENANCES				
49	12” ROOF DRAIN PIPING INCLUDING ALL REQUIRED APPURTENANCES	LF	40	$_____	$_____
50	10” ROOF DRAIN PIPING INCLUDING ALL REQUIRED APPURTENANCES	LF	560	$_____	$_____
51	8” ROOF DRAIN PIPING INCLUDING ALL REQUIRED APPURTENANCES	LF	970	$_____	$_____
52	6” ROOF DRAIN PIPING INCLUDING ALL REQUIRED APPURTENANCES	LF	490	$_____	$_____
53	4” ROOF DRAIN PIPING INCLUDING ALL REQUIRED APPURTENANCES	LF	230	$_____	$_____
54	UNDERGROUND STORMWATER DETENTION SYSTEM “A”; COMPLETE INCLUDING BUT NOT LIMITED TO SUITABLE FOUNDATION, BEDDING, HAUNCHING, PIPING, BACKFILL AND GRADING AND ALL REQUIRED APPURTENANCES	EA	1	$_____	$_____
55	UNDERGROUND STORMWATER DETENTION SYSTEM “B”; COMPLETE BUT NOT LIMITED TO SUITABLE FOUNDATION, BEDDING, HAUNCHING, PIPING, BACKFILL AND GRADING AND ALL REQUIRED APPURTENANCES	EA	1	$_____	$_____
56	SUBMERGED GRAVEL WETLAND SYSTEM; COMPLETE INCLUDING ALL REQUIRED APPURTENANCES	EA	1	$_____	$_____

57	BIO RETENTION AREA "#1"; COMPLETE	EA	1	$_____	$_____
58	TRENCH DRAIN; COMPLETE INCLUDING GRATE & COVER, 4000 PSI CONCRETE SLAB & BASE AND ALL REQUIRED APPURTENANCES	LF	370	$_____	$_____
59	GDOT 1019 PRECAST CONCRETE CURB INLET CATCH BASIN W/ CAST IRON HOOD AND GRATE; COMPLETE IN ACCORDANCE WITH GDOT DETAIL 1019B INCLUDING BUT NOT LIMITED TO TRAFFIC RATED FRAME AND GRATE, BEDDING, SEALING PIPE PENETRATION, AND BACKFILL AND ALL REQUIRED APPURTENANCES	EA	8	$_____	$_____
60	GDOT 1019 PRECAST CONCRETE DROP INLET CATCH BASIN W/ CAST IRON HOOD AND GRATE; COMPLETE IN ACCORDANCE WITH GDOT DETAIL 1019B INCLUDING BUT NOT LIMITED TO TRAFFIC RATED FRAME AND GRATE, BEDDING, SEALING PIPE PENETRATION, AND BACKFILL AND ALL REQUIRED APPURTENANCES	EA	15	$_____	$_____
61	GDOT 1034 PRECAST DOUBLE WING CATCH BASIN; COMPLETE IN ACCORDANCE WITH GDOT DETAIL 1034D INCLUDING BUT NOT LIMITED TO TRAFFIC RATED FRAME AND COVER, BEDDING, SEALING PIPE AND ALL REQUIRED APPURTENANCES	EA	1	$_____	$_____
62	GDOT 1019 PRECAST CONCRETE WIER INLET CATCH BASIN W/ CAST	EA	4	$_____	$_____

	IRON HOOD AND GRATE; COMPLETE IN ACCORDANCE WITH GDOT DETAIL 1019A INCLUDING BUT NOT LIMITED TO BEDDING, SEALING PIPE PENETRATION, AND BACKFILL AND ALL REQUIRED APPURTENANCES				
63	CONCRETE JUNCTION BOX W/ CAST IRON TRAFFIC RATED FRAME AND COVER; COMPLETE IN ACCORDANCE WITH GDOT DETAIL 9031U INCLUDING BUT NOT LIMITED TO TRAFFIC RATED FRAME AND COVER, BEDDING, SEALING PIPE PENETRATION, AND BACKFILL AND ALL REQUIRED APPURTENANCES	EA	15	$_____	$_____
64	AREA DRAIN PEDISTAL INLET COMPLETE INCLUDING ALL REQUIRED APPURTENANCES	EA	32	$_____	$_____
65	ROOF DRAIN CO	EA	30	$_____	$_____
66	6" DIAMETER DUCTILE IRON PIPE FOR SANITARY SEWER; COMPLETE INCLUDING BUT NOT LIMITED TO BEDDING, COMPACTION AND TESTING AND ALL REQUIRED APPURTENANCES	LF	230	$_____	$_____
67	8" DIAMETER DUCTILE IRON PIPE FOR SANIARY SEWER; COMPLETE INCLUDING BUT NOT LIMITED TO BEDDING, COMPACTION, TESTING AND ALL REQUIRED APPURTENANCES	LF	150	$_____	$_____
68	8” PVC DRAINAGE LINES; COMPLETE INCLUDING BEDDING AND BACKFILL	LF	90	$_____	$_____

	AND ALL REQUIRED APPURTENANCES				
69	SANITARY SEWER MANHOLE	EA	3	$_____	$_____
70	SANITARY SEWER CLEANOUT	EA	4	$_____	$_____
71	2.5" COPPER PIPE; COMPLETE INCLUDING ALL REQUIRED FITTINGS, BENDS AND BLOCKING AND ALL REQUIRED APPURTENANCES	LF	20	$_____	$_____
72	2" COPPER PIPE; COMPLETE INCLUDING ALL REQUIRED FITTINGS, BENDS AND BLOCKING AND ALL REQUIRED APPURTENANCES	LF	440	$_____	$_____
73	1.5" COPPER PIPE; COMPLETE INCLUDING ALL REQUIRED FITTINGS, BENDS AND BLOCKING AND ALL REQUIRED APPURTENANCES	LF	20	$_____	$_____
74	1" COPPER PIPE; COMPLETE INCLUDING ALL REQUIRED FITTINGS, BENDS AND BLOCKING AND ALL REQUIRED APPURTENANCES	LF	100	$_____	$_____
75	0.75" COPPER PIPE; COMPLETE INCLUDING ALL REQUIRED FITTINGS, BENDS AND BLOCKING AND ALL REQUIRED APPURTENANCES	LF	100	$_____	$_____
76	NEW 2" WATER SERVICE METER; COMPLETE INCLUDING CONNECTION TO EXISTING WATER MAIN	EA	1	$_____	$_____
77	UPSIZE EXISTING 1.5" WATER SERVICE METER	EA	1	$_____	$_____
78	REUSE EXISTING 5/8" WATER SERVICE METER	EA	1	$_____	$_____
79	REUSE EXISTING 1" WATER SERVICE METER	EA	1	$_____	$_____
80	EARTHWORK; COMPLETE	CY	16,500	$_____	$_____

SECTION III

81	4" CALIPER TREE (SPECIFIED SPECIES VARY, SEE SCHEDULE ON TP3.0)	EA	44	$_____	$_____
82	3" CALIPER TREE (SPECIFIED SPECIES VARY, SEE SCHEDULE ON TP3.0)	EA	74	$_____	$_____
83	4" POT GROUNDCOVER (SPECIFIED SPECIES VARY, SEE SCHEDULE ON L2.0)	EA	2,419	$_____	$_____
84	1 GALLON SHRUB/GOURNDCOVER (SPECIFIED SPECIES VARY, SEE SCHEDULE ON L2.0)	EA	706	$_____	$_____
85	2 GALLON SHRUB/GROUNDCOVER (SPECIFIED SPECIES VARY, SEE SCHEDULE ON L2.0)	EA	285	$_____	$_____
86	3 GALLON SHRUB/GROUNDCOVER (SPECIFIED SPECIES VARY, SEE SCHEDULE ON L2.0)	EA	3,134	$_____	$_____
87	PERMANENT GRASSING; SOD; COMPLETE	SF	236,000	$_____	$_____
88	MULCHING	SF	61,000	$_____	$_____
89	BUILDING "A"; COMPLETE INCLUDING ALL REQUIRED APPURTENANCES	EA	1	$_____	$_____
90	BUILDING "B"; COMPLETE INCLUDING ALL REQUIRED APPURTENANCES	EA	1	$_____	$_____
91	BUILDING "C"; COMPLETE INCLUDING ALL REQUIRED APPURTENANCES	EA	1	$_____	$_____
92	BUILDING "D"; COMPLETE INCLUDING ALL REQUIRED APPURTENANCES	EA	1	$_____	$_____
93	BUILDING "E"; COMPLETE INCLUDING ALL REQUIRED APPURTENANCES	EA	1	$_____	$_____
94	BUILDING "F"; COMPLETE INCLUDING ALL REQUIRED APPURTENANCES	EA	1	$_____	$_____
95	PLAYGROUND EQUIPMENT ALLOWANCE	LS	1	$_____	$_____

96	SKATE PARK ALLOWANCE	LS	1	$_____	$_____

Total Base Bid in Words:

_____

_____Dollars

In Numbers: $_____

Unit Prices have been computed in accordance with Paragraph 11.03.B of the General Conditions.

Bidder acknowledges that estimated quantities are not guaranteed, and are solely for the purpose of comparison of Bids, and final payment for all unit price Bid items will be based on actual quantities, determined as provided in the Contract Documents.

Bidder acknowledges that total base bid includes a contingency allowance equal to **10%** of the total sum of all line items within the above "**Article 5: Basis of Bid**" as provided in the Contract Documents.

ARTICLE 6 – TIME OF COMPLETION

6.01 Bidder agrees that the Work will be substantially complete within **335** calendar days after the date when the Contract Times commence to run as provided in Paragraph 2.03 of the General Conditions, and will be completed and ready for final payment in accordance with Paragraph 14.07 of the General Conditions within **365** calendar days after the date when the Contract Times commence to run.

6.02 Bidder accepts the provisions of the Agreement as to liquidated damages.

ARTICLE 7 – ATTACHMENTS TO THIS BID

7.01 The following documents are submitted with and made a condition of this Bid:

A. Required Bid Security (5%);

B. LSBD Forms 1-4 ;

C. List of 5 Project References (Section XVII – Reference and Release Form);

D. Evidence of authority to do business in the state of the Project; or a written covenant to obtain such license within the time for acceptance of Bids;

E. Copy of Contractor's License [or] Evidence of Bidder's ability to obtain a State Contractor's License and a covenant by Bidder to obtain the following said license within the time for acceptance of Bids.

1. Georgia DOT Prequalification Certification

F. Certificate of Insurance (City of Forest Park as the Certificate Holder);

G. Contractor Affidavit and Agreement (Form 6a);

H. Subcontractor Affidavit (if available) (Form 6b);

I. Contractor's Statement of Legal Status and Financial Capability (Form7);

J. Certification Regarding Debarment, Suspension, and Other Matters (Form 8);

K. Non-Collusion Affidavit (Form 9);

L. Bidder's Contact Directory (Form 10);

M. Acknowledgment of Addenda (Form 11);

N. Required Bidder Qualification Statement with Supporting Data for the following:

1. Organizational Structure/Key Personnel and Resumes:

2. Overall Project Experience, Qualifications, and Performance on Previous Similar Projects

3. Management and Staffing Plan

4. Quality Control Plan Approach

5. Procurement Plan

6. Safety Record and Experience

7.02 The following documents are to be submitted post-award:

A. LSBD Participation Report – Contract Goal: Report detailing percentage of LSBD participation (work performed) and payments to VOB/MBE/WBE/DBE subcontractors on a monthly basis.

ARTICLE 8 – DEFINED TERMS

8.01 The terms used in this Bid with initial capital letters have the meanings stated in the Instructions to Bidders, the General Conditions, and the Supplementary Conditions.

ARTICLE 9 – BID SUBMITTAL

9.01 This Bid is submitted by:

If Bidder is:

An Individual

Name (typed or printed): _____

SECTION III

By: _____
(Individual's signature)

Doing business as: _____

A Partnership

Partnership Name: _____

By: _____
(Signature of general partner -- attach evidence of authority to sign)

Name (typed or printed): _____

A Corporation

Corporation Name: _____ (SEAL)

State of Incorporation: _____
Type (General Business, Professional, Service, Limited Liability): _____

By: _____
(Signature -- attach evidence of authority to sign)

Name (typed or printed): _____

Title: _____
(CORPORATE SEAL)

Attest _____

Date of Qualification to do business in _____ is ____/____/____.

A Joint Venture

Name of Joint Venture: _____

First Joint Venturer Name: _____ (SEAL)

By: _____
(Signature of first joint venture partner -- attach evidence of authority to sign)

Name (typed or printed): _____

Title: _____

SECTION III

Second Joint Venturer Name: _____(SEAL)

By: _____
(Signature of second joint venture partner -- attach evidence of authority to sign)

Name (typed or printed): _____

Title: _____

(Each joint venturer must sign. The manner of signing for each individual, partnership, and corporation that is a party to the joint venture should be in the manner indicated above.)

Bidder's Business Address _____

_____

Phone No. _____ Fax No. _____

E-mail _____ _____

SUBMITTED on _____, 20____.

Georgia Contractor License No.: _____.

SECTION IV

BID BOND

Any singular reference to Bidder, Surety, Owner or other party shall be considered plural where applicable.

BIDDER *(Name and Address)*:

SURETY *(Name and Address of Principal Place of Business)*:

OWNER *(Name and Address)*:

BID

Bid Due Date:
Description *(Project Name and Include Location)*:
FOREST PARK – STARR PARK – PHASE I

BOND

Bond Number:
Date *(Not earlier than Bid due date)*:
Penal sum _____ $ _____
(Words) (Figures)

Surety and Bidder, intending to be legally bound hereby, subject to the terms set forth below, do each cause this Bid Bond to be duly executed by an authorized officer, agent, or representative.

BIDDER	**SURETY**
_____ (Seal)	_____ (Seal)
Bidder's Name and Corporate Seal	Surety's Name and Corporate Seal
By: _____	By: _____
Signature	Signature (Attach Power of Attorney)
_____	_____
Print Name	Print Name
_____	_____
Title	Title
Attest: _____	Attest: _____
Signature	Signature
_____	_____
Title	Title

SECTION IV

1. Bidder and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to pay Owner upon default of Bidder the penal sum set forth on the face of this Bond. Payment of the penal sum is the extent of Bidder's and Surety's liability. Recovery of such penal sum under the terms of this Bond shall be Owner's sole and exclusive remedy upon default of Bidder.

2. Default of Bidder shall occur upon the failure of Bidder to deliver within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents.

3. This obligation shall be null and void if:

3.1 Owner accepts Bidder's Bid and Bidder delivers within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents, or

3.2 All Bids are rejected by Owner, or

3.3 Owner fails to issue a Notice of Award to Bidder within the time specified in the Bidding Documents (or any extension thereof agreed to in writing by Bidder and, if applicable, consented to by Surety when required by Paragraph 5 hereof).

4. Payment under this Bond will be due and payable upon default of Bidder and within 30 calendar days after receipt by Bidder and Surety of written notice of default from Owner, which notice will be given with reasonable promptness, identifying this Bond and the Project and including a statement of the amount due.

5. Surety waives notice of any and all defenses based on or arising out of any time extension to issue Notice of Award agreed to in writing by Owner and Bidder, provided that the total time for issuing Notice of Award including extensions shall not in the aggregate exceed 120 days from Bid due date without Surety's written consent.

6. No suit or action shall be commenced under this Bond prior to 30 calendar days after the notice of default required in Paragraph 4 above is received by Bidder and Surety and in no case later than one year after Bid due date.

7. Any suit or action under this Bond shall be commenced only in a court of competent jurisdiction located in the state in which the Project is located.

8. Notices required hereunder shall be in writing and sent to Bidder and Surety at their respective addresses shown on the face of this Bond. Such notices may be sent by personal delivery, commercial courier, or by United States Registered or Certified Mail, return receipt requested, postage pre-paid, and shall be deemed to be effective upon receipt by the party concerned.

9. Surety shall cause to be attached to this Bond a current and effective Power of Attorney evidencing the authority of the officer, agent, or representative who executed this Bond on behalf of Surety to execute, seal, and deliver such Bond and bind the Surety thereby.

10. This Bond is intended to conform to all applicable statutory requirements. Any applicable requirement of any applicable statute that has been omitted from this Bond shall be deemed to be included herein as if set forth at length. If any provision of this Bond conflicts with any applicable statute, then the provision of said statute shall govern and the remainder of this Bond that is not in conflict therewith shall continue in full force and effect.

11. The term "Bid" as used herein includes a Bid, offer, or proposal as applicable.

SECTION V

CONTRACTOR FURNISHED DOCUMENTS

RETURN THIS FORM WITH BID DOCUMENTS

SECTION VI

FORM 6a

CONTRACTOR AFFIDAVIT AND AGREEMENT

By executing this affidavit, the undersigned subcontractor verifies its compliance with O.C.G.A § 13-10-91 related to any contract to which Contractor is a party that is subject to O.C.G.A. § 13-10-91 and hereby verifies its compliance with O.C.G.A. § 13-10-91, attesting as follows: **(a)** the Contractor has registered with, is authorized to use and uses the federal work authorization program commonly known as E-Verify, or any subsequent replacement program; **(b)** the Contractor will continue to use the federal work authorization program throughout the contract period, including any renewal or extension thereof; **(c)** the Contractor will notify the public employer in the event the Contractor ceases to utilize the federal work authorization program during the contract period, including renewals or extensions thereof; **(d)** the Contractor understands that ceasing to utilize the federal work authorization program constitutes a material breach of Contract; **(e)** the Contractor will contract for the performance of services in satisfaction of such contract only with subcontractors who present an affidavit to the Contractor with the information required by O.C.G.A. § 13-10-91(a), (b), and (c); **(f)** the Contractor acknowledges and agrees that this Affidavit shall be incorporated into any contract(s) subject to the provisions of O.C.G.A. § 13-10- 91 for the project listed below to which Contractor is a party after the date hereof without further action or consent by Contractor; and **(g)** Contractor acknowledges its responsibility to submit copies of any affidavits, drivers' licenses, and identification cards required pursuant to O.C.G.A. § 13-10-91 to the public employer within five business days of receipt.

_____ _____

Federal Work Authorization User Identification Number Date of Authorization *(mm/dd/yyyy*)

_____ _____

Name of Contractor (*Legal Name of Offeror)* Name of Project/Solicitation Number

_____

Name of Public Employer

I hereby declare under penalty of perjury that the foregoing is true and correct.

Executed on _____, ___, 20__ in _____ (City), _____(State).

_____

Signature of Authorized Officer or Agent

_____

Printed Name and Title of Authorized Officer or Agent

SUBSCRIBED AND SWORN BEFORE ME
ON THIS THE _____ DAY OF _____,20__.

_____

NOTARY PUBLIC

My Commission Expires: _____

The signature dates for both the authorized representative and notary public must be the same.

RETURN THIS FORM WITH BID DOCUMENTS

SECTION VII

FORM 6b
SUBCONTRACTOR AFFIDAVIT

By executing this affidavit, the undersigned subcontractor verifies its compliance with O.C.G.A. § 13-10-91, stating affirmatively that the individual, firm, or corporation which is engaged in the physical performance of services under a contract with _____(*contractor*) on behalf of _____(*public employer*) has registered with, is authorized to use and uses the federal work authorization program commonly known as E-Verify, or any subsequent replacement program, in accordance with the applicable provisions and deadlines established in O.C.G.A § 13-10-91. Furthermore, the undersigned subcontractor will continue to use the federal work authorization program throughout the contract period and the undersigned subcontractor will contract for the physical performance of services in satisfaction of such contract only with sub-subcontractors who present an affidavit to the subcontractor with the information required by O.C.G.A. § 13-10-91(b). Additionally, the undersigned subcontractor will forward notice of the receipt of an affidavit from a sub-subcontractor to the contractor within five (5) business days of receipt. If the undersigned subcontractor receives notice that a sub-subcontractor has received an affidavit from any other contracted sub-subcontractor, the undersigned subcontractor must forward, within five business days of receipt, a copy of the notice to the contractor. Subcontractor hereby attests that its federal work authorization user identification number and date of authorization are as follows:

_____ _____
Federal Work Authorization User Identification Number Date of Authorization (*mm/dd/yyyy*)

_____ _____
Name of Subcontractor (*Legal Name)* Name of Project/Solicitation Number

_____
Name of Public Employer

I hereby declare under penalty of perjury that the foregoing is true and correct.

Executed on _____, ___, 20__ in _____(City), _____(State).

_____
Signature of Authorized Officer or Agent

_____
Printed Name and Title of Authorized Officer or Agent

SUBSCRIBED AND SWORN BEFORE ME
ON THIS THE _____ DAY OF _____,20__.

_____
NOTARY PUBLIC

My Commission Expires: _____
The signature dates for both the authorized representative and notary public must be the same.

SECTION VIII

FORM OF AGREEMENT BETWEEN OWNER AND CONTRACTOR FOR CONSTRUCTION CONTRACT

THIS AGREEMENT is by and between **City of Forest Park, Georgia** ("Owner") and _____ ("Contractor").

Owner and Contractor hereby agree as follows:

ARTICLE 1 – WORK

1.01 Contractor shall complete all Work as specified or indicated in the Contract Documents. The Work is generally described as follows: All material, labor, tools, equipment, and any other miscellaneous items necessary to complete the work as described in the Construction Drawings & Specifications.

ARTICLE 2 – THE PROJECT

The Project for which the Work under the Contract Documents may be the whole or only a part is generally described as follows: The work consists of furnishing and installing all materials, labor, tools, equipment, and related services required for a complete project. This project includes but is not limited to providing the renovation of a complete City Park including a new walking track, walkways, playground, dog park, sports field, splash pad, as well as the construction of three new buildings, three new park pavilions and 347 additional square feet to an existing pool equipment room to provide a complete **"Starr Park – Phase I"** project in Forest Park Georgia.

ARTICLE 3 – ENGINEER (OWNER'S REPRESENTATIVE)

3.01 The Project has been designed by **Croft & Associates** and is the Design Engineer of record and reviewed by **Falcon Design LLC(Engineer)**. **Falcon Design LLC** is to act as Owner's representative, assume all duties and responsibilities, and have the rights and authority assigned to Engineer by the Owner and in the Contract Documents in connection with the completion of the Work in accordance with the Contract Documents.

ARTICLE 4 – CONTRACT TIMES

4.01 *Time of the Essence*

A. All time limits for Milestones, if any, Substantial Completion, and completion and readiness for final payment as stated in the Contract Documents are of the essence of the Contract.

4.02 *Days to Achieve Substantial Completion and Final Payment*

A. The Work will be substantially completed within **335** days after the date when the Contract Times commence to run as provided in Paragraph 2.03 of the General Conditions, and completed

and ready for final payment in accordance with Paragraph 14.07 of the General Conditions within **365** days after the date when the Contract Times commence to run.

4.03 *Liquidated Damages*

A. Contractor and Owner recognize that time is of the essence as stated in Paragraph 4.01 above and that Owner will suffer financial loss if the Work is not completed within the times specified in Paragraph 4.02 above, plus any extensions thereof allowed in accordance with Article 12 of the General Conditions. The parties also recognize the delays, expense, and difficulties involved in proving in a legal or arbitration proceeding the actual loss suffered by Owner if the Work is not completed on time. Accordingly, instead of requiring any such proof, Owner and Contractor agree that as liquidated damages for delay (but not as a penalty), Contractor shall pay Owner **$250** for each day that expires after the time specified in Paragraph 4.02 above for Substantial Completion until the Work is substantially complete. After Substantial Completion, if Contractor shall neglect, refuse, or fail to complete the remaining Work within the Contract Time or any proper extension thereof granted by Owner, Contractor shall pay Owner **$500** for each day that expires after the time specified in Paragraph 4.02 above for completion and readiness for final payment until the Work is completed and ready for final payment.

ARTICLE 5 – CONTRACT PRICE

5.01 Owner shall pay Contractor for completion of the Work in accordance with the Contract Documents an amount in current funds equal to the sum of the amounts determined pursuant to Paragraphs 5.01.A below:

A. For all Work at the Unit Price Base Bid of:

_____A project contingency allowance of **10%** is included into the total base bid for this project. This allowance is for additional work as directed by the Owner. Monies not utilized by the Owner for this project will be removed from the final contract price at the completion of the project by use of a Change Order.

B. All specific cash allowances are included in the above price in accordance with Paragraph 11.02 of the General Conditions.

ARTICLE 6 – PAYMENT PROCEDURES

6.01 *Submittal and Processing of PAYMENTS*

A. Contractor shall submit Applications for Payment in accordance with Article 14 of the General Conditions. Applications for Payment will be processed by Engineer as provided in the General Conditions.

SECTION VIII

6.02 *Progress Payments; Retainage*

A. Owner shall make progress payments on account of the Contract Price on the basis of Contractor's Applications for Payment on or about the 25th day of each month during performance of the Work as provided in Paragraph 6.02.A.1 below. All such payments will be measured by the schedule of values established as provided in Paragraph 2.07.A of the General Conditions (and in the case of Unit Price Work based on the number of units completed) or, in the event there is no schedule of values, as provided in the General Requirements.

1. Prior to Substantial Completion, progress payments will be made in an amount equal to the percentage indicated below but, in each case, less the aggregate of payments previously made and less such amounts as Engineer may determine or Owner may withhold, including but not limited to liquidated damages, in accordance with Paragraph 14.02 of the General Conditions.

a. 90 percent of Work completed (with the balance being retainage). If the Work has been 50 percent completed as determined by Engineer, and if the character and progress of the Work have been satisfactory to Owner and Engineer, then as long as the character and progress of the Work remain satisfactory to Owner and Engineer, there will be no additional retainage; and

b. 90 percent of cost of materials and equipment not incorporated in the Work (with the balance being retainage).

B. Upon Substantial Completion, Owner shall pay an amount sufficient to increase total payments to Contractor to 100 percent of the Work completed, less such amounts as Engineer shall determine in accordance with Paragraph 14.02.B.5 of the General Conditions and less 200 percent of Engineer's estimate of the value of Work to be completed or corrected as shown on the tentative list of items to be completed or corrected attached to the certificate of Substantial Completion.

6.03 *Final Payment*

A. Upon final completion and acceptance of the Work in accordance with Paragraph 14.07 of the General Conditions, Owner shall pay the remainder of the Contract Price as recommended by Engineer as provided in said Paragraph 14.07.

ARTICLE 7 – INTEREST

7.01 All moneys not paid when due as provided in Article 14 of the General Conditions shall bear interest at the rate of 1.0 percent per annum.

ARTICLE 8 – CONTRACTOR'S REPRESENTATIONS

8.01 In order to induce Owner to enter into this Agreement, Contractor makes the following representations:

A. Contractor has examined and carefully studied the Contract Documents and the other related data identified in the Bidding Documents.

B. Contractor has visited the Site and become familiar with and is satisfied as to the general, local, and Site conditions that may affect cost, progress, and performance of the Work.

C. Contractor is familiar with and is satisfied as to all federal, state, and local Laws and Regulations that may affect cost, progress, and performance of the Work.

D. Contractor has considered the information known to Contractor; information commonly known to contractors doing business in the locality of the Site; information and observations obtained from visits to the Site; the Contract Documents; and the Site-related reports and drawings identified in the Contract Documents, with respect to the effect of such information, observations, and documents on (1) the cost, progress, and performance of the Work; (2) the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor, including any specific means, methods, techniques, sequences, and procedures of construction expressly required by the Contract Documents; and (3) Contractor's safety precautions and programs.

E. Based on the information and observations referred to in Paragraph 8.01.D above, Contractor does not consider that further examinations, investigations, explorations, tests, studies, or data are necessary for the performance of the Work at the Contract Price, within the Contract Times, and in accordance with the other terms and conditions of the Contract Documents.

F. Contractor is aware of the general nature of work to be performed by Owner and others at the Site that relates to the Work as indicated in the Contract Documents.

G. Contractor has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Contractor has discovered in the Contract Documents, and the written resolution thereof by Engineer is acceptable to Contractor.

H. The Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.

ARTICLE 9 – CONTRACT DOCUMENTS

9.01 *Contents*

A. The Contract Documents consist of the following:

1. This Agreement, including the RFP and Contractor's proposal in response to the RFP.

2. Performance Bond.

3. Payment Bond.

4. General Conditions.

5. Supplemental General Conditions

6. Complete City of Forest Park – "Local, Small Business, Diversity Program" requirements and submitted forms included in these documents.

7. Technical Specifications (Including Georgia Department of Transportation – Standard Specifications Construction of Transportation Systems – January 21, 2021 or latest edition).

8. Drawings

9. Addenda.

10. Exhibits to this Agreement (enumerated as follows):

    a. Contractor's Bid.

    b. Documentation submitted by Contractor prior to Notice of Award.

    c. Certificate of Insurance.

11. The following which may be delivered or issued on or after the Effective Date of the Agreement and are not attached hereto:

    a. Notice to Proceed.

    b. Work Change Directives.

    c. Change Orders.

B. The documents listed in Paragraph 9.01.A are attached to this Agreement (except as expressly noted otherwise above).

C. There are no Contract Documents other than those listed above in this Article 9.

D. The Contract Documents may only be amended, modified, or supplemented as provided in Paragraph 3.04 of the General Conditions.

ARTICLE 10 – MISCELLANEOUS

10.01 *Terms*

A. Terms used in this Agreement will have the meanings stated in the General Conditions and the Supplementary Conditions.

10.02 *Assignment of Contract*

A. No assignment by a party hereto of any rights under or interests in the Contract will be binding on another party hereto without the written consent of the party sought to be bound; and,

specifically but without limitation, moneys that may become due and moneys that are due may not be assigned without such consent (except to the extent that the effect of this restriction may be limited by law), and unless specifically stated to the contrary in any written consent to an assignment, no assignment will release or discharge the assignor from any duty or responsibility under the Contract Documents.

10.03 *Successors and Assigns*

A. Owner and Contractor each binds itself, its partners, successors, assigns, and legal representatives to the other party hereto, in respect to all covenants, agreements, and obligations contained in the Contract Documents.

10.04 *Severability*

A. Any provision or part of the Contract Documents held to be void or unenforceable under any Law or Regulation shall be deemed stricken, and all remaining provisions shall continue to be valid and binding upon Owner and Contractor, who agree that the Contract Documents shall be reformed to replace such stricken provision or part thereof with a valid and enforceable provision that comes as close as possible to expressing the intention of the stricken provision.

10.05 *Contractor's Certifications*

A. Contractor certifies that it has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for or in executing the Contract. For the purposes of this Paragraph 10.05:

1. "corrupt practice" means the offering, giving, receiving, or soliciting of anything of value likely to influence the action of a public official in the bidding process or in the Contract execution;

2. "fraudulent practice" means an intentional misrepresentation of facts made (a) to influence the bidding process or the execution of the Contract to the detriment of Owner, (b) to establish Bid or Contract prices at artificial non-competitive levels, or (c) to deprive Owner of the benefits of free and open competition;

3. "collusive practice" means a scheme or arrangement between two or more Bidders, with or without the knowledge of Owner, a purpose of which is to establish Bid prices at artificial, non-competitive levels; and

4. "coercive practice" means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the bidding process or affect the execution of the Contract.

SECTION VIII

10.06 *Other Provisions*

1. *Indemnification:* The CONTRACTOR shall indemnify and hold harmless the OWNER and Consulting ENGINEER (also known as Falcon Design Consultants, LLC) and their agents and employees from and against all claims, damages, losses and expenses, including but not limited to attorney's fees, arising out of or resulting from the performance of the WORK, provided that any such claim, damage, loss, expense or attorney's fees is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property including the loss of use resulting therefrom, and is caused in whole or in part by any negligent act or omission of the CONTRACTOR, any Subcontractor, anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable, regardless of whether or not the negligent act is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or otherwise reduce any other right or obligation of indemnity which would otherwise exist as to any party or person described in this Clause. In any and all claims against the OWNER or the Consulting ENGINEER (Falcon Design Consultants, LLC) or any of their agents or employees, by any employee of the CONTRACTOR, any Subcontractor, anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable, the indemnification obligation set forth in this paragraph shall not be limited in any way by any limitation on the amount or type of damages, compensation or benefits payable by or for the CONTRACTOR or any Subcontractor under workers' or workman's compensation acts, disability benefit acts or other employee benefit acts.

IN WITNESS WHEREOF, Owner and Contractor have signed this Agreement. Counterparts have been delivered to Owner and Contractor. All portions of the Contract Documents have been signed or have been identified by Owner and Contractor or on their behalf.

This Agreement will be effective on _____ (which is the Effective Date of the Agreement).

OWNER:	CONTRACTOR
City of Forest Park, Georgia	_____
By: _____	By: _____
Title: _____	Title: _____
	(If Contractor is a corporation, a partnership, or a joint venture, attach evidence of authority to sign.)
Attest: _____	Attest: _____
Title: _____	Title: _____
Address for giving notices:	Address for giving notices:
745 Forest Parkway	_____
Forest Park, GA 30297	_____
Phone: (404) 366-4720	_____
	Georgia Contractor License No. _____
	(Where applicable)
	Agent for service of process:
	_____

SECTION IX

NOTICE TO PROCEED

Date: _____

Project: **Forest Park – Starr Park – Phase I**	
Owner: City of Forest Park, Georgia	Owner's Contract No.: 02072023
Contract:	Engineer's Project No.:
Contractor:	
Contractor's Address:	

You are notified that the Contract Times under the above Contract will commence to run on _____. On or before that date, you are to start performing your obligations under the Contract Documents. In accordance with Article 4 of the Agreement, the date of Completion is _____, and the number of consecutive calendar days to achieve Substantial Completion is **335.** and the number of consecutive calendar days to achieve readiness for Final Completion including Closeout Documents is **365.**

Before you may start any Work at the Site, Paragraph 2.01.B of the General Conditions provides that you and Owner must each deliver to the other (with copies to Engineer and other identified additional insureds and loss payees) certificates of insurance which each is required to purchase and maintain in accordance with the Contract Documents.

Contractor:	Owner: **CITY OF FOREST PARK**
Authorized Signature	Authorized Signature
Title	Title
Date	Date

SECTION X

PERFORMANCE BOND

Any singular reference to Contractor, Surety, Owner, or other party shall be considered plural where applicable.

CONTRACTOR (*Name and Address*):

SURETY (*Name, and Address of Principal Place of Business*):

OWNER (*Name and Address*):
City of Forest Park, Georgia
745 Forest Parkway
Forest, GA 30297

CONTRACT
Effective Date of Agreement:
Amount: **$ _____.**
Description (*Name and Location*): **FOREST PARK – STARR PARK – PHASE I**

BOND
Bond Number:
Date (*Not earlier than Effective Date of Agreement*):
Amount:
Modifications to this Bond Form:

Surety and Contractor, intending to be legally bound hereby, subject to the terms set forth below, do each cause this Performance Bond to be duly executed by an authorized officer, agent, or representative.

CONTRACTOR AS PRINCIPAL	**SURETY**
_____ (Seal)	_____ (Seal)
Contractor's Name and Corporate Seal	Surety's Name and Corporate Seal
By: _____	By: _____
Signature	Signature (Attach Power of Attorney)
_____	_____
Print Name	Print Name
_____	_____
Title	Title
Attest: _____	Attest: _____
Signature	Signature
_____	_____
Title	Title

Note: Provide execution by additional parties, such as joint venturers, if necessary.

SECTION X

Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to Owner for the performance of the Contract, which is incorporated herein by reference.

1. If Contractor performs the Contract, Surety and Contractor have no obligation under this Bond, except to participate in conferences as provided in Paragraph 2.1.

2. If there is no Owner Default, Surety's obligation under this Bond shall arise after:
   2.1 Owner has notified Contractor and Surety, at the addresses described in Paragraph 9 below, that Owner is considering declaring a Contractor Default and has requested and attempted to arrange a conference with Contractor and Surety to be held not later than 15 days after receipt of such notice to discuss methods of performing the Contract. If Owner, Contractor, and Surety agree, Contractor shall be allowed a reasonable time to perform the Contract, but such an agreement shall not waive Owner's right, if any, subsequently to declare a Contractor Default; and
   2.2 Owner has declared a Contractor Default and formally terminated Contractor's right to complete the Contract. Such Contractor Default shall not be declared earlier than 20 days after Contractor and Surety have received notice as provided in Paragraph 2.1; and
   2.3 Owner has agreed to pay the Balance of the Contract Price to:
      1. Surety in accordance with the terms of the Contract; or
      2. Another contractor selected pursuant to Paragraph 3.3 to perform the Contract.

3. When Owner has satisfied the conditions of Paragraph 2, Surety shall promptly, and at Surety's expense, take one of the following actions:

   3.1 Arrange for Contractor, with consent of Owner, to perform and complete the Contract; or
   3.2 Undertake to perform and complete the Contract itself, through its agents or through independent contractors; or
   3.3 Obtain bids or negotiated proposals from qualified contractors acceptable to Owner for a contract for performance and completion of the Contract, arrange for a contract to be prepared for execution by Owner and contractor selected with Owner's concurrence, to be secured with performance and payment bonds executed by a qualified surety equivalent to the bonds issued on the Contract, and pay to Owner the amount of damages as described in Paragraph 5 in excess of the Balance of the Contract Price incurred by Owner resulting from Contractor Default; or
   3.4 Waive its right to perform and complete, arrange for completion, or obtain a new contractor, and with reasonable promptness under the circumstances:
      1. After investigation, determine the amount for which it may be liable to Owner and, as soon as practicable after the amount is determined, tender payment therefor to Owner; or
      2. Deny liability in whole or in part and notify Owner citing reasons therefor.

4. If Surety does not proceed as provided in Paragraph 3 with reasonable promptness, Surety shall be deemed to be in default on this Bond 15 days after receipt of an additional written notice from Owner to Surety demanding that Surety perform its obligations under this Bond, and Owner shall be entitled to enforce any remedy available to Owner. If Surety proceeds as provided in Paragraph 3.4, and Owner refuses the payment tendered or Surety has denied liability, in whole or in part, without further notice Owner shall be entitled to enforce any remedy available to Owner.

SECTION X

5. After Owner has terminated Contractor's right to complete the Contract, and if Surety elects to act under Paragraph 3.1, 3.2, or 3.3 above, then the responsibilities of Surety to Owner shall not be greater than those of Contractor under the Contract, and the responsibilities of Owner to Surety shall not be greater than those of Owner under the Contract. To the limit of the amount of this Bond, but subject to commitment by Owner of the Balance of the Contract Price to mitigation of costs and damages on the Contract, Surety is obligated without duplication for:

5.1 The responsibilities of Contractor for correction of defective Work and completion of the Contract;
5.2 Additional legal, design professional, and delay costs resulting from Contractor's Default, and resulting from the actions of or failure to act of Surety under Paragraph 3; and
5.3 Liquidated damages, or if no liquidated damages are specified in the Contract, actual damages caused by delayed performance or non-performance of Contractor.

6. Surety shall not be liable to Owner or others for obligations of Contractor that are unrelated to the Contract, and the Balance of the Contract Price shall not be reduced or set off on account of any such unrelated obligations. No right of action shall accrue on this Bond to any person or entity other than Owner or its heirs, executors, administrators, or successors.

7. Surety hereby waives notice of any change, including changes of time, to Contract or to related subcontracts, purchase orders, and other obligations.

8. Any proceeding, legal or equitable, under this Bond may be instituted in any court of competent jurisdiction in the location in which the Work or part of the Work is located, and shall be instituted within two years after Contractor Default or within two years after Contractor ceased working or within two years after Surety refuses or fails to perform its obligations under this Bond, whichever occurs first. If the provisions of this paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

9. Notice to Surety, Owner, or Contractor shall be mailed or delivered to the address shown on the signature page.

10. When this Bond has been furnished to comply with a statutory requirement in the location where the Contract was to be performed, any provision in this Bond conflicting with said statutory requirement shall be deemed deleted here from and provisions conforming to such statutory requirement shall be deemed incorporated herein. The intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

11. Definitions.

11.1 Balance of the Contract Price: The total amount payable by Owner to Contractor under the Contract after all proper adjustments have been made, including allowance to Contractor of any amounts received or to be received by Owner in settlement of insurance or other Claims for damages to which Contractor is entitled, reduced by all valid and proper payments made to or on behalf of Contractor under the Contract.
11.2 Contract: The agreement between Owner and Contractor identified on the signature page, including all Contract Documents and changes thereto.
11.3 Contractor Default: Failure of Contractor, which has neither been remedied nor waived, to perform or otherwise to comply with the terms of the Contract.

SECTION X

11.4 Owner Default: Failure of Owner, which has neither been remedied nor waived, to pay Contractor as required by the Contract or to perform and complete or otherwise comply with the other terms thereof.

FOR INFORMATION ONLY – (*Name, Address and Telephone*) Surety Agency or Broker: Owner's Representative (*Engineer or other party*):

SECTION XI

PAYMENT BOND

Any singular reference to Contractor, Surety, Owner, or other party shall be considered plural where applicable.

CONTRACTOR (*Name and Address*):

SURETY (*Name, and Address of Principal Place of Business*):

OWNER (*Name and Address*):
City of Forest Park, Georgia
745 Forest Parkway
Forest Park, GA 30297

CONTRACT
Effective Date of Agreement:
Amount: **$ _____.**
Description *(Name and Location)*: **FOREST PARK – STARR PARK – PHASE I**

BOND
Bond Number:
Date (*Not earlier than Effective Date of Agreement*):
Amount:
Modifications to this Bond Form:

Surety and Contractor, intending to be legally bound hereby, subject to the terms set forth below, do each cause this Payment Bond to be duly executed by an authorized officer, agent, or representative.

CONTRACTOR AS PRINCIPAL	**SURETY**
_____ (Seal)	_____ (Seal)
Contractor's Name and Corporate Seal	Surety's Name and Corporate Seal
By: _____	By: _____
Signature	Signature (Attach Power of Attorney)
_____	_____
Print Name	Print Name
_____	_____
Title	Title
Attest: _____	Attest: _____
Signature	Signature
_____	_____
Title	Title

Note: Provide execution by additional parties, such as joint venturers, if necessary.

SECTION XI

1. Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to Owner to pay for labor, materials, and equipment furnished by Claimants for use in the performance of the Contract, which is incorporated herein by reference.

2. With respect to Owner, this obligation shall be null and void if Contractor:

2.1 Promptly makes payment, directly or indirectly, for all sums due Claimants, and

2.2 Defends, indemnifies, and holds harmless Owner from all claims, demands, liens, or suits alleging non-payment by Contractor by any person or entity who furnished labor, materials, or equipment for use in the performance of the Contract, provided Owner has promptly notified Contractor and Surety (at the addresses described in Paragraph 12) of any claims, demands, liens, or suits and tendered defense of such claims, demands, liens, or suits to Contractor and Surety, and provided there is no Owner Default.

3. With respect to Claimants, this obligation shall be null and void if Contractor promptly makes payment, directly or indirectly, for all sums due.

4. Surety shall have no obligation to Claimants under this Bond until:

4.1 Claimants who are employed by or have a direct contract with Contractor have given notice to Surety (at the address described in Paragraph 12) and sent a copy, or notice thereof, to Owner, stating that a claim is being made under this Bond and, with substantial accuracy, the amount of the claim.

4.2 Claimants who do not have a direct contract with Contractor:

1. Have furnished written notice to Contractor and sent a copy, or notice thereof, to Owner, within 90 days after having last performed labor or last furnished materials or equipment included in the claim stating, with substantial accuracy, the amount of the claim and the name of the party to whom the materials or equipment were furnished or supplied, or for whom the labor was done or performed; and
2. Have either received a rejection in whole or in part from Contractor, or not received within 30 days of furnishing the above notice any communication from Contractor by which Contractor had indicated the claim will be paid directly or indirectly; and
3. Not having been paid within the above 30 days, have sent a written notice to Surety (at the address described in Paragraph 12) and sent a copy, or notice thereof, to Owner, stating that a claim is being made under this Bond and enclosing a copy of the previous written notice furnished to Contractor.

5. If a notice by a Claimant required by Paragraph 4 is provided by Owner to Contractor or to Surety, that is sufficient compliance.

6. When a Claimant has satisfied the conditions of Paragraph 4, the Surety shall promptly and at Surety's expense take the following actions:

6.1 Send an answer to that Claimant, with a copy to Owner, within 45 days after receipt of the claim, stating the amounts that are undisputed and the basis for challenging any amounts that are disputed.

6.2 Pay or arrange for payment of any undisputed amounts.

7. Surety's total obligation shall not exceed the amount of this Bond, and the amount of this Bond shall be credited for any payments made in good faith by Surety.

8. Amounts owed by Owner to Contractor under the Contract shall be used for the performance of the Contract and to satisfy claims, if any, under any performance bond. By Contractor furnishing and Owner accepting this Bond, they agree that all funds earned by Contractor in the performance of the Contract are

dedicated to satisfy obligations of Contractor and Surety under this Bond, subject to Owner's priority to use the funds for the completion of the Work.

9. Surety shall not be liable to Owner, Claimants, or others for obligations of Contractor that are unrelated to the Contract. Owner shall not be liable for payment of any costs or expenses of any Claimant under this Bond, and shall have under this Bond no obligations to make payments to, give notices on behalf of, or otherwise have obligations to Claimants under this Bond.

10. Surety hereby waives notice of any change, including changes of time, to the Contract or to related subcontracts, purchase orders, and other obligations.

11. No suit or action shall be commenced by a Claimant under this Bond other than in a court of competent jurisdiction in the location in which the Work or part of the Work is located or after the expiration of one year from the date (1) on which the Claimant gave the notice required by Paragraph 4.1 or Paragraph 4.2.3, or (2) on which the last labor or service was performed by anyone or the last materials or equipment were furnished by anyone under the Contract, whichever of (1) or (2) first occurs. If the provisions of this paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

12. Notice to Surety, Owner, or Contractor shall be mailed or delivered to the addresses shown on the signature page. Actual receipt of notice by Surety, Owner, or Contractor, however accomplished, shall be sufficient compliance as of the date received at the address shown on the signature page.

13. When this Bond has been furnished to comply with a statutory requirement in the location where the Contract was to be performed, any provision in this Bond conflicting with said statutory requirement shall be deemed deleted herefrom and provisions conforming to such statutory requirement shall be deemed incorporated herein. The intent is that this Bond shall be construed as a statutory Bond and not as a common law bond.

14. Upon request of any person or entity appearing to be a potential beneficiary of this Bond, Contractor shall promptly furnish a copy of this Bond or shall permit a copy to be made.

15. Definitions

15.1 Claimant: An individual or entity having a direct contract with Contractor, or with a first-tier subcontractor of Contractor, to furnish labor, materials, or equipment for use in the performance of the Contract. The intent of this Bond shall be to include without limitation in the terms "labor, materials or equipment" that part of water, gas, power, light, heat, oil, gasoline, telephone service, or rental equipment used in the Contract, architectural and engineering services required for performance of the Work of Contractor and Contractor's subcontractors, and all other items for which a mechanic's lien may be asserted in the jurisdiction where the labor, materials, or equipment were furnished.

15.2 Contract: The agreement between Owner and Contractor identified on the signature page, including all Contract Documents and changes thereto.

15.3 Owner Default: Failure of Owner, which has neither been remedied nor waived, to pay Contractor as required by the Contract, or to perform and complete or otherwise comply with the other terms thereof.

FOR INFORMATION ONLY – (*Name, Address, and Telephone*) Surety Agency or Broker: Owner's Representative (*Engineer or other*):

SECTION XII

CERTIFICATE OF CONTRACTOR'S ATTORNEY

I, the undersigned, _____, the duly authorized and

acting legal representative of (Contractor)_____,
do hereby certify as follows:

I have examined the attached Contract and Performance and Payment Bond and the manner of execution thereof, and I am of the opinion that each of the aforesaid agreements are adequate and have been duly executed by the proper parties thereto acting through their duly authorized representatives; that said representatives have full power and authority to execute said agreements on behalf of the respective parties named thereon; and that the foregoing agreements constitute valid and legally binding obligations upon the parties executing the same in accordance with the terms, conditions, and provisions thereof.

Signature: _____

Date: _____

SECTION XIII

CERTIFICATE OF OWNER'S ATTORNEY

I, the undersigned, _____, the duly authorized and acting legal representative of the **City of Forest Park, Georgia**, do hereby certify as follows:

I have examined the attached Contract and the manner of execution thereof by the authorized City representatives, and I am of the opinion that each of the aforesaid agreements are adequate and have been duly executed by the proper parties thereto acting through their duly authorized representatives; that said representatives have full power and authority to execute said agreements on behalf of the City of Forest Park, Georgia; and that the foregoing agreements constitute valid and legally binding obligations upon the parties executing the same in accordance with the terms, conditions, and provisions thereof.

Signature: _____

Date: _____

SECTION XIV
GENERAL CONDITIONS

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SECTION XIV

ARTICLE 1 – DEFINITIONS AND TERMINOLOGY

1.01 *Defined Terms*

A. Wherever used in the Bidding Requirements or Contract Documents and printed with initial capital letters, the terms listed below will have the meanings indicated which are applicable to both the singular and plural thereof. In addition to terms specifically defined, terms with initial capital letters in the Contract Documents include references to identified articles and paragraphs, and the titles of other documents or forms.

1. *Addenda*—Written or graphic instruments issued prior to the opening of Bids which clarify, correct, or change the Bidding Requirements or the proposed Contract Documents.

2. *Agreement*—The written instrument which is evidence of the agreement between Owner and Contractor covering the Work.

3. *Application for Payment*—The form acceptable to Engineer which is to be used by Contractor during the course of the Work in requesting progress or final payments and which is to be accompanied by such supporting documentation as is required by the Contract Documents.

4. *Asbestos*—Any material that contains more than one percent asbestos and is friable or is releasing asbestos fibers into the air above current action levels established by the United States Occupational Safety and Health Administration.

5. *Bid*—The offer or proposal of a Bidder submitted on the prescribed form setting forth the prices for the Work to be performed.

6. *Bidder*—The individual or entity who submits a Bid directly to Owner.

7. *Bidding Documents*—The Bidding Requirements and the proposed Contract Documents (including all Addenda).

8. *Bidding Requirements*—The advertisement or invitation to bid, Instructions to Bidders, Bid security of acceptable form, if any, and the Bid Form with any supplements.

9. *Change Order*—A document recommended by Engineer which is signed by Contractor and Owner and authorizes an addition, deletion, or revision in the Work or an adjustment in the Contract Price or the Contract Times, issued on or after the Effective Date of the Agreement.

10. *Claim*—A demand or assertion by Owner or Contractor seeking an adjustment of Contract Price or Contract Times, or both, or other relief with respect to the terms of the Contract. A demand for money or services by a third party is not a Claim.

11. *Contract*—The entire and integrated written agreement between the Owner and Contractor concerning the Work. The Contract supersedes prior negotiations, representations, or agreements, whether written or oral.

12. *Contract Documents*—Those items so designated in the Agreement. Only printed or hard copies of the items listed in the Agreement are Contract Documents. Approved Shop

Drawings, other Contractor submittals, and the reports and drawings of subsurface and physical conditions are not Contract Documents.

13. *Contract Price*—The moneys payable by Owner to Contractor for completion of the Work in accordance with the Contract Documents as stated in the Agreement (subject to the provisions of Paragraph 11.03 in the case of Unit Price Work).

14. *Contract Times*—The number of days or the dates stated in the Agreement to: (i) achieve Milestones, if any; (ii) achieve Substantial Completion; and (iii) complete the Work so that it is ready for final payment as evidenced by Engineer's written recommendation of final payment.

15. *Contractor*—The individual or entity with whom Owner has entered into the Agreement.

16. *Cost of the Work*—See Paragraph 11.01 for definition.

17. *Drawings*—That part of the Contract Documents prepared or approved by Engineer which graphically shows the scope, extent, and character of the Work to be performed by Contractor. Shop Drawings and other Contractor submittals are not Drawings as so defined.

18. *Effective Date of the Agreement*—The date indicated in the Agreement on which it becomes effective, but if no such date is indicated, it means the date on which the Agreement is signed and delivered by the last of the two parties to sign and deliver.

19. *Engineer*—The individual or entity named as such in the Agreement.

20. *Field Order*—A written order issued by Engineer which requires minor changes in the Work but which does not involve a change in the Contract Price or the Contract Times.

21. *General Requirements*—Sections of Division 1 of the Specifications.

22. *Hazardous Environmental Condition*—The presence at the Site of Asbestos, PCBs, Petroleum, Hazardous Waste, or Radioactive Material in such quantities or circumstances that may present a substantial danger to persons or property exposed thereto.

23. *Hazardous Waste*—The term Hazardous Waste shall have the meaning provided in Section 1004 of the Solid Waste Disposal Act (42 USC Section 6903) as amended from time to time.

24. *Laws and Regulations; Laws or Regulations*—Any and all applicable laws, rules, regulations, ordinances, codes, and orders of any and all governmental bodies, agencies, authorities, and courts having jurisdiction.

25. *Liens*—Charges, security interests, or encumbrances upon Project funds, real property, or personal property.

26. *Milestone*—A principal event specified in the Contract Documents relating to an intermediate completion date or time prior to Substantial Completion of all the Work.

27. *Notice of Award*—The written notice by Owner to the Successful Bidder stating that upon timely compliance by the Successful Bidder with the condition's precedent listed therein, Owner will sign and deliver the Agreement.

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28. *Notice to Proceed*—A written notice given by Owner to Contractor fixing the date on which the Contract Times will commence to run and on which Contractor shall start to perform the Work under the Contract Documents.

29. *Owner*—The individual or entity with whom Contractor has entered into the Agreement and for whom the Work is to be performed.

30. *PCBs*—Polychlorinated biphenyls.

31. *Petroleum*—Petroleum, including crude oil or any fraction thereof which is liquid at standard conditions of temperature and pressure (60 degrees Fahrenheit and 14.7 pounds per square inch absolute), such as oil, petroleum, fuel oil, oil sludge, oil refuse, gasoline, kerosene, and oil mixed with other non-Hazardous Waste and crude oils.

32. *Progress Schedule*—A schedule, prepared and maintained by Contractor, describing the sequence and duration of the activities comprising the Contractor's plan to accomplish the Work within the Contract Times.

33. *Project*—The total construction of which the Work to be performed under the Contract Documents may be the whole, or a part.

34. *Project Manual*—The bound documentary information prepared for bidding and constructing the Work. A listing of the contents of the Project Manual, which may be bound in one or more volumes, is contained in the table(s) of contents.

35. *Radioactive Material*—Source, special nuclear, or byproduct material as defined by the Atomic Energy Act of 1954 (42 USC Section 2011 et seq.) as amended from time to time.

36. *Resident Project Representative*—The authorized representative of Engineer who may be assigned to the Site or any part thereof.

37. *Samples*—Physical examples of materials, equipment, or workmanship that are representative of some portion of the Work and which establish the standards by which such portion of the Work will be judged.

38. *Schedule of Submittals*—A schedule, prepared and maintained by Contractor, of required submittals and the time requirements to support scheduled performance of related construction activities.

39. *Schedule of Values*—A schedule, prepared and maintained by Contractor, allocating portions of the Contract Price to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

40. *Shop Drawings*—All drawings, diagrams, illustrations, schedules, and other data or information which are specifically prepared or assembled by or for Contractor and submitted by Contractor to illustrate some portion of the Work.

41. *Site*—Lands or areas indicated in the Contract Documents as being furnished by Owner upon which the Work is to be performed, including rights-of-way and easements for access thereto, and such other lands furnished by Owner which are designated for the use of Contractor.

42. *Specifications*—That part of the Contract Documents consisting of written requirements for materials, equipment, systems, standards and workmanship as applied to the Work, and certain administrative requirements and procedural matters applicable thereto.

43. *Subcontractor*—An individual or entity having a direct contract with Contractor or with any other Subcontractor for the performance of a part of the Work at the Site.

44. *Substantial Completion*—The time at which the Work (or a specified part thereof) has progressed to the point where, in the opinion of Engineer, the Work (or a specified part thereof) is sufficiently complete, in accordance with the Contract Documents, so that the Work (or a specified part thereof) can be utilized for the purposes for which it is intended. The terms "substantially complete" and "substantially completed" as applied to all or part of the Work refer to Substantial Completion thereof.

45. *Successful Bidder*—The Bidder submitting a responsive Bid to whom Owner makes an award.

46. *Supplementary Conditions*—That part of the Contract Documents which amends or supplements these General Conditions.

47. *Supplier*—A manufacturer, fabricator, supplier, distributor, materialman, or vendor having a direct contract with Contractor or with any Subcontractor to furnish materials or equipment to be incorporated in the Work by Contractor or Subcontractor.

48. *Underground Facilities*—All underground pipelines, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or attachments, and any encasements containing such facilities, including those that convey electricity, gases, steam, liquid petroleum products, telephone or other communications, cable television, water, wastewater, storm water, other liquids or chemicals, or traffic or other control systems.

49. *Unit Price Work*—Work to be paid for on the basis of unit prices.

50. *Work*—The entire construction or the various separately identifiable parts thereof required to be provided under the Contract Documents. Work includes and is the result of performing or providing all labor, services, and documentation necessary to produce such construction, and furnishing, installing, and incorporating all materials and equipment into such construction, all as required by the Contract Documents.

51. *Work Change Directive*—A written statement to Contractor issued on or after the Effective Date of the Agreement and signed by Owner and recommended by Engineer ordering an addition, deletion, or revision in the Work, or responding to differing or unforeseen subsurface or physical conditions under which the Work is to be performed or to emergencies. A Work Change Directive will not change the Contract Price or the Contract Times but is evidence that the parties expect that the change ordered or documented by a Work Change Directive will be incorporated in a subsequently issued Change Order following negotiations by the parties as to its effect, if any, on the Contract Price or Contract Times.

1.02 *Terminology*

A. The words and terms discussed in Paragraph 1.02.B through F are not defined but, when used in the Bidding Requirements or Contract Documents, have the indicated meaning.

B. *Intent of Certain Terms or Adjectives:*

1. The Contract Documents include the terms "as allowed," "as approved," "as ordered," "as directed" or terms of like effect or import to authorize an exercise of professional judgment by Engineer. In addition, the adjectives "reasonable," "suitable," "acceptable," "proper," "satisfactory," or adjectives of like effect or import are used to describe an action or determination of Engineer as to the Work. It is intended that such exercise of professional judgment, action, or determination will be solely to evaluate, in general, the Work for compliance with the information in the Contract Documents and with the design concept of the Project as a functioning whole as shown or indicated in the Contract Documents (unless there is a specific statement indicating otherwise). The use of any such term or adjective is not intended to and shall not be effective to assign to Engineer any duty or authority to supervise or direct the performance of the Work, or any duty or authority to undertake responsibility contrary to the provisions of Paragraph 9.09 or any other provision of the Contract Documents.

C. *Day:*

1. The word "day" means a calendar day of 24 hours measured from midnight to the next midnight.

D. *Defective:*

1. The word "defective," when modifying the word "Work," refers to Work that is unsatisfactory, faulty, or deficient in that it:

   a. does not conform to the Contract Documents; or

   b. does not meet the requirements of any applicable inspection, reference standard, test, or approval referred to in the Contract Documents; or

   c. has been damaged prior to Engineer's recommendation of final payment (unless responsibility for the protection thereof has been assumed by Owner at Substantial Completion in accordance with Paragraph 14.04 or 14.05).

E. *Furnish, Install, Perform, Provide:*

1. The word "furnish," when used in connection with services, materials, or equipment, shall mean to supply and deliver said services, materials, or equipment to the Site (or some other specified location) ready for use or installation and in usable or operable condition.

2. The word "install," when used in connection with services, materials, or equipment, shall mean to put into use or place in final position said services, materials, or equipment complete and ready for intended use.

3. The words "perform" or "provide," when used in connection with services, materials, or equipment, shall mean to furnish and install said services, materials, or equipment complete and ready for intended use.

4. When "furnish," "install," "perform," or "provide" is not used in connection with services, materials, or equipment in a context clearly requiring an obligation of Contractor, "provide" is implied.

F. Unless stated otherwise in the Contract Documents, words or phrases that have a well-known technical or construction industry or trade meaning are used in the Contract Documents in accordance with such recognized meaning.

ARTICLE 2 – PRELIMINARY MATTERS

2.01 *Delivery of Bonds and Evidence of Insurance*

A. When Contractor delivers the executed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner such bonds as Contractor may be required to furnish.

B. *Evidence of Insurance:* Before any Work at the Site is started, Contractor and Owner shall each deliver to the other, with copies to each additional insured identified in the Supplementary Conditions, certificates of insurance (and other evidence of insurance which either of them or any additional insured may reasonably request) which Contractor and Owner respectively are required to purchase and maintain in accordance with Article 5.

2.02 *Copies of Documents*

A. Owner shall furnish to Contractor up to three printed or hard copies of the Drawings and Project Manual. Additional copies will be furnished upon request at the cost of reproduction.

2.03 *Commencement of Contract Times; Notice to Proceed*

A. The Contract Times will commence to run on the 15th day after the Effective Date of the Agreement or, if a Notice to Proceed is given, on the day indicated in the Notice to Proceed. A Notice to Proceed may be given at any time within 15 days after the Effective Date of the Agreement. In no event will the Contract Times commence to run later than the sixtieth day after the day of Bid opening or the thirtieth day after the Effective Date of the Agreement, whichever date is earlier.

2.04 *Starting the Work*

A. Contractor shall start to perform the Work on the date when the Contract Times commence to run. No Work shall be done at the Site prior to the date on which the Contract Times commence to run.

2.05 *Before Starting Construction*

A. *Preliminary Schedules:* Within 10 days after the Effective Date of the Agreement (unless otherwise specified in the General Requirements), Contractor shall submit to Engineer for timely review:

1. a preliminary Progress Schedule indicating the times (numbers of days or dates) for starting and completing the various stages of the Work, including any Milestones specified in the Contract Documents;

2. a preliminary Schedule of Submittals; and

3. a preliminary Schedule of Values for all of the Work which includes quantities and prices of items which when added together equal the Contract Price and subdivides the Work into component parts in sufficient detail to serve as the basis for progress payments during

performance of the Work. Such prices will include an appropriate amount of overhead and profit applicable to each item of Work.

2.06 *Preconstruction Conference; Designation of Authorized Representatives*

A. Before any Work at the Site is started, a conference attended by Owner, Contractor, Engineer, and others as appropriate will be held to establish a working understanding among the parties as to the Work and to discuss the schedules referred to in Paragraph 2.05.A, procedures for handling Shop Drawings and other submittals, processing Applications for Payment, and maintaining required records.

B. At this conference Owner and Contractor each shall designate, in writing, a specific individual to act as its authorized representative with respect to the services and responsibilities under the Contract. Such individuals shall have the authority to transmit instructions, receive information, render decisions relative to the Contract, and otherwise act on behalf of each respective party.

2.07 *Initial Acceptance of Schedules*

A. At least 10 days before submission of the first Application for Payment a conference attended by Contractor, Engineer, and others as appropriate will be held to review for acceptability to Engineer as provided below the schedules submitted in accordance with Paragraph 2.05.A. Contractor shall have an additional 10 days to make corrections and adjustments and to complete and resubmit the schedules. No progress payment shall be made to Contractor until acceptable schedules are submitted to Engineer.

1. The Progress Schedule will be acceptable to Engineer if it provides an orderly progression of the Work to completion within the Contract Times. Such acceptance will not impose on Engineer responsibility for the Progress Schedule, for sequencing, scheduling, or progress of the Work, nor interfere with or relieve Contractor from Contractor's full responsibility therefor.

2. Contractor's Schedule of Submittals will be acceptable to Engineer if it provides a workable arrangement for reviewing and processing the required submittals.

3. Contractor's Schedule of Values will be acceptable to Engineer as to form and substance if it provides a reasonable allocation of the Contract Price to component parts of the Work.

ARTICLE 3 – CONTRACT DOCUMENTS: INTENT, AMENDING, REUSE

3.01 *Intent*

A. The Contract Documents are complementary; what is required by one is as binding as if required by all.

B. It is the intent of the Contract Documents to describe a functionally complete project (or part thereof) to be constructed in accordance with the Contract Documents. Any labor, documentation, services, materials, or equipment that reasonably may be inferred from the Contract Documents or from prevailing custom or trade usage as being required to produce the indicated result will be provided whether or not specifically called for, at no additional cost to Owner.

C. Clarifications and interpretations of the Contract Documents shall be issued by Engineer as provided in Article 9.

3.02 *Reference Standards*

A. Standards, Specifications, Codes, Laws, and Regulations

1. Reference to standards, specifications, manuals, or codes of any technical society, organization, or association, or to Laws or Regulations, whether such reference be specific or by implication, shall mean the standard, specification, manual, code, or Laws or Regulations in effect at the time of opening of Bids (or on the Effective Date of the Agreement if there were no Bids), except as may be otherwise specifically stated in the Contract Documents.

2. No provision of any such standard, specification, manual, or code, or any instruction of a Supplier, shall be effective to change the duties or responsibilities of Owner, Contractor, or Engineer, or any of their subcontractors, consultants, agents, or employees, from those set forth in the Contract Documents. No such provision or instruction shall be effective to assign to Owner, Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, any duty or authority to supervise or direct the performance of the Work or any duty or authority to undertake responsibility inconsistent with the provisions of the Contract Documents.

3.03 *Reporting and Resolving Discrepancies*

A. *Reporting Discrepancies:*

1. *Contractor's Review of Contract Documents Before Starting Work*: Before undertaking each part of the Work, Contractor shall carefully study and compare the Contract Documents and check and verify pertinent figures therein and all applicable field measurements. Contractor shall promptly report in writing to Engineer any conflict, error, ambiguity, or discrepancy which Contractor discovers, or has actual knowledge of, and shall obtain a written interpretation or clarification from Engineer before proceeding with any Work affected thereby.

2. *Contractor's Review of Contract Documents During Performance of Work*: If, during the performance of the Work, Contractor discovers any conflict, error, ambiguity, or discrepancy within the Contract Documents, or between the Contract Documents and (a) any applicable Law or Regulation, (b) any standard, specification, manual, or code, or (c) any instruction of any Supplier, then Contractor shall promptly report it to Engineer in writing. Contractor shall not proceed with the Work affected thereby (except in an emergency as required by Paragraph 6.16.A) until an amendment or supplement to the Contract Documents has been issued by one of the methods indicated in Paragraph 3.04.

3. Contractor shall not be liable to Owner or Engineer for failure to report any conflict, error, ambiguity, or discrepancy in the Contract Documents unless Contractor had actual knowledge thereof.

B. *Resolving Discrepancies:*

1. Except as may be otherwise specifically stated in the Contract Documents, the provisions of the Contract Documents shall take precedence in resolving any conflict, error, ambiguity, or discrepancy between the provisions of the Contract Documents and:

   a. the provisions of any standard, specification, manual, or code, or the instruction of any Supplier (whether or not specifically incorporated by reference in the Contract Documents); or

   b. the provisions of any Laws or Regulations applicable to the performance of the Work (unless such an interpretation of the provisions of the Contract Documents would result in violation of such Law or Regulation).

3.04 *Amending and Supplementing Contract Documents*

A. The Contract Documents may be amended to provide for additions, deletions, and revisions in the Work or to modify the terms and conditions thereof by either a Change Order or a Work Change Directive.

B. The requirements of the Contract Documents may be supplemented, and minor variations and deviations in the Work may be authorized, by one or more of the following ways:

   1. A Field Order;

   2. Engineer's approval of a Shop Drawing or Sample (subject to the provisions of Paragraph 6.17.D.3); or

   3. Engineer's written interpretation or clarification.

3.05 *Reuse of Documents*

A. Contractor and any Subcontractor or Supplier shall not:

   1. have or acquire any title to or ownership rights in any of the Drawings, Specifications, or other documents (or copies of any thereof) prepared by or bearing the seal of Engineer or its consultants, including electronic media editions; or

   2. reuse any such Drawings, Specifications, other documents, or copies thereof on extensions of the Project or any other project without written consent of Owner and Engineer and specific written verification or adaptation by Engineer.

B. The prohibitions of this Paragraph 3.05 will survive final payment, or termination of the Contract. Nothing herein shall preclude Contractor from retaining copies of the Contract Documents for record purposes.

3.06 *Electronic Data*

A. Unless otherwise stated in the Supplementary Conditions, the data furnished by Owner or Engineer to Contractor, or by Contractor to Owner or Engineer, that may be relied upon are limited to the printed copies (also known as hard copies). Files in electronic media format of text, data, graphics, or other types are furnished only for the convenience of the receiving party. Any conclusion or information obtained or derived from such electronic files will be at the user's sole

risk. If there is a discrepancy between the electronic files and the hard copies, the hard copies govern.

B. Because data stored in electronic media format can deteriorate or be modified inadvertently or otherwise without authorization of the data's creator, the party receiving electronic files agrees that it will perform acceptance tests or procedures within 60 days, after which the receiving party shall be deemed to have accepted the data thus transferred. Any errors detected within the 60-day acceptance period will be corrected by the transferring party.

C. When transferring documents in electronic media format, the transferring party makes no representations as to long term compatibility, usability, or readability of documents resulting from the use of software application packages, operating systems, or computer hardware differing from those used by the data's creator.

ARTICLE 4 – AVAILABILITY OF LANDS; SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS; REFERENCE POINTS

4.01 *Availability of Lands*

A. Owner shall furnish the Site. Owner shall notify Contractor of any encumbrances or restrictions not of general application but specifically related to use of the Site with which Contractor must comply in performing the Work. Owner will obtain in a timely manner and pay for easements for permanent structures or permanent changes in existing facilities. If Contractor and Owner are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times, or both, as a result of any delay in Owner's furnishing the Site or a part thereof, Contractor may make a Claim therefore as provided in Paragraph 10.05.

B. Upon reasonable written request, Owner shall furnish Contractor with a current statement of record legal title and legal description of the lands upon which the Work is to be performed.

C. Contractor shall provide for all additional lands and access thereto that may be required for temporary construction facilities or storage of materials and equipment.

4.02 *Subsurface and Physical Conditions*

A. *Reports and Drawings:* The Supplementary Conditions identify:

1. those reports known to Owner of explorations and tests of subsurface conditions at or contiguous to the Site; and

2. those drawings known to Owner of physical conditions relating to existing surface.

B. *Limited Reliance by Contractor on Technical Data Authorized:* Not Used

4.03 *Differing Subsurface or Physical Conditions*

A. *Notice:* If Contractor believes that any subsurface or physical condition that is uncovered or revealed either:

1. is of such a nature as to require a change in the Contract Documents; or

2. differs materially from that shown or indicated in the Contract Documents; or

3. is of an unusual nature, and differs materially from conditions ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract Documents;

then Contractor shall, promptly after becoming aware thereof and before further disturbing the subsurface or physical conditions or performing any Work in connection therewith (except in an emergency as required by Paragraph 6.16.A), notify Owner and Engineer in writing about such condition. Contractor shall not further disturb such condition or perform any Work in connection therewith (except as aforesaid) until receipt of written order to do so.

B. *Engineer's Review*: After receipt of written notice as required by Paragraph 4.03.A, Engineer will promptly review the pertinent condition, determine the necessity of Owner's obtaining additional exploration or tests with respect thereto, and advise Owner in writing (with a copy to Contractor) of Engineer's findings and conclusions.

C. *Possible Price and Times Adjustments:*

1. The Contract Price or the Contract Times, or both, will be equitably adjusted to the extent that the existence of such differing subsurface or physical condition causes an increase or decrease in Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:

   a. such condition must meet any one or more of the categories described in Paragraph 4.03.A; and

   b. with respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraphs 9.07 and 11.03.

2. Contractor shall not be entitled to any adjustment in the Contract Price or Contract Times if:

   a. Contractor knew of the existence of such conditions at the time Contractor made a final commitment to Owner with respect to Contract Price and Contract Times by the submission of a Bid or becoming bound under a negotiated contract; or

   b. the existence of such condition could reasonably have been discovered or revealed as a result of any examination, investigation, exploration, test, or study of the Site and contiguous areas required by the Bidding Requirements or Contract Documents to be conducted by or for Contractor prior to Contractor's making such final commitment; or

   c. Contractor failed to give the written notice as required by Paragraph 4.03.A.

3. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times, or both, a Claim may be made therefor as provided in Paragraph 10.05. However, neither Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors shall be liable to Contractor for any claims, costs, losses, or damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) sustained by Contractor on or in connection with any other project or anticipated project.

4.04 *Underground Facilities*

A. *Shown or Indicated:* The information and data shown or indicated in the Contract Documents with respect to existing Underground Facilities at or contiguous to the Site is based on information and data furnished to Owner or Engineer by the owners of such Underground Facilities, including Owner, or by others. Unless it is otherwise expressly provided in the Supplementary Conditions:

1. Owner and Engineer shall not be responsible for the accuracy or completeness of any such information or data provided by others; and

2. the cost of all of the following will be included in the Contract Price, and Contractor shall have full responsibility for:

a. reviewing and checking all such information and data;

b. locating all Underground Facilities shown or indicated in the Contract Documents;

c. coordination of the Work with the owners of such Underground Facilities, including Owner, during construction; and

d. the safety and protection of all such Underground Facilities and repairing any damage thereto resulting from the Work.

B. *Not Shown or Indicated:*

1. If an Underground Facility is uncovered or revealed at or contiguous to the Site which was not shown or indicated, or not shown or indicated with reasonable accuracy in the Contract Documents, Contractor shall, promptly after becoming aware thereof and before further disturbing conditions affected thereby or performing any Work in connection therewith (except in an emergency as required by Paragraph 6.16.A), identify the owner of such Underground Facility and give written notice to that owner and to Owner and Engineer. Engineer will promptly review the Underground Facility and determine the extent, if any, to which a change is required in the Contract Documents to reflect and document the consequences of the existence or location of the Underground Facility. During such time, Contractor shall be responsible for the safety and protection of such Underground Facility.

2. If Engineer concludes that a change in the Contract Documents is required, a Work Change Directive or a Change Order will be issued to reflect and document such consequences. An equitable adjustment shall be made in the Contract Price or Contract Times, or both, to the extent that they are attributable to the existence or location of any Underground Facility that was not shown or indicated or not shown or indicated with reasonable accuracy in the Contract Documents and that Contractor did not know of and could not reasonably have been expected to be aware of or to have anticipated. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any such adjustment in Contract Price or Contract Times, Owner or Contractor may make a Claim therefor as provided in Paragraph 10.05.

4.05 *Reference Points*

A. Owner shall provide engineering surveys to establish reference points for construction which in Engineer's judgment are necessary to enable Contractor to proceed with the Work. Contractor

shall be responsible for laying out the Work, shall protect and preserve the established reference points and property monuments, and shall make no changes or relocations without the prior written approval of Owner. Contractor shall report to Engineer whenever any reference point or property monument is lost or destroyed or requires relocation because of necessary changes in grades or locations, and shall be responsible for the accurate replacement or relocation of such reference points or property monuments by professionally qualified personnel.

4.06 *Hazardous Environmental Condition at Site*

A. *Reports and Drawings:* The Supplementary Conditions identify those reports and drawings known to Owner relating to Hazardous Environmental Conditions that have been identified at the Site.

B. *Limited Reliance by Contractor on Technical Data Authorized:* Contractor may rely upon the accuracy of the "technical data" contained in such reports and drawings, but such reports and drawings are not Contract Documents. Such "technical data" is identified in the Supplementary Conditions. Except for such reliance on such "technical data," Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors with respect to:

1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences and procedures of construction to be employed by Contractor and safety precautions and programs incident thereto; or

2. other data, interpretations, opinions and information contained in such reports or shown or indicated in such drawings; or

3. any Contractor interpretation of or conclusion drawn from any "technical data" or any such other data, interpretations, opinions or information.

C. Contractor shall not be responsible for any Hazardous Environmental Condition uncovered or revealed at the Site which was not shown or indicated in Drawings or Specifications or identified in the Contract Documents to be within the scope of the Work. Contractor shall be responsible for a Hazardous Environmental Condition created with any materials brought to the Site by Contractor, Subcontractors, Suppliers, or anyone else for whom Contractor is responsible.

D. If Contractor encounters a Hazardous Environmental Condition, Contractor shall immediately: (i) secure or otherwise isolate such condition; (ii) stop all Work in connection with such condition and in any area affected thereby (except in an emergency as required by Paragraph 6.16.A); and (iii) notify Owner and Engineer (and promptly thereafter confirm such notice in writing). Owner shall promptly consult with Engineer concerning the necessity for Owner to retain a qualified expert to evaluate such condition or take corrective action, if any. Promptly after consulting with Engineer, Owner shall take such actions as are necessary to permit Owner to timely obtain required permits and provide Contractor the written notice required by Paragraph 4.06.E.

E. Contractor shall not be required to resume Work in connection with such condition or in any affected area until after Owner has obtained any required permits related thereto and delivered written notice to Contractor: (i) specifying that such condition and any affected area is or has been rendered safe for the resumption of Work; or (ii) specifying any special conditions under which

such Work may be resumed safely. If Owner and Contractor cannot agree as to entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times, or both, as a result of such Work stoppage or such special conditions under which Work is agreed to be resumed by Contractor, either party may make a Claim therefor as provided in Paragraph 10.05.

F. If after receipt of such written notice Contractor does not agree to resume such Work based on a reasonable belief it is unsafe, or does not agree to resume such Work under such special conditions, then Owner may order the portion of the Work that is in the area affected by such condition to be deleted from the Work. If Owner and Contractor cannot agree as to entitlement to or on the amount or extent, if any, of an adjustment in Contract Price or Contract Times as a result of deleting such portion of the Work, then either party may make a Claim therefor as provided in Paragraph 10.05. Owner may have such deleted portion of the Work performed by Owner's own forces or others in accordance with Article 7.

G. Not Used

H. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of contractors or subcontractors operations or relating to a Hazardous Environmental Condition created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 4.06.H shall obligate Contractor to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

I. The provisions of Paragraphs 4.02, 4.03, and 4.04 do not apply to a Hazardous Environmental Condition uncovered or revealed at the Site.

ARTICLE 5 – BONDS AND INSURANCE

5.01 *Bid, Performance, Payment, and Other Bonds*

A. Contractor shall furnish a Bid security made payable to Owner in an amount of **5 percent.** The Bid security will be retained until such Contractor has executed the Contract Documents, furnished the required contract security and met the other conditions of the Notice of Award, whereupon the Bid security will be returned. Contractor shall also furnish performance and payment bonds, each in an amount at least equal to the Contract Price as security for the faithful performance and payment of all of Contractor's obligations under the Contract Documents. These bonds shall remain in effect until one year after the date when final payment becomes due or until completion of the correction period specified in Paragraph 13.07, whichever is later, except as provided otherwise by Laws or Regulations or by the Contract Documents. Contractor shall also furnish such other bonds as are required by the Contract Documents.

B. All bonds shall be in the form prescribed by the Contract Documents except as provided otherwise by Laws or Regulations, and shall be executed by such sureties as are named in the list of "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Circular 570 (amended) by the Financial Management Service, Surety Bond Branch, U.S. Department of the Treasury. All bonds signed by an agent or attorney-in-fact must be accompanied by a certified copy of that individual's authority

to bind the surety. The evidence of authority shall show that it is effective on the date the agent or attorney-in-fact signed each bond.

C. If the surety on any bond furnished by Contractor is declared bankrupt or becomes insolvent or its right to do business is terminated in any state where any part of the Project is located or it ceases to meet the requirements of Paragraph 5.01.B, Contractor shall promptly notify Owner and Engineer and shall, within 20 days after the event giving rise to such notification, provide another bond and surety, both of which shall comply with the requirements of Paragraphs 5.01.B and 5.02.

5.02 *Licensed Sureties and Insurers*

A. All bonds and insurance required by the Contract Documents to be purchased and maintained by Owner or Contractor shall be obtained from surety or insurance companies that are duly licensed or authorized in the jurisdiction in which the Project is located to issue bonds or insurance policies for the limits and coverages so required. Such surety and insurance companies shall also meet such additional requirements and qualifications as may be provided in the Supplementary Conditions.

5.03 *Certificates of Insurance*

A. Contractor shall deliver to Owner, with copies to each additional insured and loss payee identified in the Supplementary Conditions, certificates of insurance (and other evidence of insurance requested by Owner or any other additional insured) which Contractor is required to purchase and maintain.

B. Owner shall deliver to Contractor, with copies to each additional insured and loss payee identified in the Supplementary Conditions, certificates of insurance (and other evidence of insurance requested by Contractor or any other additional insured) which Owner is required to purchase and maintain.

C. Failure of Owner to demand such certificates or other evidence of Contractor's full compliance with these insurance requirements or failure of Owner to identify a deficiency in compliance from the evidence provided shall not be construed as a waiver of Contractor’s obligation to maintain such insurance.

D. Owner does not represent that insurance coverage and limits established in this Contract necessarily will be adequate to protect Contractor.

E. The insurance and insurance limits required herein shall not be deemed as a limitation on Contractor’s liability under the indemnities granted to Owner in the Contract Documents.

5.04 *Contractor’s Insurance*

A. Contractor shall purchase and maintain such insurance as is appropriate for the Work being performed and as will provide protection from claims set forth below which may arise out of or result from Contractor’s performance of the Work and Contractor’s other obligations under the Contract Documents, whether it is to be performed by Contractor, any Subcontractor or Supplier, or by anyone directly or indirectly employed by any of them to perform any of the Work, or by anyone for whose acts any of them may be liable:

1. claims under workers’ compensation, disability benefits, and other similar employee benefit acts;

2. claims for damages because of bodily injury, occupational sickness or disease, or death of Contractor's employees;

3. claims for damages because of bodily injury, sickness or disease, or death of any person other than Contractor's employees;

4. claims for damages insured by reasonably available personal injury liability coverage which are sustained:

   a. by any person as a result of an offense directly or indirectly related to the employment of such person by Contractor, or

   b. by any other person for any other reason;

5. claims for damages, other than to the Work itself, because of injury to or destruction of tangible property wherever located, including loss of use resulting therefrom; and

6. claims for damages because of bodily injury or death of any person or property damage arising out of the ownership, maintenance or use of any motor vehicle.

B. The policies of insurance required by this Paragraph 5.04 shall:

1. with respect to insurance required by Paragraphs 5.04.A.3 through 5.04.A.6 inclusive, be written on an occurrence basis, include as additional insureds (subject to any customary exclusion regarding professional liability) Owner and Engineer, and any other individuals or entities identified in the Supplementary Conditions, all of whom shall be listed as additional insureds for ongoing and completed operations, and include coverage for the respective officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of all such additional insureds, and the insurance afforded to these additional insureds shall provide primary and non-contributory coverage for all claims covered thereby. ISO additional insured endorsements CG(2010-07/04) and CG(2037-07/04) or their equivalence shall be utilized;

2. include at least the specific coverages and be written for not less than the limits of liability provided in the Supplementary Conditions or required by Laws or Regulations, whichever is greater;

3. include contractual liability insurance covering Contractor's indemnity obligations under Paragraphs 6.11 and 6.20;

4. contain a provision or endorsement that the coverage afforded will not be canceled, materially changed or renewal refused until at least 30 days prior written notice has been given to Owner and Contractor and to each other additional insured identified in the Supplementary Conditions to whom a certificate of insurance has been issued (and the certificates of insurance furnished by the Contractor pursuant to Paragraph 5.03 will so provide);

5. remain in effect at least until final payment and at all times thereafter when Contractor may be correcting, removing, or replacing defective Work in accordance with Paragraph 13.07; and

6. include completed operations coverage:

   a. Such insurance shall remain in effect for five years after final payment.

   b. Contractor shall furnish Owner and each other additional insured identified in the Supplementary Conditions, to whom a certificate of insurance has been issued, evidence satisfactory to Owner and any such additional insured of continuation of such insurance at final payment and one year thereafter.

5.05 *Owner's Liability Insurance*

A. In addition to the insurance required to be provided by Contractor under Paragraph 5.04, Owner, at Owner's option, may purchase and maintain at Owner's expense Owner's own liability insurance as will protect Owner against claims which may arise from operations under the Contract Documents.

5.06 *Property Insurance*

Not Used

5.07 *Waiver of Rights*

A. Owner and Contractor intend that all policies purchased in accordance with Paragraph 5.06 will protect Owner, Contractor, Subcontractors, and Engineer, and all other individuals or entities identified in the Supplementary Conditions as loss payees (and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them) in such policies and will provide primary coverage for all losses and damages caused by the perils or causes of loss covered thereby. All such policies shall contain provisions to the effect that in the event of payment of any loss or damage the insurers will have no rights of recovery against any of the insureds or loss payees thereunder. Owner and Contractor waive all rights against each other and their respective officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them for all losses and damages caused by, arising out of or resulting from any of the perils or causes of loss covered by such policies and any other property insurance applicable to the Work; and, in addition, waive all such rights against Subcontractors and Engineer, and all other individuals or entities identified in the Supplementary Conditions as loss payees (and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them) under such policies for losses and damages so caused. None of the above waivers shall extend to the rights that any party making such waiver may have to the proceeds of insurance held by Owner as trustee or otherwise payable under any policy so issued.

B. Owner waives all rights against Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them for:

   1. loss due to business interruption, loss of use, or other consequential loss extending beyond direct physical loss or damage to Owner's property or the Work caused by, arising out of, or resulting from fire or other perils whether or not insured by Owner; and

   2. loss or damage to the completed Project or part thereof caused by, arising out of, or resulting from fire or other insured peril or cause of loss covered by any property insurance maintained

on the completed Project or part thereof by Owner during partial utilization pursuant to Paragraph 14.05, after Substantial Completion pursuant to Paragraph 14.04, or after final payment pursuant to Paragraph 14.07.

C. Any insurance policy maintained by Owner covering any loss, damage or consequential loss referred to in Paragraph 5.07.B shall contain provisions to the effect that in the event of payment of any such loss, damage, or consequential loss, the insurers will have no rights of recovery against Contractor, Subcontractors, or Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them.

5.08 *Receipt and Application of Insurance Proceeds*

A. Not Used

B. Not Used

5.09 *Acceptance of Bonds and Insurance; Option to Replace*

A. If either Owner or Contractor has any objection to the coverage afforded by or other provisions of the bonds or insurance required to be purchased and maintained by the other party in accordance with Article 5 on the basis of non-conformance with the Contract Documents, the objecting party shall so notify the other party in writing within 10 days after receipt of the certificates (or other evidence requested) required by Paragraph 2.01.B. Owner and Contractor shall each provide to the other such additional information in respect of insurance provided as the other may reasonably request. If either party does not purchase or maintain all of the bonds and insurance required of such party by the Contract Documents, such party shall notify the other party in writing of such failure to purchase prior to the start of the Work, or of such failure to maintain prior to any change in the required coverage. Without prejudice to any other right or remedy, the other party may elect to obtain equivalent bonds or insurance to protect such other party's interests at the expense of the party who was required to provide such coverage, and a Change Order shall be issued to adjust the Contract Price accordingly.

5.10 *Partial Utilization, Acknowledgment of Property Insurer*

Not Used

ARTICLE 6 – CONTRACTOR'S RESPONSIBILITIES

6.01 *Supervision and Superintendence*

A. Contractor shall supervise, inspect, and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with the Contract Documents. Contractor shall be solely responsible for the means, methods, techniques, sequences, and procedures of construction. Contractor shall not be responsible for the negligence of Owner or Engineer in the design or specification of a specific means, method, technique, sequence, or procedure of construction which is shown or indicated in and expressly required by the Contract Documents.

B. At all times during the progress of the Work, Contractor shall assign a competent resident superintendent who shall not be replaced without written notice to Owner and Engineer except under extraordinary circumstances.

6.02 *Labor; Working Hours*

A. Contractor shall provide competent, suitably qualified personnel to survey and lay out the Work and perform construction as required by the Contract Documents. Contractor shall at all times maintain good discipline and order at the Site.

B. Except as otherwise required for the safety or protection of persons or the Work or property at the Site or adjacent thereto, and except as otherwise stated in the Contract Documents, all Work at the Site shall be performed during regular working hours. Contractor will not permit the performance of Work on a Saturday, Sunday, or any legal holiday without Owner's written consent (which will not be unreasonably withheld) given after prior written notice to Engineer.

6.03 *Services, Materials, and Equipment*

A. Unless otherwise specified in the Contract Documents, Contractor shall provide and assume full responsibility for all services, materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities, and all other facilities and incidentals necessary for the performance, testing, start-up, and completion of the Work.

B. All materials and equipment incorporated into the Work shall be as specified or, if not specified, shall be of good quality and new, except as otherwise provided in the Contract Documents. All special warranties and guarantees required by the Specifications shall expressly run to the benefit of Owner. If required by Engineer, Contractor shall furnish satisfactory evidence (including reports of required tests) as to the source, kind, and quality of materials and equipment.

C. All materials and equipment shall be stored, applied, installed, connected, erected, protected, used, cleaned, and conditioned in accordance with instructions of the applicable Supplier, except as otherwise may be provided in the Contract Documents.

6.04 *Progress Schedule*

A. Contractor shall adhere to the Progress Schedule established in accordance with Paragraph 2.07 as it may be adjusted from time to time as provided below.

1. Contractor shall submit to Engineer for acceptance (to the extent indicated in Paragraph 2.07) proposed adjustments in the Progress Schedule that will not result in changing the Contract Times. Such adjustments will comply with any provisions of the General Requirements applicable thereto.

2. Proposed adjustments in the Progress Schedule that will change the Contract Times shall be submitted in accordance with the requirements of Article 12. Adjustments in Contract Times may only be made by a Change Order.

6.05 *Substitutes and "Or-Equals"*

A. Whenever an item of material or equipment is specified or described in the Contract Documents by using the name of a proprietary item or the name of a particular Supplier, the specification or description is intended to establish the type, function, appearance, and quality required. Unless the specification or description contains or is followed by words reading that no like, equivalent, or "or-equal" item or no substitution is permitted, other items of material or equipment or material

or equipment of other Suppliers may be submitted to Engineer for review under the circumstances described below.

1. *"Or-Equal" Items:* If in Engineer's sole discretion an item of material or equipment proposed by Contractor is functionally equal to that named and sufficiently similar so that no change in related Work will be required, it may be considered by Engineer as an "or-equal" item, in which case review and approval of the proposed item may, in Engineer's sole discretion, be accomplished without compliance with some or all of the requirements for approval of proposed substitute items. For the purposes of this Paragraph 6.05.A.1, a proposed item of material or equipment will be considered functionally equal to an item so named if:

    a. in the exercise of reasonable judgment Engineer determines that:

        1) it is at least equal in materials of construction, quality, durability, appearance, strength, and design characteristics;

        2) it will reliably perform at least equally well the function and achieve the results imposed by the design concept of the completed Project as a functioning whole; and

        3) it has a proven record of performance and availability of responsive service.

    b. Contractor certifies that, if approved and incorporated into the Work:

        1) there will be no increase in cost to the Owner or increase in Contract Times; and

        2) it will conform substantially to the detailed requirements of the item named in the Contract Documents.

2. *Substitute Items:*

    a. If in Engineer's sole discretion an item of material or equipment proposed by Contractor does not qualify as an "or-equal" item under Paragraph 6.05.A.1, it will be considered a proposed substitute item.

    b. Contractor shall submit sufficient information as provided below to allow Engineer to determine if the item of material or equipment proposed is essentially equivalent to that named and an acceptable substitute therefor. Requests for review of proposed substitute items of material or equipment will not be accepted by Engineer from anyone other than Contractor.

    c. The requirements for review by Engineer will be as set forth in Paragraph 6.05.A.2.d, as supplemented by the General Requirements, and as Engineer may decide is appropriate under the circumstances.

    d. Contractor shall make written application to Engineer for review of a proposed substitute item of material or equipment that Contractor seeks to furnish or use. The application:

        1) shall certify that the proposed substitute item will:

            a) perform adequately the functions and achieve the results called for by the general design,

b) be similar in substance to that specified, and

c) be suited to the same use as that specified;

2) will state:

a) the extent, if any, to which the use of the proposed substitute item will prejudice Contractor's achievement of Substantial Completion on time,

b) whether use of the proposed substitute item in the Work will require a change in any of the Contract Documents (or in the provisions of any other direct contract with Owner for other work on the Project) to adapt the design to the proposed substitute item, and

c) whether incorporation or use of the proposed substitute item in connection with the Work is subject to payment of any license fee or royalty;

3) will identify:

a) all variations of the proposed substitute item from that specified, and

b) available engineering, sales, maintenance, repair, and replacement services; and

4) shall contain an itemized estimate of all costs or credits that will result directly or indirectly from use of such substitute item, including costs of redesign and claims of other contractors affected by any resulting change.

B. *Substitute Construction Methods or Procedures:* If a specific means, method, technique, sequence, or procedure of construction is expressly required by the Contract Documents, Contractor may furnish or utilize a substitute means, method, technique, sequence, or procedure of construction approved by Engineer. Contractor shall submit sufficient information to allow Engineer, in Engineer's sole discretion, to determine that the substitute proposed is equivalent to that expressly called for by the Contract Documents. The requirements for review by Engineer will be similar to those provided in Paragraph 6.05.A.2.

C. *Engineer's Evaluation:* Engineer will be allowed a reasonable time within which to evaluate each proposal or submittal made pursuant to Paragraphs 6.05.A and 6.05.B. Engineer may require Contractor to furnish additional data about the proposed substitute item. Engineer will be the sole judge of acceptability. No "or equal" or substitute will be ordered, installed or utilized until Engineer's review is complete, which will be evidenced by a Change Order in the case of a substitute and an approved Shop Drawing for an "or equal." Engineer will advise Contractor in writing of any negative determination.

D. *Special Guarantee:* Owner may require Contractor to furnish at Contractor's expense a special performance guarantee or other surety with respect to any substitute.

E. *Engineer's Cost Reimbursement*: Engineer will record Engineer's costs in evaluating a substitute proposed or submitted by Contractor pursuant to Paragraphs 6.05.A.2 and 6.05.B. Whether or not Engineer approves a substitute so proposed or submitted by Contractor, Contractor shall reimburse Owner for the reasonable charges of Engineer for evaluating each such proposed substitute. Contractor shall also reimburse Owner for the reasonable charges of Engineer for making changes

in the Contract Documents (or in the provisions of any other direct contract with Owner) resulting from the acceptance of each proposed substitute.

F. *Contractor's Expense*: Contractor shall provide all data in support of any proposed substitute or "or-equal" at Contractor's expense.

6.06 *Concerning Subcontractors, Suppliers, and Others*

A. Contractor shall not employ any Subcontractor, Supplier, or other individual or entity (including those acceptable to Owner as indicated in Paragraph 6.06.B), whether initially or as a replacement, against whom Owner may have reasonable objection. Contractor shall not be required to employ any Subcontractor, Supplier, or other individual or entity to furnish or perform any of the Work against whom Contractor has reasonable objection.

B. If the Supplementary Conditions require the identity of certain Subcontractors, Suppliers, or other individuals or entities to be submitted to Owner in advance for acceptance by Owner by a specified date prior to the Effective Date of the Agreement, and if Contractor has submitted a list thereof in accordance with the Supplementary Conditions, Owner's acceptance (either in writing or by failing to make written objection thereto by the date indicated for acceptance or objection in the Bidding Documents or the Contract Documents) of any such Subcontractor, Supplier, or other individual or entity so identified may be revoked on the basis of reasonable objection after due investigation. Contractor shall submit an acceptable replacement for the rejected Subcontractor, Supplier, or other individual or entity, and the Contract Price will be adjusted by the difference in the cost occasioned by such replacement, and an appropriate Change Order will be issued. No acceptance by Owner of any such Subcontractor, Supplier, or other individual or entity, whether initially or as a replacement, shall constitute a waiver of any right of Owner or Engineer to reject defective Work.

C. Contractor shall be fully responsible to Owner and Engineer for all acts and omissions of the Subcontractors, Suppliers, and other individuals or entities performing or furnishing any of the Work just as Contractor is responsible for Contractor's own acts and omissions. Nothing in the Contract Documents:

1. shall create for the benefit of any such Subcontractor, Supplier, or other individual or entity any contractual relationship between Owner or Engineer and any such Subcontractor, Supplier or other individual or entity; nor

2. shall create any obligation on the part of Owner or Engineer to pay or to see to the payment of any moneys due any such Subcontractor, Supplier, or other individual or entity except as may otherwise be required by Laws and Regulations.

D. Contractor shall be solely responsible for scheduling and coordinating the Work of Subcontractors, Suppliers, and other individuals or entities performing or furnishing any of the Work under a direct or indirect contract with Contractor.

E. Contractor shall require all Subcontractors, Suppliers, and such other individuals or entities performing or furnishing any of the Work to communicate with Engineer through Contractor.

F. The divisions and sections of the Specifications and the identifications of any Drawings shall not control Contractor in dividing the Work among Subcontractors or Suppliers or delineating the Work to be performed by any specific trade.

G. All Work performed for Contractor by a Subcontractor or Supplier will be pursuant to an appropriate agreement between Contractor and the Subcontractor or Supplier which specifically binds the Subcontractor or Supplier to the applicable terms and conditions of the Contract Documents for the benefit of Owner and Engineer. Whenever any such agreement is with a Subcontractor or Supplier who is listed as a loss payee on the property insurance provided in Paragraph 5.06, the agreement between the Contractor and the Subcontractor or Supplier will contain provisions whereby the Subcontractor or Supplier waives all rights against Owner, Contractor, Engineer, and all other individuals or entities identified in the Supplementary Conditions to be listed as insureds or loss payees (and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them) for all losses and damages caused by, arising out of, relating to, or resulting from any of the perils or causes of loss covered by such policies and any other property insurance applicable to the Work. If the insurers on any such policies require separate waiver forms to be signed by any Subcontractor or Supplier, Contractor will obtain the same.

6.07 *Patent Fees and Royalties*

A. Contractor shall pay all license fees and royalties and assume all costs incident to the use in the performance of the Work or the incorporation in the Work of any invention, design, process, product, or device which is the subject of patent rights or copyrights held by others. If a particular invention, design, process, product, or device is specified in the Contract Documents for use in the performance of the Work and if, to the actual knowledge of Owner or Engineer, its use is subject to patent rights or copyrights calling for the payment of any license fee or royalty to others, the existence of such rights shall be disclosed by Owner in the Contract Documents.

B. Not Used

C. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device not specified in the Contract Documents.

6.08 *Permits*

A. Unless otherwise provided in the Supplementary Conditions, Contractor shall obtain and pay for all construction permits and licenses. Owner shall assist Contractor, when necessary, in obtaining such permits and licenses. Contractor shall pay all governmental charges and inspection fees necessary for the prosecution of the Work which are applicable at the time of opening of Bids, or, if there are no Bids, on the Effective Date of the Agreement. Owner shall pay all charges of utility owners for connections for providing permanent service to the Work.

SECTION XIV

6.09 *Laws and Regulations*

A. Contractor shall give all notices required by and shall comply with all Laws and Regulations applicable to the performance of the Work. Except where otherwise expressly required by applicable Laws and Regulations, neither Owner nor Engineer shall be responsible for monitoring Contractor's compliance with any Laws or Regulations.

B. If Contractor performs any Work knowing or having reason to know that it is contrary to Laws or Regulations, Contractor shall bear all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such Work. However, it shall not be Contractor's responsibility to make certain that the Specifications and Drawings are in accordance with Laws and Regulations, but this shall not relieve Contractor of Contractor's obligations under Paragraph 3.03.

C. Changes in Laws or Regulations not known at the time of opening of Bids (or, on the Effective Date of the Agreement if there were no Bids) having an effect on the cost or time of performance of the Work shall be the subject of an adjustment in Contract Price or Contract Times. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any such adjustment, a Claim may be made therefor as provided in Paragraph 10.05.

6.10 *Taxes*

A. Contractor shall pay all sales, consumer, use, and other similar taxes required to be paid by Contractor in accordance with the Laws and Regulations of the place of the Project which are applicable during the performance of the Work.

6.11 *Use of Site and Other Areas*

A. *Limitation on Use of Site and Other Areas:*

1. Contractor shall confine construction equipment, the storage of materials and equipment, and the operations of workers to the Site and other areas permitted by Laws and Regulations, and shall not unreasonably encumber the Site and other areas with construction equipment or other materials or equipment. Contractor shall assume full responsibility for any damage to any such land or area, or to the owner or occupant thereof, or of any adjacent land or areas resulting from the performance of the Work.

2. Should any claim be made by any such owner or occupant because of the performance of the Work, Contractor shall promptly settle with such other party by negotiation or otherwise resolve the claim by arbitration or other dispute resolution proceeding or at law.

3. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any claim or action, legal or equitable, brought by any such owner or occupant against Owner, Engineer, or any other party indemnified hereunder to the extent caused by or based upon Contractor's performance of the Work.

B. *Removal of Debris During Performance of the Work:* During the progress of the Work Contractor shall keep the Site and other areas free from accumulations of waste materials, rubbish, and other debris. Removal and disposal of such waste materials, rubbish, and other debris shall conform to applicable Laws and Regulations.

C. *Cleaning:* Prior to Substantial Completion of the Work Contractor shall clean the Site and the Work and make it ready for utilization by Owner. At the completion of the Work Contractor shall remove from the Site all tools, appliances, construction equipment and machinery, and surplus materials and shall restore to original condition all property not designated for alteration by the Contract Documents.

D. *Loading Structures:* Contractor shall not load nor permit any part of any structure to be loaded in any manner that will endanger the structure, nor shall Contractor subject any part of the Work or adjacent property to stresses or pressures that will endanger it.

6.12 *Record Documents*

A. Contractor shall maintain in a safe place at the Site one record copy of all Drawings, Specifications, Addenda, Change Orders, Work Change Directives, Field Orders, and written interpretations and clarifications in good order and annotated to show changes made during construction. These record documents together with all approved Samples and a counterpart of all approved Shop Drawings will be available to Engineer for reference. Upon completion of the Work, these record documents, Samples, and Shop Drawings will be delivered to Engineer for Owner.

6.13 *Safety and Protection*

A. Contractor shall be solely responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work. Such responsibility does not relieve Subcontractors of their responsibility for the safety of persons or property in the performance of their work, nor for compliance with applicable safety Laws and Regulations. Contractor shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury or loss to:

1. all persons on the Site or who may be affected by the Work;

2. all the Work and materials and equipment to be incorporated therein, whether in storage on or off the Site; and

3. other property at the Site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, utilities, and Underground Facilities not designated for removal, relocation, or replacement in the course of construction.

B. Contractor shall comply with all applicable Laws and Regulations relating to the safety of persons or property, or to the protection of persons or property from damage, injury, or loss; and shall erect and maintain all necessary safeguards for such safety and protection. Contractor shall notify owners of adjacent property and of Underground Facilities and other utility owners when prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation, and replacement of their property.

C. Contractor shall comply with the applicable requirements of Owner's safety programs, if any. The Supplementary Conditions identify any Owner's safety programs that are applicable to the Work.

D. Contractor shall inform Owner and Engineer of the specific requirements of Contractor's safety program with which Owner's and Engineer's employees and representatives must comply while at the Site.

E. All damage, injury, or loss to any property referred to in Paragraph 6.13.A.2 or 6.13.A.3 caused, directly or indirectly, in whole or in part, by Contractor, any Subcontractor, Supplier, or any other individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, shall be remedied by Contractor (except damage or loss attributable to the fault of Drawings or Specifications or to the acts or omissions of Owner or Engineer or anyone employed by any of them, or anyone for whose acts any of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of Contractor or any Subcontractor, Supplier, or other individual or entity directly or indirectly employed by any of them).

F. Contractor's duties and responsibilities for safety and for protection of the Work shall continue until such time as all the Work is completed and Engineer has issued a notice to Owner and Contractor in accordance with Paragraph 14.07.B that the Work is acceptable (except as otherwise expressly provided in connection with Substantial Completion).

6.14 *Safety Representative*

A. Contractor shall designate a qualified and experienced safety representative at the Site whose duties and responsibilities shall be the prevention of accidents and the maintaining and supervising of safety precautions and programs.

6.15 *Hazard Communication Programs*

A. Contractor shall be responsible for coordinating any exchange of material safety data sheets or other hazard communication information required to be made available to or exchanged between or among employers at the Site in accordance with Laws or Regulations.

6.16 *Emergencies*

A. In emergencies affecting the safety or protection of persons or the Work or property at the Site or adjacent thereto, Contractor is obligated to act to prevent threatened damage, injury, or loss. Contractor shall give Engineer prompt written notice if Contractor believes that any significant changes in the Work or variations from the Contract Documents have been caused thereby or are required as a result thereof. If Engineer determines that a change in the Contract Documents is required because of the action taken by Contractor in response to such an emergency, a Work Change Directive or Change Order will be issued.

6.17 *Shop Drawings and Samples*

A. Contractor shall submit Shop Drawings and Samples to Engineer for review and approval in accordance with the accepted Schedule of Submittals (as required by Paragraph 2.07). Each submittal will be identified as Engineer may require.

SECTION XIV

1. *Shop Drawings:*

    a. Submit number of copies specified in the General Requirements.

    b. Data shown on the Shop Drawings will be complete with respect to quantities, dimensions, specified performance and design criteria, materials, and similar data to show Engineer the services, materials, and equipment Contractor proposes to provide and to enable Engineer to review the information for the limited purposes required by Paragraph 6.17.D.

2. *Samples:*

    a. Submit number of Samples specified in the Specifications.

    b. Clearly identify each Sample as to material, Supplier, pertinent data such as catalog numbers, the use for which intended and other data as Engineer may require to enable Engineer to review the submittal for the limited purposes required by Paragraph 6.17.D.

B. Where a Shop Drawing or Sample is required by the Contract Documents or the Schedule of Submittals, any related Work performed prior to Engineer's review and approval of the pertinent submittal will be at the sole expense and responsibility of Contractor.

C. *Submittal Procedures:*

1. Before submitting each Shop Drawing or Sample, Contractor shall have:

    a. reviewed and coordinated each Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents;

    b. determined and verified all field measurements, quantities, dimensions, specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information with respect thereto;

    c. determined and verified the suitability of all materials offered with respect to the indicated application, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work; and

    d. determined and verified all information relative to Contractor's responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto.

2. Each submittal shall bear a stamp or specific written certification that Contractor has satisfied Contractor's obligations under the Contract Documents with respect to Contractor's review and approval of that submittal.

3. With each submittal, Contractor shall give Engineer specific written notice of any variations that the Shop Drawing or Sample may have from the requirements of the Contract Documents. This notice shall be both a written communication separate from the Shop Drawings or Sample submittal; and, in addition, by a specific notation made on each Shop Drawing or Sample submitted to Engineer for review and approval of each such variation.

D. *Engineer's Review:*

1. Engineer will provide timely review of Shop Drawings and Samples in accordance with the Schedule of Submittals acceptable to Engineer. Engineer's review and approval will be only to determine if the items covered by the submittals will, after installation or incorporation in the Work, conform to the information given in the Contract Documents and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents.

2. Engineer's review and approval will not extend to means, methods, techniques, sequences, or procedures of construction (except where a particular means, method, technique, sequence, or procedure of construction is specifically and expressly called for by the Contract Documents) or to safety precautions or programs incident thereto. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

3. Engineer's review and approval shall not relieve Contractor from responsibility for any variation from the requirements of the Contract Documents unless Contractor has complied with the requirements of Paragraph 6.17.C.3 and Engineer has given written approval of each such variation by specific written notation thereof incorporated in or accompanying the Shop Drawing or Sample. Engineer's review and approval shall not relieve Contractor from responsibility for complying with the requirements of Paragraph 6.17.C.1.

E. *Resubmittal Procedures:*

1. Contractor shall make corrections required by Engineer and shall return the required number of corrected copies of Shop Drawings and submit, as required, new Samples for review and approval. Contractor shall direct specific attention in writing to revisions other than the corrections called for by Engineer on previous submittals.

6.18 *Continuing the Work*

A. Contractor shall carry on the Work and adhere to the Progress Schedule during all disputes or disagreements with Owner. No Work shall be delayed or postponed pending resolution of any disputes or disagreements, except as permitted by Paragraph 15.04 or as Owner and Contractor may otherwise agree in writing.

6.19 *Contractor's General Warranty and Guarantee*

A. Contractor warrants and guarantees to Owner that all Work will be in accordance with the Contract Documents and will not be defective. Engineer and its officers, directors, members, partners, employees, agents, consultants, and subcontractors shall be entitled to rely on representation of Contractor's warranty and guarantee.

B. Contractor's warranty and guarantee hereunder excludes defects or damage caused by:

1. abuse, modification, or improper maintenance or operation by persons other than Contractor, Subcontractors, Suppliers, or any other individual or entity for whom Contractor is responsible; or

2. normal wear and tear under normal usage.

C. Contractor's obligation to perform and complete the Work in accordance with the Contract Documents shall be absolute. None of the following will constitute an acceptance of Work that is

not in accordance with the Contract Documents or a release of Contractor's obligation to perform the Work in accordance with the Contract Documents:

1. observations by Engineer;

2. recommendation by Engineer or payment by Owner of any progress or final payment;

3. the issuance of a certificate of Substantial Completion by Engineer or any payment related thereto by Owner;

4. use or occupancy of the Work or any part thereof by Owner;

5. any review and approval of a Shop Drawing or Sample submittal or the issuance of a notice of acceptability by Engineer;

6. any inspection, test, or approval by others; or

7. any correction of defective Work by Owner.

6.20 *Indemnification*

A. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to the performance of the Work, provided that any such claim, cost, loss, or damage is attributable to bodily injury, sickness, disease, or death, or to injury to or destruction of tangible property (other than the Work itself), including the loss of use resulting therefrom but only to the extent caused by any negligent act or omission of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work or anyone for whose acts any of them may be liable .

B. In any and all claims against Owner or Engineer or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors by any employee (or the survivor or personal representative of such employee) of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, the indemnification obligation under Paragraph 6.20.A shall not be limited in any way by any limitation on the amount or type of damages, compensation, or benefits payable by or for Contractor or any such Subcontractor, Supplier, or other individual or entity under workers' compensation acts, disability benefit acts, or other employee benefit acts.

C. The indemnification obligations of Contractor under Paragraph 6.20.A shall not extend to the liability of Engineer and Engineer's officers, directors, members, partners, employees, agents, consultants and subcontractors arising out of:

1. the preparation or approval of, or the failure to prepare or approve maps, Drawings, opinions, reports, surveys, Change Orders, designs, or Specifications; or

2. giving directions or instructions, or failing to give them, if that is the primary cause of the injury or damage.

6.21 *Delegation of Professional Design Services*

A. Contractor will not be required to provide professional design services unless such services are specifically required by the Contract Documents for a portion of the Work or unless such services are required to carry out Contractor's responsibilities for construction means, methods, techniques, sequences and procedures. Contractor shall not be required to provide professional services in violation of applicable law.

B. If professional design services or certifications by a design professional related to systems, materials or equipment are specifically required of Contractor by the Contract Documents, Owner and Engineer will specify all performance and design criteria that such services must satisfy. Contractor shall cause such services or certifications to be provided by a properly licensed professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings and other submittals prepared by such professional. Shop Drawings and other submittals related to the Work designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to Engineer.

C. Owner and Engineer shall be entitled to rely upon the adequacy, accuracy and completeness of the services, certifications or approvals performed by such design professionals, provided Owner and Engineer have specified to Contractor all performance and design criteria that such services must satisfy.

D. Pursuant to this Paragraph 6.21, Engineer's review and approval of design calculations and design drawings will be only for the limited purpose of checking for conformance with performance and design criteria given and the design concept expressed in the Contract Documents. Engineer's review and approval of Shop Drawings and other submittals (except design calculations and design drawings) will be only for the purpose stated in Paragraph 6.17.D.1.

E. Contractor shall not be responsible for the adequacy of the performance or design criteria required by the Contract Documents.

ARTICLE 7 – OTHER WORK AT THE SITE

7.01 *Related Work at Site*

A. Owner may perform other work related to the Project at the Site with Owner's employees, or through other direct contracts therefor, or have other work performed by utility owners. If such other work is not noted in the Contract Documents, then:

1. written notice thereof will be given to Contractor prior to starting any such other work; and

2. if Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times that should be allowed as a result of such other work, a Claim may be made therefor as provided in Paragraph 10.05.

B. Contractor shall afford each other contractor who is a party to such a direct contract, each utility owner, and Owner, if Owner is performing other work with Owner's employees, proper and safe access to the Site, provide a reasonable opportunity for the introduction and storage of materials

and equipment and the execution of such other work, and properly coordinate the Work with theirs. Contractor shall do all cutting, fitting, and patching of the Work that may be required to properly connect or otherwise make its several parts come together and properly integrate with such other work. Contractor shall not endanger any work of others by cutting, excavating, or otherwise altering such work; provided, however, that Contractor may cut or alter others' work with the written consent of Engineer and the others whose work will be affected. The duties and responsibilities of Contractor under this Paragraph are for the benefit of such utility owners and other contractors to the extent that there are comparable provisions for the benefit of Contractor in said direct contracts between Owner and such utility owners and other contractors.

C. If the proper execution or results of any part of Contractor's Work depends upon work performed by others under this Article 7, Contractor shall inspect such other work and promptly report to Engineer in writing any delays, defects, or deficiencies in such other work that render it unavailable or unsuitable for the proper execution and results of Contractor's Work. Contractor's failure to so report will constitute an acceptance of such other work as fit and proper for integration with Contractor's Work except for latent defects and deficiencies in such other work.

7.02 *Coordination*

A. If Owner intends to contract with others for the performance of other work on the Project at the Site, the following will be set forth in Supplementary Conditions:

1. the individual or entity who will have authority and responsibility for coordination of the activities among the various contractors will be identified;

2. the specific matters to be covered by such authority and responsibility will be itemized; and

3. the extent of such authority and responsibilities will be provided.

B. Unless otherwise provided in the Supplementary Conditions, Owner shall have sole authority and responsibility for such coordination.

7.03 *Legal Relationships*

A. Paragraphs 7.01.A and 7.02 are not applicable for utilities not under the control of Owner.

B. Each other direct contract of Owner under Paragraph 7.01.A shall provide that the other contractor is liable to Owner and Contractor for the reasonable direct delay and disruption costs incurred by Contractor as a result of the other contractor's wrongful actions or inactions.

C. Contractor shall be liable to Owner and any other contractor under direct contract to Owner for the reasonable direct delay and disruption costs incurred by such other contractor as a result of Contractor's wrongful action or inactions.

ARTICLE 8 – OWNER'S RESPONSIBILITIES

8.01 *Communications to Contractor*

A. Except as otherwise provided in these General Conditions, Owner shall issue all communications to Contractor through Engineer.

SECTION XIV

8.02 *Replacement of Engineer*

A. In case of termination of the employment of Engineer, Owner shall appoint an engineer to whom Contractor makes no reasonable objection, whose status under the Contract Documents shall be that of the former Engineer.

8.03 *Furnish Data*

A. Owner shall promptly furnish the data required of Owner under the Contract Documents.

8.04 *Pay When Due*

A. Owner shall make payments to Contractor when they are due as provided in Paragraphs 14.02.C and 14.07.C.

8.05 *Lands and Easements; Reports and Tests*

A. Owner's duties with respect to providing lands and easements and providing engineering surveys to establish reference points are set forth in Paragraphs 4.01 and 4.05. Paragraph 4.02 refers to Owner's identifying and making available to Contractor copies of reports of explorations and tests of subsurface conditions and drawings of physical conditions relating to existing surface or subsurface structures at the Site.

8.06 *Insurance*

A. Owner's responsibilities, if any, with respect to purchasing and maintaining liability and property insurance are set forth in Article 5.

8.07 *Change Orders*

A. Owner is obligated to execute Change Orders as indicated in Paragraph 10.03.

8.08 *Inspections, Tests, and Approvals*

A. Owner's responsibility with respect to certain inspections, tests, and approvals is set forth in Paragraph 13.03.B.

8.09 *Limitations on Owner's Responsibilities*

A. The Owner shall not supervise, direct, or have control or authority over, nor be responsible for, Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Owner will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.

8.10 *Undisclosed Hazardous Environmental Condition*

A. Not Used

8.11 *Evidence of Financial Arrangements*

A. Upon request of Contractor, Owner shall furnish Contractor reasonable evidence that financial arrangements have been made to satisfy Owner's obligations under the Contract Documents.

8.12 *Compliance with Safety Program*

A. While at the Site, Owner's employees and representatives shall comply with the specific applicable requirements of Contractor's safety programs of which Owner has been informed pursuant to Paragraph 6.13.D.

ARTICLE 9 – ENGINEER'S STATUS DURING CONSTRUCTION

9.01 *Owner's Representative*

A. Engineer will be Owner's representative during the construction period. The duties and responsibilities and the limitations of authority of Engineer as Owner's representative during construction are set forth in the Contract Documents.

9.02 *Visits to Site*

A. Engineer will make visits to the Site at intervals appropriate to the various stages of construction as Engineer deems necessary in order to observe as an experienced and qualified design professional the progress that has been made and the quality of the various aspects of Contractor's executed Work. Based on information obtained during such visits and observations, Engineer, for the benefit of Owner, will determine, in general, if the Work is proceeding in accordance with the Contract Documents. Engineer will not be required to make exhaustive or continuous inspections on the Site to check the quality or quantity of the Work. Engineer's efforts will be directed toward providing for Owner a greater degree of confidence that the completed Work will conform generally to the Contract Documents. On the basis of such visits and observations, Engineer will keep Owner informed of the progress of the Work and will endeavor to guard Owner against defective Work.

B. Engineer's visits and observations are subject to all the limitations on Engineer's authority and responsibility set forth in Paragraph 9.09. Particularly, but without limitation, during or as a result of Engineer's visits or observations of Contractor's Work, Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work.

9.03 *Project Representative*

A. If Owner and Engineer agree, Engineer will furnish a Resident Project Representative to assist Engineer in providing more extensive observation of the Work. The authority and responsibilities of any such Resident Project Representative and assistants will be as provided in the Supplementary Conditions, and limitations on the responsibilities thereof will be as provided in Paragraph 9.09. If Owner designates another representative or agent to represent Owner at the Site who is not Engineer's consultant, agent or employee, the responsibilities and authority and limitations thereon of such other individual or entity will be as provided in the Supplementary Conditions.

SECTION XIV

9.04 *Authorized Variations in Work*

A. Engineer may authorize minor variations in the Work from the requirements of the Contract Documents which do not involve an adjustment in the Contract Price or the Contract Times and are compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. These may be accomplished by a Field Order and will be binding on Owner and also on Contractor, who shall perform the Work involved promptly. If Owner or Contractor believes that a Field Order justifies an adjustment in the Contract Price or Contract Times, or both, and the parties are unable to agree on entitlement to or on the amount or extent, if any, of any such adjustment, a Claim may be made therefor as provided in Paragraph 10.05.

9.05 *Rejecting Defective Work*

A. Engineer will have authority to reject Work which Engineer believes to be defective, or that Engineer believes will not produce a completed Project that conforms to the Contract Documents or that will prejudice the integrity of the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. Engineer will also have authority to require special inspection or testing of the Work as provided in Paragraph 13.04, whether or not the Work is fabricated, installed, or completed.

9.06 *Shop Drawings, Change Orders and Payments*

A. In connection with Engineer's authority, and limitations thereof, as to Shop Drawings and Samples, see Paragraph 6.17.

B. In connection with Engineer's authority, and limitations thereof, as to design calculations and design drawings submitted in response to a delegation of professional design services, if any, see Paragraph 6.21.

C. In connection with Engineer's authority as to Change Orders, see Articles 10, 11, and 12.

D. In connection with Engineer's authority as to Applications for Payment, see Article 14.

9.07 *Determinations for Unit Price Work*

A. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor. Engineer will review with Contractor the Engineer's preliminary determinations on such matters before rendering a written decision thereon (by recommendation of an Application for Payment or otherwise).

9.08 *Decisions on Requirements of Contract Documents and Acceptability of Work*

A. Engineer will be the initial interpreter of the requirements of the Contract Documents and judge of the acceptability of the Work thereunder. All matters in question and other matters between Owner and Contractor arising prior to the date final payment is due relating to the acceptability of the Work, and the interpretation of the requirements of the Contract Documents pertaining to the performance of the Work, will be referred initially to Engineer in writing within 30 days of the event giving rise to the question.

B. Engineer will, with reasonable promptness, render a written decision on the issue referred. If Owner or Contractor believes that any such decision entitles them to an adjustment in the Contract Price or Contract Times or both, a Claim may be made under Paragraph 10.05. The date of Engineer's decision shall be the date of the event giving rise to the issues referenced for the purposes of Paragraph 10.05.B.

C. Engineer's written decision on the issue referred will be final and binding on Owner and Contractor, subject to the provisions of Paragraph 10.05.

D. When functioning as interpreter and judge under this Paragraph 9.08, Engineer will not show partiality to Owner or Contractor and will not be liable in connection with any interpretation or decision rendered in good faith in such capacity.

9.09 *Limitations on Engineer's Authority and Responsibilities*

A. Neither Engineer's authority or responsibility under this Article 9 or under any other provision of the Contract Documents nor any decision made by Engineer in good faith either to exercise or not exercise such authority or responsibility or the undertaking, exercise, or performance of any authority or responsibility by Engineer shall create, impose, or give rise to any duty in contract, tort, or otherwise owed by Engineer to Contractor, any Subcontractor, any Supplier, any other individual or entity, or to any surety for or employee or agent of any of them.

B. Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Engineer will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.

C. Engineer will not be responsible for the acts or omissions of Contractor or of any Subcontractor, any Supplier, or of any other individual or entity performing any of the Work.

D. Engineer's review of the final Application for Payment and accompanying documentation and all maintenance and operating instructions, schedules, guarantees, bonds, certificates of inspection, tests and approvals, and other documentation required to be delivered by Paragraph 14.07.A will only be to determine generally that their content complies with the requirements of, and in the case of certificates of inspections, tests, and approvals that the results certified indicate compliance with, the Contract Documents.

E. The limitations upon authority and responsibility set forth in this Paragraph 9.09 shall also apply to the Resident Project Representative, if any, and assistants, if any.

9.10 *Compliance with Safety Program*

A. While at the Site, Engineer's employees and representatives shall comply with the specific applicable requirements of Contractor's safety programs of which Engineer has been informed pursuant to Paragraph 6.13.D.

SECTION XIV

ARTICLE 10 – CHANGES IN THE WORK; CLAIMS

10.01 *Authorized Changes in the Work*

A. Without invalidating the Contract and without notice to any surety, Owner may, at any time or from time to time, order additions, deletions, or revisions in the Work by a Change Order, or a Work Change Directive. Upon receipt of any such document, Contractor shall promptly proceed with the Work involved which will be performed under the applicable conditions of the Contract Documents (except as otherwise specifically provided).

B. If Owner and Contractor are unable to agree on entitlement to, or on the amount or extent, if any, of an adjustment in the Contract Price or Contract Times, or both, that should be allowed as a result of a Work Change Directive, a Claim may be made therefor as provided in Paragraph 10.05.

10.02 *Unauthorized Changes in the Work*

A. Contractor shall not be entitled to an increase in the Contract Price or an extension of the Contract Times with respect to any work performed that is not required by the Contract Documents as amended, modified, or supplemented as provided in Paragraph 3.04, except in the case of an emergency as provided in Paragraph 6.16 or in the case of uncovering Work as provided in Paragraph 13.04.D.

10.03 *Execution of Change Orders*

A. Owner and Contractor shall execute appropriate Change Orders recommended by Engineer covering:

1. changes in the Work which are: (i) ordered by Owner pursuant to Paragraph 10.01.A, (ii) required because of acceptance of defective Work under Paragraph 13.08.A or Owner's correction of defective Work under Paragraph 13.09, or (iii) agreed to by the parties;

2. changes in the Contract Price or Contract Times which are agreed to by the parties, including any undisputed sum or amount of time for Work actually performed in accordance with a Work Change Directive; and

3. changes in the Contract Price or Contract Times which embody the substance of any written decision rendered by Engineer pursuant to Paragraph 10.05; provided that, in lieu of executing any such Change Order, an appeal may be taken from any such decision in accordance with the provisions of the Contract Documents and applicable Laws and Regulations, but during any such appeal, Contractor shall carry on the Work and adhere to the Progress Schedule as provided in Paragraph 6.18.A.

10.04 *Notification to Surety*

A. If the provisions of any bond require notice to be given to a surety of any change affecting the general scope of the Work or the provisions of the Contract Documents (including, but not limited to, Contract Price or Contract Times), the giving of any such notice will be Contractor's responsibility. The amount of each applicable bond will be adjusted to reflect the effect of any such change.

10.05 *Claims*

A. *Engineer's Decision Required*: All Claims, except those waived pursuant to Paragraph 14.09, shall be referred to the Engineer for decision. A decision by Engineer shall be required as a condition precedent to any exercise by Owner or Contractor of any rights or remedies either may otherwise have under the Contract Documents or by Laws and Regulations in respect of such Claims.

B. *Notice:* Written notice stating the general nature of each Claim shall be delivered by the claimant to Engineer and the other party to the Contract promptly (but in no event later than 30 days) after the start of the event giving rise thereto. The responsibility to substantiate a Claim shall rest with the party making the Claim. Notice of the amount or extent of the Claim, with supporting data shall be delivered to the Engineer and the other party to the Contract within 60 days after the start of such event (unless Engineer allows additional time for claimant to submit additional or more accurate data in support of such Claim). A Claim for an adjustment in Contract Price shall be prepared in accordance with the provisions of Paragraph 12.01.B. A Claim for an adjustment in Contract Times shall be prepared in accordance with the provisions of Paragraph 12.02.B. Each Claim shall be accompanied by claimant's written statement that the adjustment claimed is the entire adjustment to which the claimant believes it is entitled as a result of said event. The opposing party shall submit any response to Engineer and the claimant within 30 days after receipt of the claimant's last submittal (unless Engineer allows additional time).

C. *Engineer's Action*: Engineer will review each Claim and, within 30 days after receipt of the last submittal of the claimant or the last submittal of the opposing party, if any, take one of the following actions in writing:

1. deny the Claim in whole or in part;

2. approve the Claim; or

3. notify the parties that the Engineer is unable to resolve the Claim if, in the Engineer's sole discretion, it would be inappropriate for the Engineer to do so. For purposes of further resolution of the Claim, such notice shall be deemed a denial.

D. In the event that Engineer does not take action on a Claim within said 30 days, the Claim shall be deemed denied.

E. Engineer's written action under Paragraph 10.05.C or denial pursuant to Paragraphs 10.05.C.3 or 10.05.D will be final and binding upon Owner and Contractor, unless Owner or Contractor invoke the dispute resolution procedure set forth in Article 16 within 30 days of such action or denial.

F. No Claim for an adjustment in Contract Price or Contract Times will be valid if not submitted in accordance with this Paragraph 10.05.

ARTICLE 11 – COST OF THE WORK; ALLOWANCES; UNIT PRICE WORK

11.01 *Cost of the Work*

A. *Costs Included:* The term Cost of the Work means the sum of all costs, except those excluded in Paragraph 11.01.B, necessarily incurred and paid by Contractor in the proper performance of the Work. When the value of any Work covered by a Change Order or when a Claim for an adjustment

in Contract Price is determined on the basis of Cost of the Work, the costs to be reimbursed to Contractor will be only those additional or incremental costs required because of the change in the Work or because of the event giving rise to the Claim. Except as otherwise may be agreed to in writing by Owner, such costs shall be in amounts no higher than those prevailing in the locality of the Project, shall not include any of the costs itemized in Paragraph 11.01.B, and shall include only the following items:

1. Payroll costs for employees in the direct employ of Contractor in the performance of the Work under schedules of job classifications agreed upon by Owner and Contractor. Such employees shall include, without limitation, superintendents, foremen, and other personnel employed full time on the Work. Payroll costs for employees not employed full time on the Work shall be apportioned on the basis of their time spent on the Work. Payroll costs shall include, but not be limited to, salaries and wages plus the cost of fringe benefits, which shall include social security contributions, unemployment, excise, and payroll taxes, workers' compensation, health and retirement benefits, bonuses, sick leave, vacation and holiday pay applicable thereto. The expenses of performing Work outside of regular working hours, on Saturday, Sunday, or legal holidays, shall be included in the above to the extent authorized by Owner.

2. Cost of all materials and equipment furnished and incorporated in the Work, including costs of transportation and storage thereof, and Suppliers' field services required in connection therewith. All cash discounts shall accrue to Contractor unless Owner deposits funds with Contractor with which to make payments, in which case the cash discounts shall accrue to Owner. All trade discounts, rebates and refunds and returns from sale of surplus materials and equipment shall accrue to Owner, and Contractor shall make provisions so that they may be obtained.

3. Payments made by Contractor to Subcontractors for Work performed by Subcontractors. If required by Owner, Contractor shall obtain competitive bids from subcontractors acceptable to Owner and Contractor and shall deliver such bids to Owner, who will then determine, with the advice of Engineer, which bids, if any, will be acceptable. If any subcontract provides that the Subcontractor is to be paid on the basis of Cost of the Work plus a fee, the Subcontractor's Cost of the Work and fee shall be determined in the same manner as Contractor's Cost of the Work and fee as provided in this Paragraph 11.01.

4. Costs of special consultants (including but not limited to engineers, architects, testing laboratories, surveyors, attorneys, and accountants) employed for services specifically related to the Work.

5. Supplemental costs including the following:

    a. The proportion of necessary transportation, travel, and subsistence expenses of Contractor's employees incurred in discharge of duties connected with the Work.

    b. Cost, including transportation and maintenance, of all materials, supplies, equipment, machinery, appliances, office, and temporary facilities at the Site, and hand tools not owned by the workers, which are consumed in the performance of the Work, and cost, less market value, of such items used but not consumed which remain the property of Contractor.

c. Rentals of all construction equipment and machinery, and the parts thereof whether rented from Contractor or others in accordance with rental agreements approved by Owner with the advice of Engineer, and the costs of transportation, loading, unloading, assembly, dismantling, and removal thereof. All such costs shall be in accordance with the terms of said rental agreements. The rental of any such equipment, machinery, or parts shall cease when the use thereof is no longer necessary for the Work.

d. Sales, consumer, use, and other similar taxes related to the Work, and for which Contractor is liable, as imposed by Laws and Regulations.

e. Deposits lost for causes other than negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, and royalty payments and fees for permits and licenses.

f. Losses and damages (and related expenses) caused by damage to the Work, not compensated by insurance or otherwise, sustained by Contractor in connection with the performance of the Work (except losses and damages within the deductible amounts of property insurance established in accordance with Paragraph 5.06.D), provided such losses and damages have resulted from causes other than the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable. Such losses shall include settlements made with the written consent and approval of Owner. No such losses, damages, and expenses shall be included in the Cost of the Work for the purpose of determining Contractor's fee.

g. The cost of utilities, fuel, and sanitary facilities at the Site.

h. Minor expenses such as telegrams, long distance telephone calls, telephone service at the Site, express and courier services, and similar petty cash items in connection with the Work.

i. The costs of premiums for all bonds and insurance Contractor are required by the Contract Documents to purchase and maintain.

B. *Costs Excluded:* The term Cost of the Work shall not include any of the following items:

1. Payroll costs and other compensation of Contractor's officers, executives, principals (of partnerships and sole proprietorships), general managers, safety managers, engineers, architects, estimators, attorneys, auditors, accountants, purchasing and contracting agents, expediters, timekeepers, clerks, and other personnel employed by Contractor, whether at the Site or in Contractor's principal or branch office for general administration of the Work and not specifically included in the agreed upon schedule of job classifications referred to in Paragraph 11.01.A.1 or specifically covered by Paragraph 11.01.A.4, all of which are to be considered administrative costs covered by the Contractor's fee.

2. Expenses of Contractor's principal and branch offices other than Contractor's office at the Site.

3. Any part of Contractor's capital expenses, including interest on Contractor's capital employed for the Work and charges against Contractor for delinquent payments.

4. Costs due to the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, including but not limited to, the correction of defective Work, disposal of materials or equipment wrongly supplied, and making good any damage to property.

5. Other overhead or general expense costs of any kind and the costs of any item not specifically and expressly included in Paragraphs 11.01.A.

C. *Contractor's Fee:* When all the Work is performed on the basis of cost-plus, Contractor's fee shall be determined as set forth in the Agreement. When the value of any Work covered by a Change Order or when a Claim for an adjustment in Contract Price is determined on the basis of Cost of the Work, Contractor's fee shall be determined as set forth in Paragraph 12.01.C.

D. *Documentation:* Whenever the Cost of the Work for any purpose is to be determined pursuant to Paragraphs 11.01.A and 11.01.B, Contractor will establish and maintain records thereof in accordance with generally accepted accounting practices and submit in a form acceptable to Engineer an itemized cost breakdown together with supporting data.

11.02 *Allowances*

A. It is understood that Contractor has included in the Contract Price all allowances so named in the Contract Documents and shall cause the Work so covered to be performed for such sums and by such persons or entities as may be acceptable to Owner and Engineer.

B. *Cash Allowances:*

1. Contractor agrees that:

a. the cash allowances include the cost to Contractor (less any applicable trade discounts) of materials and equipment required by the allowances to be delivered at the Site, and all applicable taxes; and

b. Contractor's costs for unloading and handling on the Site, labor, installation, overhead, profit, and other expenses contemplated for the cash allowances have been included in the Contract Price and not in the allowances, and no demand for additional payment on account of any of the foregoing will be valid.

C. *Contingency Allowance:*

1. Contractor agrees that a contingency allowance, if any, is for the sole use of Owner to cover unanticipated costs.

D. Prior to final payment, an appropriate Change Order will be issued as recommended by Engineer to reflect actual amounts due Contractor on account of Work covered by allowances, and the Contract Price shall be correspondingly adjusted.

11.03 *Unit Price Work*

A. Where the Contract Documents provide that all or part of the Work is to be Unit Price Work, initially the Contract Price will be deemed to include for all Unit Price Work an amount equal to

the sum of the unit price for each separately identified item of Unit Price Work times the estimated quantity of each item as indicated in the Agreement.

B. The estimated quantities of items of Unit Price Work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Price. Determinations of the actual quantities and classifications of Unit Price Work performed by Contractor will be made by Engineer subject to the provisions of Paragraph 9.07.

C. Each unit price will be deemed to include an amount considered by Contractor to be adequate to cover Contractor's overhead and profit for each separately identified item.

D. Owner or Contractor may make a Claim for an adjustment in the Contract Price in accordance with Paragraph 10.05 if:

1. the quantity of any item of Unit Price Work performed by Contractor differs materially and significantly from the estimated quantity of such item indicated in the Agreement; and

2. there is no corresponding adjustment with respect to any other item of Work; and

3. Contractor believes that Contractor is entitled to an increase in Contract Price as a result of having incurred additional expense or Owner believes that Owner is entitled to a decrease in Contract Price and the parties are unable to agree as to the amount of any such increase or decrease.

ARTICLE 12 – CHANGE OF CONTRACT PRICE; CHANGE OF CONTRACT TIMES

12.01 *Change of Contract Price*

A. The Contract Price may only be changed by a Change Order. Any Claim for an adjustment in the Contract Price shall be based on written notice submitted by the party making the Claim to the Engineer and the other party to the Contract in accordance with the provisions of Paragraph 10.05.

B. The value of any Work covered by a Change Order or of any Claim for an adjustment in the Contract Price will be determined as follows:

1. where the Work involved is covered by unit prices contained in the Contract Documents, by application of such unit prices to the quantities of the items involved (subject to the provisions of Paragraph 11.03); or

2. where the Work involved is not covered by unit prices contained in the Contract Documents, by a mutually agreed lump sum (which may include an allowance for overhead and profit not necessarily in accordance with Paragraph 12.01.C.2); or

3. where the Work involved is not covered by unit prices contained in the Contract Documents and agreement to a lump sum is not reached under Paragraph 12.01.B.2, on the basis of the Cost of the Work (determined as provided in Paragraph 11.01) plus a Contractor's fee for overhead and profit (determined as provided in Paragraph 12.01.C).

C. *Contractor's Fee:* The Contractor's fee for overhead and profit shall be determined as follows:

1. a mutually acceptable fixed fee; or

2. if a fixed fee is not agreed upon, then a fee based on the following percentages of the various portions of the Cost of the Work:

   a. for costs incurred under Paragraphs 11.01.A.1 and 11.01.A.2, the Contractor's fee shall be 15 percent;

   b. for costs incurred under Paragraph 11.01.A.3, the Contractor's fee shall be five percent;

   c. where one or more tiers of subcontracts are on the basis of Cost of the Work plus a fee and no fixed fee is agreed upon, the intent of Paragraphs 12.01.C.2.a and 12.01.C.2.b is that the Subcontractor who actually performs the Work, at whatever tier, will be paid a fee of 15 percent of the costs incurred by such Subcontractor under Paragraphs 11.01.A.1 and 11.01.A.2 and that any higher tier Subcontractor and Contractor will each be paid a fee of five percent of the amount paid to the next lower tier Subcontractor;

   d. no fee shall be payable on the basis of costs itemized under Paragraphs 11.01.A.4, 11.01.A.5, and 11.01.B;

   e. the amount of credit to be allowed by Contractor to Owner for any change which results in a net decrease in cost will be the amount of the actual net decrease in cost plus a deduction in Contractor's fee by an amount equal to five percent of such net decrease; and

   f. when both additions and credits are involved in any one change, the adjustment in Contractor's fee shall be computed on the basis of the net change in accordance with Paragraphs 12.01.C.2.a through 12.01.C.2.e, inclusive.

12.02 *Change of Contract Times*

A. The Contract Times may only be changed by a Change Order. Any Claim for an adjustment in the Contract Times shall be based on written notice submitted by the party making the Claim to the Engineer and the other party to the Contract in accordance with the provisions of Paragraph 10.05.

B. Any adjustment of the Contract Times covered by a Change Order or any Claim for an adjustment in the Contract Times will be determined in accordance with the provisions of this Article 12.

12.03 *Delays*

A. Where Contractor is prevented from completing any part of the Work within the Contract Times due to delay beyond the control of Contractor, the Contract Times will be extended in an amount equal to the time lost due to such delay if a Claim is made therefor as provided in Paragraph 12.02.A. Delays beyond the control of Contractor shall include, but not be limited to, acts or neglect by Owner, acts or neglect of utility owners or other contractors performing other work as contemplated by Article 7, fires, floods, epidemics, abnormal weather conditions, or acts of God.

B. If Owner, Engineer, or other contractors or utility owners performing other work for Owner as contemplated by Article 7, or anyone for whom Owner is responsible, delays, disrupts, or interferes with the performance or progress of the Work, then Contractor shall be entitled to an equitable adjustment in the Contract Price or the Contract Times, or both. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times.

C. If Contractor is delayed in the performance or progress of the Work by fire, flood, epidemic, abnormal weather conditions, acts of God, acts or failures to act of utility owners not under the control of Owner, or other causes not the fault of and beyond control of Owner and Contractor, then Contractor shall be entitled to an equitable adjustment in Contract Times, if such adjustment is essential to Contractor's ability to complete the Work within the Contract Times. Such an adjustment shall be Contractor's sole and exclusive remedy for the delays described in this Paragraph 12.03.C.

D. Owner, Engineer, and their officers, directors, members, partners, employees, agents, consultants, or subcontractors shall not be liable to Contractor for any claims, costs, losses, or damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) sustained by Contractor on or in connection with any other project or anticipated project.

E. Contractor shall not be entitled to an adjustment in Contract Price or Contract Times for delays within the control of Contractor. Delays attributable to and within the control of a Subcontractor or Supplier shall be deemed to be delays within the control of Contractor.

ARTICLE 13 – TESTS AND INSPECTIONS; CORRECTION, REMOVAL OR ACCEPTANCE OF DEFECTIVE WORK

13.01 *Notice of Defects*

A. Prompt notice of all defective Work of which Owner or Engineer has actual knowledge will be given to Contractor. Defective Work may be rejected, corrected, or accepted as provided in this Article 13.

13.02 *Access to Work*

A. Owner, Engineer, their consultants and other representatives and personnel of Owner, independent testing laboratories, and governmental agencies with jurisdictional interests will have access to the Site and the Work at reasonable times for their observation, inspection, and testing. Contractor shall provide them proper and safe conditions for such access and advise them of Contractor's safety procedures and programs so that they may comply therewith as applicable.

13.03 *Tests and Inspections*

A. Contractor shall give Engineer timely notice of readiness of the Work for all required inspections, tests, or approvals and shall cooperate with inspection and testing personnel to facilitate required inspections or tests.

B. Owner shall employ and pay for the services of an independent testing laboratory to perform all inspections, tests, or approvals required by the Contract Documents except:

1. for inspections, tests, or approvals covered by Paragraphs 13.03.C and 13.03.D below;

2. that costs incurred in connection with tests or inspections conducted pursuant to Paragraph 13.04.B shall be paid as provided in Paragraph 13.04.C; and

3. as otherwise specifically provided in the Contract Documents.

C. If Laws or Regulations of any public body having jurisdiction require any Work (or part thereof) specifically to be inspected, tested, or approved by an employee or other representative of such public body, Contractor shall assume full responsibility for arranging and obtaining such inspections, tests, or approvals, pay all costs in connection therewith, and furnish Engineer the required certificates of inspection or approval.

D. Contractor shall be responsible for arranging and obtaining and shall pay all costs in connection with any inspections, tests, or approvals required for Owner's and Engineer's acceptance of materials or equipment to be incorporated in the Work; or acceptance of materials, mix designs, or equipment submitted for approval prior to Contractor's purchase thereof for incorporation in the Work. Such inspections, tests, or approvals shall be performed by organizations acceptable to Owner and Engineer.

E. If any Work (or the work of others) that is to be inspected, tested, or approved is covered by Contractor without written concurrence of Engineer, Contractor shall, if requested by Engineer, uncover such Work for observation.

F. Uncovering Work as provided in Paragraph 13.03.E shall be at Contractor's expense unless Contractor has given Engineer timely notice of Contractor's intention to cover the same and Engineer has not acted with reasonable promptness in response to such notice.

13.04 *Uncovering Work*

A. If any Work is covered contrary to the written request of Engineer, it must, if requested by Engineer, be uncovered for Engineer's observation and replaced at Contractor's expense.

B. If Engineer considers it necessary or advisable that covered Work be observed by Engineer or inspected or tested by others, Contractor, at Engineer's request, shall uncover, expose, or otherwise make available for observation, inspection, or testing as Engineer may require, that portion of the Work in question, furnishing all necessary labor, material, and equipment.

C. If it is found that the uncovered Work is defective, Contractor shall pay all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such uncovering, exposure, observation, inspection, and testing, and of satisfactory replacement or reconstruction (including but not limited to all costs of repair or replacement of work of others); and Owner shall be entitled to an appropriate decrease in the Contract Price. If the parties are unable to agree as to the amount thereof, Owner may make a Claim therefor as provided in Paragraph 10.05.

D. If the uncovered Work is not found to be defective, Contractor shall be allowed an increase in the Contract Price or an extension of the Contract Times, or both, directly attributable to such uncovering, exposure, observation, inspection, testing, replacement, and reconstruction. If the parties are unable to agree as to the amount or extent thereof, Contractor may make a Claim therefor as provided in Paragraph 10.05.

13.05 *Owner May Stop the Work*

A. If the Work is defective, or Contractor fails to supply sufficient skilled workers or suitable materials or equipment, or fails to perform the Work in such a way that the completed Work will

conform to the Contract Documents, Owner may order Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, this right of Owner to stop the Work shall not give rise to any duty on the part of Owner to exercise this right for the benefit of Contractor, any Subcontractor, any Supplier, any other individual or entity, or any surety for, or employee or agent of any of them.

13.06 *Correction or Removal of Defective Work*

A. Promptly after receipt of written notice, Contractor shall correct all defective Work, whether or not fabricated, installed, or completed, or, if the Work has been rejected by Engineer, remove it from the Project and replace it with Work that is not defective. Contractor shall pay all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction or removal (including but not limited to all costs of repair or replacement of work of others).

B. When correcting defective Work under the terms of this Paragraph 13.06 or Paragraph 13.07, Contractor shall take no action that would void or otherwise impair Owner's special warranty and guarantee, if any, on said Work.

13.07 *Correction Period*

A. If within one year after the date of Substantial Completion (or such longer period of time as may be prescribed by the terms of any applicable special guarantee required by the Contract Documents) or by any specific provision of the Contract Documents, any Work is found to be defective, or if the repair of any damages to the land or areas made available for Contractor's use by Owner or permitted by Laws and Regulations as contemplated in Paragraph 6.11.A is found to be defective, Contractor shall promptly, without cost to Owner and in accordance with Owner's written instructions:

1. repair such defective land or areas; or

2. correct such defective Work; or

3. if the defective Work has been rejected by Owner, remove it from the Project and replace it with Work that is not defective, and

4. satisfactorily correct or repair or remove and replace any damage to other Work, to the work of others or other land or areas resulting therefrom.

B. If Contractor does not promptly comply with the terms of Owner's written instructions, or in an emergency where delay would cause serious risk of loss or damage, Owner may have the defective Work corrected or repaired or may have the rejected Work removed and replaced. All claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction or repair or such removal and replacement (including but not limited to all costs of repair or replacement of work of others) will be paid by Contractor.

C. In special circumstances where a particular item of equipment is placed in continuous service before Substantial Completion of all the Work, the correction period for that item may start to run from an earlier date if so provided in the Specifications.

D. Where defective Work (and damage to other Work resulting therefrom) has been corrected or removed and replaced under this Paragraph 13.07, the correction period hereunder with respect to such Work will be extended for an additional period of one year after such correction or removal and replacement has been satisfactorily completed.

E. Contractor's obligations under this Paragraph 13.07 are in addition to any other obligation or warranty. The provisions of this Paragraph 13.07 shall not be construed as a substitute for, or a waiver of, the provisions of any applicable statute of limitation or repose.

13.08 *Acceptance of Defective Work*

A. If, instead of requiring correction or removal and replacement of defective Work, Owner (and, prior to Engineer's recommendation of final payment, Engineer) prefers to accept it, Owner may do so. Contractor shall pay all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) attributable to Owner's evaluation of and determination to accept such defective Work (such costs to be approved by Engineer as to reasonableness) and for the diminished value of the Work to the extent not otherwise paid by Contractor pursuant to this sentence. If any such acceptance occurs prior to Engineer's recommendation of final payment, a Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the Work, and Owner shall be entitled to an appropriate decrease in the Contract Price, reflecting the diminished value of Work so accepted. If the parties are unable to agree as to the amount thereof, Owner may make a Claim therefor as provided in Paragraph 10.05. If the acceptance occurs after such recommendation, an appropriate amount will be paid by Contractor to Owner.

13.09 *Owner May Correct Defective Work*

A. If Contractor fails within a reasonable time after written notice from Engineer to correct defective Work, or to remove and replace rejected Work as required by Engineer in accordance with Paragraph 13.06.A, or if Contractor fails to perform the Work in accordance with the Contract Documents, or if Contractor fails to comply with any other provision of the Contract Documents, Owner may, after seven days written notice to Contractor, correct, or remedy any such deficiency.

B. In exercising the rights and remedies under this Paragraph 13.09, Owner shall proceed expeditiously. In connection with such corrective or remedial action, Owner may exclude Contractor from all or part of the Site, take possession of all or part of the Work and suspend Contractor's services related thereto, take possession of Contractor's tools, appliances, construction equipment and machinery at the Site, and incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere. Contractor shall allow Owner, Owner's representatives, agents and employees, Owner's other contractors, and Engineer and Engineer's consultants access to the Site to enable Owner to exercise the rights and remedies under this Paragraph.

C. All claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute

resolution costs) incurred or sustained by Owner in exercising the rights and remedies under this Paragraph 13.09 will be charged against Contractor, and a Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the Work; and Owner shall be entitled to an appropriate decrease in the Contract Price. If the parties are unable to agree as to the amount of the adjustment, Owner may make a Claim therefor as provided in Paragraph 10.05. Such claims, costs, losses and damages will include but not be limited to all costs of repair, or replacement of work of others destroyed or damaged by correction, removal, or replacement of Contractor's defective Work.

D. Contractor shall not be allowed an extension of the Contract Times because of any delay in the performance of the Work attributable to the exercise by Owner of Owner's rights and remedies under this Paragraph 13.09.

ARTICLE 14 – PAYMENTS TO CONTRACTOR AND COMPLETION

14.01 *Schedule of Values*

A. The Schedule of Values established as provided in Paragraph 2.07.A will serve as the basis for progress payments and will be incorporated into a form of Application for Payment acceptable to Engineer. Progress payments on account of Unit Price Work will be based on the number of units completed.

14.02 *Progress Payments*

A. *Applications for Payments:*

1. At least 20 days before the date established in the Agreement for each progress payment (but not more often than once a month), Contractor shall submit to Engineer for review an Application for Payment filled out and signed by Contractor covering the Work completed as of the date of the Application and accompanied by such supporting documentation as is required by the Contract Documents. If payment is requested on the basis of materials and equipment not incorporated in the Work but delivered and suitably stored at the Site or at another location agreed to in writing, the Application for Payment shall also be accompanied by a bill of sale, invoice, or other documentation warranting that Owner has received the materials and equipment free and clear of all Liens and evidence that the materials and equipment are covered by appropriate property insurance or other arrangements to protect Owner's interest therein, all of which must be satisfactory to Owner.

2. Beginning with the second Application for Payment, each Application shall include an affidavit of Contractor stating that all previous progress payments received on account of the Work have been applied on account to discharge Contractor's legitimate obligations associated with prior Applications for Payment.

3. The amount of retainage with respect to progress payments will be as stipulated in the Agreement.

B. *Review of Applications:*

1. Engineer will, within 10 days after receipt of each Application for Payment, either indicate in writing a recommendation of payment and present the Application to Owner or return the Application to Contractor indicating in writing Engineer's reasons for refusing to recommend

payment. In the latter case, Contractor may make the necessary corrections and resubmit the Application.

2. Engineer's recommendation of any payment requested in an Application for Payment will constitute a representation by Engineer to Owner, based on Engineer's observations of the executed Work as an experienced and qualified design professional, and on Engineer's review of the Application for Payment and the accompanying data and schedules, that to the best of Engineer's knowledge, information and belief:

   a. the Work has progressed to the point indicated;

   b. the quality of the Work is generally in accordance with the Contract Documents (subject to an evaluation of the Work as a functioning whole prior to or upon Substantial Completion, the results of any subsequent tests called for in the Contract Documents, a final determination of quantities and classifications for Unit Price Work under Paragraph 9.07, and any other qualifications stated in the recommendation); and

   c. the conditions precedent to Contractor's being entitled to such payment appear to have been fulfilled in so far as it is Engineer's responsibility to observe the Work.

3. By recommending any such payment Engineer will not thereby be deemed to have represented that:

   a. inspections made to check the quality or the quantity of the Work as it has been performed have been exhaustive, extended to every aspect of the Work in progress, or involved detailed inspections of the Work beyond the responsibilities specifically assigned to Engineer in the Contract Documents; or

   b. there may not be other matters or issues between the parties that might entitle Contractor to be paid additionally by Owner or entitle Owner to withhold payment to Contractor.

4. Neither Engineer's review of Contractor's Work for the purposes of recommending payments nor Engineer's recommendation of any payment, including final payment, will impose responsibility on Engineer:

   a. to supervise, direct, or control the Work, or

   b. for the means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or

   c. for Contractor's failure to comply with Laws and Regulations applicable to Contractor's performance of the Work, or

   d. to make any examination to ascertain how or for what purposes Contractor has used the moneys paid on account of the Contract Price, or

   e. to determine that title to any of the Work, materials, or equipment has passed to Owner free and clear of any Liens.

5. Engineer may refuse to recommend the whole or any part of any payment if, in Engineer's opinion, it would be incorrect to make the representations to Owner stated in

Paragraph 14.02.B.2. Engineer may also refuse to recommend any such payment or, because of subsequently discovered evidence or the results of subsequent inspections or tests, revise or revoke any such payment recommendation previously made, to such extent as may be necessary in Engineer's opinion to protect Owner from loss because:

a. the Work is defective, or completed Work has been damaged, requiring correction or replacement;

b. the Contract Price has been reduced by Change Orders;

c. Owner has been required to correct defective Work or complete Work in accordance with Paragraph 13.09; or

d. Engineer has actual knowledge of the occurrence of any of the events enumerated in Paragraph 15.02.A.

C. *Payment Becomes Due:*

1. Twenty days after presentation of the Application for Payment to Owner with Engineer's recommendation, the amount recommended will (subject to the provisions of Paragraph 14.02.D) become due, and when due will be paid by Owner to Contractor.

D. *Reduction in Payment:*

1. Owner may refuse to make payment of the full amount recommended by Engineer because:

a. claims have been made against Owner on account of Contractor's performance or furnishing of the Work;

b. Liens have been filed in connection with the Work, except where Contractor has delivered a specific bond satisfactory to Owner to secure the satisfaction and discharge of such Liens;

c. there are other items entitling Owner to a set-off against the amount recommended; or

d. Owner has actual knowledge of the occurrence of any of the events enumerated in Paragraphs 14.02.B.5.a through 14.02.B.5.c or Paragraph 15.02.A.

2. If Owner refuses to make payment of the full amount recommended by Engineer, Owner will give Contractor immediate written notice (with a copy to Engineer) stating the reasons for such action and promptly pay Contractor any amount remaining after deduction of the amount so withheld. Owner shall promptly pay Contractor the amount so withheld, or any adjustment thereto agreed to by Owner and Contractor, when Contractor remedies the reasons for such action.

3. Upon a subsequent determination that Owner's refusal of payment was not justified, the amount wrongfully withheld shall be treated as an amount due as determined by Paragraph 14.02.C.1 and subject to interest as provided in the Agreement.

SECTION XIV

14.03 *Contractor's Warranty of Title*

A. Contractor warrants and guarantees that title to all Work, materials, and equipment covered by any Application for Payment, whether incorporated in the Project or not, will pass to Owner no later than the time of payment free and clear of all Liens.

14.04 *Substantial Completion*

A. When Contractor considers the entire Work ready for its intended use Contractor shall notify Owner and Engineer in writing that the entire Work is substantially complete (except for items specifically listed by Contractor as incomplete) and request that Engineer issue a certificate of Substantial Completion.

B. Promptly after Contractor's notification, Owner, Contractor, and Engineer shall make an inspection of the Work to determine the status of completion. If Engineer does not consider the Work substantially complete, Engineer will notify Contractor in writing giving the reasons therefor.

C. If Engineer considers the Work substantially complete, Engineer will deliver to Owner a tentative certificate of Substantial Completion which shall fix the date of Substantial Completion. There shall be attached to the certificate a tentative list of items to be completed or corrected before final payment. Owner shall have seven days after receipt of the tentative certificate during which to make written objection to Engineer as to any provisions of the certificate or attached list. If, after considering such objections, Engineer concludes that the Work is not substantially complete, Engineer will, within 14 days after submission of the tentative certificate to Owner, notify Contractor in writing, stating the reasons therefor. If, after consideration of Owner's objections, Engineer considers the Work substantially complete, Engineer will, within said 14 days, execute and deliver to Owner and Contractor a definitive certificate of Substantial Completion (with a revised tentative list of items to be completed or corrected) reflecting such changes from the tentative certificate as Engineer believes justified after consideration of any objections from Owner.

D. At the time of delivery of the tentative certificate of Substantial Completion, Engineer will deliver to Owner and Contractor a written recommendation as to division of responsibilities pending final payment between Owner and Contractor with respect to security, operation, safety, and protection of the Work, maintenance, heat, utilities, insurance, and warranties and guarantees. Unless Owner and Contractor agree otherwise in writing and so inform Engineer in writing prior to Engineer's issuing the definitive certificate of Substantial Completion, Engineer's aforesaid recommendation will be binding on Owner and Contractor until final payment.

E. Owner shall have the right to exclude Contractor from the Site after the date of Substantial Completion subject to allowing Contractor reasonable access to remove its property and complete or correct items on the tentative list.

14.05 *Partial Utilization*

A. Prior to Substantial Completion of all the Work, Owner may use or occupy any substantially completed part of the Work which has specifically been identified in the Contract Documents, or which Owner, Engineer, and Contractor agree constitutes a separately functioning and usable part

of the Work that can be used by Owner for its intended purpose without significant interference with Contractor's performance of the remainder of the Work, subject to the following conditions:

1. Owner at any time may request Contractor in writing to permit Owner to use or occupy any such part of the Work which Owner believes to be ready for its intended use and substantially complete. If and when Contractor agrees that such part of the Work is substantially complete, Contractor, Owner, and Engineer will follow the procedures of Paragraph 14.04.A through D for that part of the Work.

2. Contractor at any time may notify Owner and Engineer in writing that Contractor considers any such part of the Work ready for its intended use and substantially complete and request Engineer to issue a certificate of Substantial Completion for that part of the Work.

3. Within a reasonable time after either such request, Owner, Contractor, and Engineer shall make an inspection of that part of the Work to determine its status of completion. If Engineer does not consider that part of the Work to be substantially complete, Engineer will notify Owner and Contractor in writing giving the reasons therefor. If Engineer considers that part of the Work to be substantially complete, the provisions of Paragraph 14.04 will apply with respect to certification of Substantial Completion of that part of the Work and the division of responsibility in respect thereof and access thereto.

4. Not Used

14.06 *Final Inspection*

A. Upon written notice from Contractor that the entire Work or an agreed portion thereof is complete, Engineer will promptly make a final inspection with Owner and Contractor and will notify Contractor in writing of all particulars in which this inspection reveals that the Work is incomplete or defective. Contractor shall immediately take such measures as are necessary to complete such Work or remedy such deficiencies.

14.07 *Final Payment*

A. *Application for Payment:*

1. After Contractor has, in the opinion of Engineer, satisfactorily completed all corrections identified during the final inspection and has delivered, in accordance with the Contract Documents, all maintenance and operating instructions, schedules, guarantees, bonds, certificates or other evidence of insurance, certificates of inspection, marked-up record documents (as provided in Paragraph 6.12), and other documents, Contractor may make application for final payment following the procedure for progress payments.

2. The final Application for Payment shall be accompanied (except as previously delivered) by:

   a. all documentation called for in the Contract Documents, including but not limited to the evidence of insurance required by Paragraph 5.04.B.6;

   b. consent of the surety, if any, to final payment;

   c. a list of all Claims against Owner that Contractor believes are unsettled; and

d. complete and legally effective releases or waivers (satisfactory to Owner) of all Lien rights arising out of or Liens filed in connection with the Work.

3. In lieu of the releases or waivers of Liens specified in Paragraph 14.07.A.2 and as approved by Owner, Contractor may furnish receipts or releases in full and an affidavit of Contractor that: (i) the releases and receipts include all labor, services, material, and equipment for which a Lien could be filed; and (ii) all payrolls, material and equipment bills, and other indebtedness connected with the Work for which Owner might in any way be responsible, or which might in any way result in liens or other burdens on Owner's property, have been paid or otherwise satisfied. If any Subcontractor or Supplier fails to furnish such a release or receipt in full, Contractor may furnish a bond or other collateral satisfactory to Owner to indemnify Owner against any Lien.

B. *Engineer's Review of Application and Acceptance:*

1. If, on the basis of Engineer's observation of the Work during construction and final inspection, and Engineer's review of the final Application for Payment and accompanying documentation as required by the Contract Documents, Engineer is satisfied that the Work has been completed and Contractor's other obligations under the Contract Documents have been fulfilled, Engineer will, within ten days after receipt of the final Application for Payment, indicate in writing Engineer's recommendation of payment and present the Application for Payment to Owner for payment. At the same time Engineer will also give written notice to Owner and Contractor that the Work is acceptable subject to the provisions of Paragraph 14.09. Otherwise, Engineer will return the Application for Payment to Contractor, indicating in writing the reasons for refusing to recommend final payment, in which case Contractor shall make the necessary corrections and resubmit the Application for Payment.

C. *Payment Becomes Due:*

1. Thirty days after the presentation to Owner of the Application for Payment and accompanying documentation, the amount recommended by Engineer, less any sum Owner is entitled to set off against Engineer's recommendation, including but not limited to liquidated damages, will become due and will be paid by Owner to Contractor.

14.08 *Final Completion Delayed*

A. If, through no fault of Contractor, final completion of the Work is significantly delayed, and if Engineer so confirms, Owner shall, upon receipt of Contractor's final Application for Payment (for Work fully completed and accepted) and recommendation of Engineer, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed and accepted. If the remaining balance to be held by Owner for Work not fully completed or corrected is less than the retainage stipulated in the Agreement, and if bonds have been furnished as required in Paragraph 5.01, the written consent of the surety to the payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by Contractor to Engineer with the Application for such payment. Such payment shall be made under the terms and conditions governing final payment, except that it shall not constitute a waiver of Claims.

14.09 *Waiver of Claims*

A. The making and acceptance of final payment will constitute:

1. a waiver of all Claims by Owner against Contractor, except Claims arising from unsettled Liens, from defective Work appearing after final inspection pursuant to Paragraph 14.06, from failure to comply with the Contract Documents or the terms of any special guarantees specified therein, or from Contractor's continuing obligations under the Contract Documents; and

2. a waiver of all Claims by Contractor against Owner other than those previously made in accordance with the requirements herein and expressly acknowledged by Owner in writing as still unsettled.

ARTICLE 15 – SUSPENSION OF WORK AND TERMINATION

15.01 *Owner May Suspend Work*

A. At any time and without cause, Owner may suspend the Work or any portion thereof for a period of not more than 90 consecutive days by notice in writing to Contractor and Engineer which will fix the date on which Work will be resumed. Contractor shall resume the Work on the date so fixed. Contractor shall be granted an adjustment in the Contract Price or an extension of the Contract Times, or both, directly attributable to any such suspension if Contractor makes a Claim therefor as provided in Paragraph 10.05.

15.02 *Owner May Terminate for Cause*

A. The occurrence of any one or more of the following events will justify termination for cause:

1. Contractor's persistent failure to perform the Work in accordance with the Contract Documents (including, but not limited to, failure to supply sufficient skilled workers or suitable materials or equipment or failure to adhere to the Progress Schedule established under Paragraph 2.07 as adjusted from time to time pursuant to Paragraph 6.04);

2. Contractor's disregard of Laws or Regulations of any public body having jurisdiction;

3. Contractor's repeated disregard of the authority of Engineer; or

4. Contractor's violation in any substantial way of any provisions of the Contract Documents.

B. If one or more of the events identified in Paragraph 15.02.A occur, Owner may, after giving Contractor (and surety) seven days written notice of its intent to terminate the services of Contractor:

1. exclude Contractor from the Site, and take possession of the Work and of all Contractor's tools, appliances, construction equipment, and machinery at the Site, and use the same to the full extent they could be used by Contractor (without liability to Contractor for trespass or conversion);

2. incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere; and

3. complete the Work as Owner may deem expedient.

C. If Owner proceeds as provided in Paragraph 15.02.B, Contractor shall not be entitled to receive any further payment until the Work is completed. If the unpaid balance of the Contract Price exceeds all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) sustained by Owner arising out of or relating to completing the Work, such excess will be paid to Contractor. If such claims, costs, losses, and damages exceed such unpaid balance, Contractor shall pay the difference to Owner. Such claims, costs, losses, and damages incurred by Owner will be reviewed by Engineer as to their reasonableness and, when so approved by Engineer, incorporated in a Change Order. When exercising any rights or remedies under this Paragraph, Owner shall not be required to obtain the lowest price for the Work performed.

D. Notwithstanding Paragraphs 15.02.B and 15.02.C, Contractor's services will not be terminated if Contractor begins within seven days of receipt of notice of intent to terminate to correct its failure to perform and proceeds diligently to cure such failure within no more than 7 days of receipt of said notice.

E. Where Contractor's services have been so terminated by Owner, the termination will not affect any rights or remedies of Owner against Contractor then existing or which may thereafter accrue. Any retention or payment of moneys due Contractor by Owner will not release Contractor from liability.

F. If and to the extent that Contractor has provided a performance bond under the provisions of Paragraph 5.01.A, the termination procedures of that bond shall supersede the provisions of Paragraphs 15.02.B and 15.02.C.

15.03 *Owner May Terminate For Convenience*

A. Upon seven days written notice to Contractor and Engineer, Owner may, without cause and without prejudice to any other right or remedy of Owner, terminate the Contract. In such case, Contractor shall be paid for (without duplication of any items):

1. completed and acceptable Work executed in accordance with the Contract Documents prior to the effective date of termination, including fair and reasonable sums for overhead and profit on such Work;

2. expenses sustained prior to the effective date of termination in performing services and furnishing labor, materials, or equipment as required by the Contract Documents in connection with uncompleted Work, plus fair and reasonable sums for overhead and profit on such expenses;

3. Not Used

4. reasonable expenses directly attributable to termination.

B. Contractor shall not be paid on account of loss of anticipated profits or revenue or other economic loss arising out of or resulting from such termination.

15.04 *Contractor May Stop Work or Terminate*

A. If, through no act or fault of Contractor, (i) the Work is suspended for more than 90 consecutive days by Owner or under an order of court or other public authority, or (ii) Engineer fails to act on any Application for Payment within 30 days after it is submitted, or (iii) Owner fails for 30 days to pay Contractor any sum finally determined to be due, then Contractor may, upon seven days written notice to Owner and Engineer, and provided Owner or Engineer do not remedy such suspension or failure within that time, terminate the Contract and recover from Owner payment on the same terms as provided in Paragraph 15.03.

B. In lieu of terminating the Contract and without prejudice to any other right or remedy, if Engineer has failed to act on an Application for Payment within 30 days after it is submitted, or Owner has failed for 30 days to pay Contractor any sum finally determined to be due, Contractor may, seven days after written notice to Owner and Engineer, stop the Work until payment is made of all such amounts due Contractor, including interest thereon. The provisions of this Paragraph 15.04 are not intended to preclude Contractor from making a Claim under Paragraph 10.05 for an adjustment in Contract Price or Contract Times or otherwise for expenses or damage directly attributable to Contractor's stopping the Work as permitted by this Paragraph.

ARTICLE 16 – DISPUTE RESOLUTION

16.01 *Methods and Procedures*

A. Either Owner or Contractor may request mediation of any Claim submitted to Engineer for a decision under Paragraph 10.05 before such decision becomes final and binding. The mediation will be governed by the Construction Industry Mediation Rules of the American Arbitration Association in effect as of the Effective Date of the Agreement. The request for mediation shall be submitted in writing to the American Arbitration Association and the other party to the Contract. Timely submission of the request shall stay the effect of Paragraph 10.05.E.

B. Owner and Contractor shall participate in the mediation process in good faith. The process shall be concluded within 60 days of filing of the request. The date of termination of the mediation shall be determined by application of the mediation rules referenced above.

C. If the Claim is not resolved by mediation, Engineer's action under Paragraph 10.05.C or a denial pursuant to Paragraphs 10.05.C.3 or 10.05.D shall become final and binding 30 days after termination of the mediation unless, within that time period, Owner or Contractor:

1. elects in writing to invoke any dispute resolution process provided for in the Supplementary Conditions; or

2. agrees with the other party to submit the Claim to another dispute resolution process; or

3. gives written notice to the other party of the intent to submit the Claim to a court of competent jurisdiction.

SECTION XIV

ARTICLE 17 – MISCELLANEOUS

17.01 *Giving Notice*

A. Whenever any provision of the Contract Documents requires the giving of written notice, it will be deemed to have been validly given if:

1. delivered in person to the individual or to a member of the firm or to an officer of the corporation for whom it is intended; or

2. delivered at or sent by registered or certified mail, postage prepaid, to the last business address known to the giver of the notice.

17.02 *Computation of Times*

A. When any period of time is referred to in the Contract Documents by days, it will be computed to exclude the first and include the last day of such period. If the last day of any such period falls on a Saturday or Sunday or on a day made a legal holiday by the law of the State of Georgia.

17.03 *Cumulative Remedies*

A. The duties and obligations imposed by these General Conditions and the rights and remedies available hereunder to the parties hereto are in addition to, and are not to be construed in any way as a limitation of, any rights and remedies available to any or all of them which are otherwise imposed or available by Laws or Regulations, by special warranty or guarantee, or by other provisions of the Contract Documents. The provisions of this Paragraph will be as effective as if repeated specifically in the Contract Documents in connection with each particular duty, obligation, right, and remedy to which they apply.

17.04 *Survival of Obligations*

A. All representations, indemnifications, warranties, and guarantees made in, required by, or given in accordance with the Contract Documents, as well as all continuing obligations indicated in the Contract Documents, will survive final payment, completion, and acceptance of the Work or termination or completion of the Contract or termination of the services of Contractor.

17.05 *Controlling Law*

A. This Contract is to be governed by the law of the state in which the Project is located.

17.06 *Headings*

A. Article and paragraph headings are inserted for convenience only and do not constitute parts of these General Conditions.

SECTION XV

SUPPLEMENTARY CONDITIONS

1. **THE GENERAL CONDITIONS:** The General Conditions shall apply to all work in the Contract Documents, except as otherwise specified in the Supplementary Conditions. Requirements of the Supplementary Conditions supersede those of the General Conditions.

2. **COMMENCEMENT AND COMPLETION OF WORK:** The Contractor shall commence the Work on the date indicated in the Notice to Proceed and shall diligently prosecute said Work so as to complete the entire projects and place them in use within the number of calendar days set forth in the Agreement.

3. **SCOPE OF WORK:** The project includes but is not limited to the construction of the "Forest Park – Starr Park – Phase I" project. The work consists of furnishing and installing all materials, labor, tools, equipment, and related services required for a complete project. This project includes but is not limited to providing the renovation of a complete City Park including a new walking track, walkways, playground, dog park, sports field, splash pad, as well as the construction of three new buildings, three new park pavilions and 347 additional square feet to an existing pool equipment room to provide a complete **"Starr Park – Phase I"** project in Forest Park Georgia.

4. **LOCATION:** The work under this Contract will be located at one (1) individual location within the City of Forest Park, GA 30297; Clayton County, GA.

5. **EXTENSION OF TIME AND FAILURE TO COMPLETE ON TIME:** Any and all extensions of time shall be in accordance with the General Conditions, except as otherwise hereinafter provided. Failure to complete the Project on or before the stipulated completion date will result in the assessment of liquidated damages in the amount stated in the Proposal.

6. **WEATHER DELAYS:** Completion time will not be extended for normal bad weather. Time for completion as stated in the Contract Documents includes an allowance for calendar days on which work cannot be performed out-of-doors. The term "calendar day" as used in the Contract Documents shall mean Mondays through Fridays, excluding weekends and legal holidays. For the purpose of this Contract, Contractor agrees that he may expect to lose calendar days due to weather in accordance with the following table:

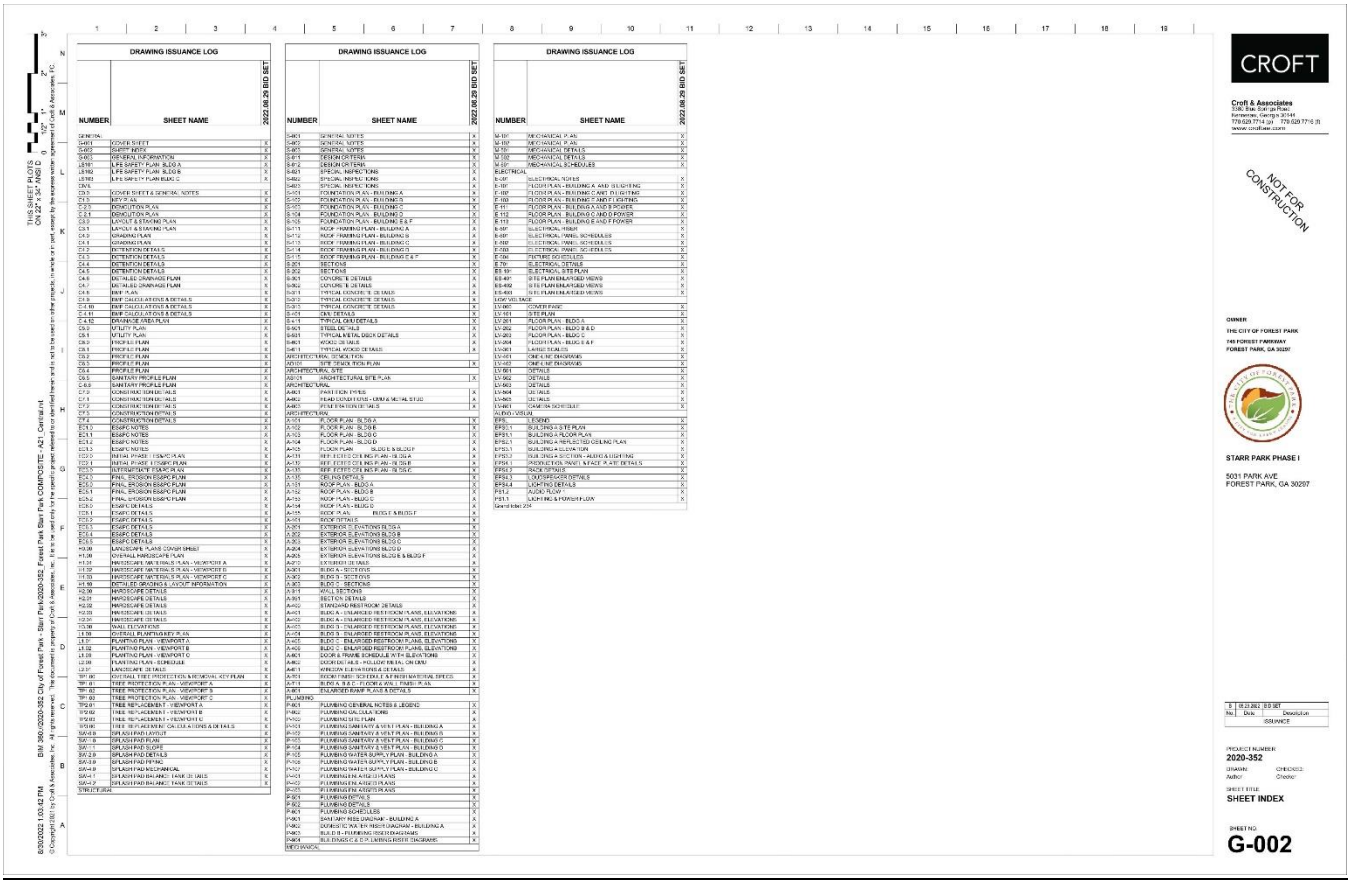
January - 14 days	**February - 14 days**	**March - 10 days**	**April - 7 days**
May - 6 days	**June - 3 days**	**July - 4 days**	**August - 2 days**
September - 2 days	**October - 3 days**	**November - 5 days**	**December - 9 days**

The Contractor agrees that it shall provide written notice to the OWNER'S REPRESENTATIVE on the day of any adverse weather not anticipated and for which a request for a time extension has been, or will be, made. Said notice shall state with particularity a description of the adverse weather as well as a description of the nature and extent of any delay caused by such weather. Receipt of this notice by the OWNER'S REPRESENTATIVE is a condition precedent to the submission of any claim for an extension of time. Furthermore, the Contractor shall submit a written claim for extension of time within seven (7) days after the occurrence of the adverse weather and such claim

shall be supported by such documentation including, but not limited to, official weather reports, as the OWNER'S REPRESENTATIVE may require. No extension will be made for days of bad weather occurring after the building is dried in. Requested working days lost to the weather shall be submitted for review with the pay request for that month, any requests later than the billable month will not be considered. To the extent that any of the terms and conditions set forth in this paragraph are in conflict with any of the terms and conditions of this Agreement, the terms and conditions of this paragraph shall govern and control.

7. **CONSTRUCTION DRAWINGS:** The work shall conform to the following construction drawings "100% CONSTRUCTION DOCUMENTS FOR THE CITY OF FOREST PARK – STARR PARK – PHASE I" as shown on cover sheet for this project with a complete sheet index of design drawings:

SECTION XV



8. **REPORTS AND DRAWINGS USED:** In the preparation of Drawings and Specifications, Engineer has relied upon:

A. The following reports of explorations and test of subsurface conditions at the site of the Work:

1) Geotechnical reports of subgrade and stormwater conditions available upon request.

B. The following drawings of physical conditions in or relating to existing surface and subsurface structures (except Underground Facilities) which are contiguous to the site of the Work.

1) None

9. **SANITARY CONVENIENCES:** THE CONTRACTOR shall provide adequate sanitary conveniences for use of those employed on the work and their use shall be strictly enforced. Such conveniences shall be made available when the first employees arrive on the site and shall be removed after the departure of the last employees from the job.

10. **ENVIRONMENTAL IMPACT:** THE CONTRACTOR shall conduct all operations so as to minimize, to the greatest extent possible, adverse environmental impact.

SECTION XV

A. **NOISE:** All equipment and machinery shall be provided with exhaust mufflers maintained in good working order so as to reduce operating noise to minimum levels.

B. **DUST/SMOKE:** All equipment movements shall be accompanied by a minimum of dust. Traveled surfaces and earthwork shall be maintained in a moist condition to avoid the generation of dust or the airborne movement of particulate matter under all prevailing atmosphere conditions. Burning operations will be conducted only with written permission of the OWNER and/or appropriate regulatory agency. The CONTRACTOR shall be responsible for obtaining all permits and comply with all codes, ordinances and regulations pertaining to the burning.

C. **TRAFFIC:** Equipment and vehicles related to this project shall be routed over roads which will result in the least effect on traffic and nuisance to the public. All material shall be loaded in a manner which will preclude the loss of any portion of the load in transit, including covering, if necessary.

D. **SEDIMENTATION:** All points of concentrated runoff from rainfall shall be visually monitored to determine that no eroded material from the construction site is being deposited offsite. Measures shall be taken to promptly eliminate such a deposition if occurring, including the installation of detention basins. All work shall be performed per the "Georgia Soil and Water Conservation Commission - Manual for Erosion and Sediment Control in Georgia – 2016 Edition or latest revision"

11. **PROJECT VIDEO RECORDING:** Contractor is to provide a full color video survey of the complete project limits to the Owner. This video is to be taken within 72 hours of the Contractor's mobilization and start of the project and delivered to the OWNER'S REPRESENTATIVE.

12. **PROJECT PHOTO LOG:** Contractor is required to take daily digital progress photos of the work being performed. These photos are required to show a TIME/DATE stamp directly on each picture. Minimum 10M resolution required. Photos are to be delivered to the OWNER'S REPRESENTATIVE monthly with each pay request submitted.

13. **CONSTRUCTION STAKEOUT:** If requested by the CONTRACTOR, the OWNER'S REPRESENTATIVE will provide benchmarks and baseline coordination's for horizontal and vertical control at the site of the work. From the baselines and benchmarks the CONTRACTOR shall complete the layout of the work and shall be responsible for all measurements that may be required for the executions of the work prescribed in the specifications or on the Drawings, subject to such modifications as may be required to meet changed conditions or as a result of necessary modifications to the Work.

    The CONTRACTOR shall furnish, at his own expense, all such stakes, spikes, steel pins, templates, platforms, equipment, instruments, tools and material and all labor as may be required in laying out any part of the Work from the baselines and benchmarks.

It shall be the responsibility of the CONTRACTOR to maintain and preserve all stakes and other marks established by the OWNER'S REPRESENTATIVE until authorized to remove them, and if such marks are destroyed by the Contractor or through his negligence prior to their authorized removal, they may be replaced by the OWNER'S REPRESENTATIVE at his discretion, and the expense of replacement will be deducted from any amounts due or to become due the CONTRACTOR.

All survey data shall be recorded in accordance with standard and approved methods. All field notes, sketches, records and computations made by the CONTRACTOR in laying out the work shall be available at all times during the progress of the work for the ready examination by the OWNER'S REPRESENTATIVE or his duly authorized representative.

The OWNER'S REPRESENTATIVE may make original and final surveys and make computations to determine the quantities of work performed or finally in place, if required.

The CONTRACTOR shall make such surveys and computations as are necessary to determine the quantities of work performed or placed during each period for which a progress payment is to be made. All original field notes, computations and other records, or facsimile copies thereof, taken by the CONTRACTOR for the purpose of construction and for progress surveys, shall be furnished promptly to the representative of the OWNER'S REPRESENTATIVE for permanent records and for determining the proper amount of progress payments due to the CONTRACTOR. Unless waived in each specific case, quantity surveys made by the CONTRACTOR shall be made during the presence of a representative of the OWNER'S REPRESENTATIVE.

THE OWNER'S REPRESENTATIVE may make checks as the work progresses to verify lines and grades established by the CONTACTOR and to determine the conformance of the completed work as it progresses with the requirements of Contract Documents and Drawings. Such as checking by the OWNER'S REPRESENTATIVE or his representative shall not relieve the CONTRACTOR of his responsibility to perform all work in accordance with the Contract Documents and Drawings and the lines and grades given therein. In the event that location marks as established by the CONTRACTOR are found to be inaccurate or inadequate, work shall be suspended until corrections have been made.

Contractor to provide Owner with complete electronic GIS survey based upon State Plane Coordinate System of all improvements including all subsurface structures related to the completed project.

No separate payment will be made for the costs involved in the survey work, layout work or staking performed by the CONTRACTOR. All such costs will be considered as incidental to the Work.

14. **UTILITIES:** Utilities such as sewer, water and electric lines encountered in the work shall be protected from Injury and maintained in service until moved or replaced as required under this Contract or by others as the case may be, or abandoned as may be necessary for this proper

construction and use of the new work. State law requires that the contractor call Georgia811 at 811 or 1-800-282-7411 at least 72 hours in advance of construction commencing.

15. **ADJUSTMENT OF DISCREPANCIES:** In all cases of discrepancies between the various dimensions and details shown on drawings, or between the drawings are these specifications, the more expensive construction shall be estimated before construction is started, the matter shall be submitted to the OWNER'S REPRESENTATIVE for clarification. Without such a decision, discrepancies shall be adjusted by the CONTRACTOR at his own risk and in settlement of any complications arising from such adjustment, the CONTRACTOR shall bear all of the extra expense involved.

16. **RESTORATION:** The CONTRACTOR shall conduct his operations so that restoration of roadways, driveways, curb and gutter, ditches and easements progresses along with the pipe laying. If the OWNER'S REPRESENTATIVE determines that inadequate progress is being made with the restoration, he may shut down the CONTRACTOR's pipe laying operation until the restoration is caught up with the pipe installation. Reasonable care shall be taken during construction to avoid damage to vegetation. Ornamental shrubbery and tree branches shall be temporarily tied back, where appropriate, to minimize damage. Trees which receive damage to branches shall be trimmed appearance of the tree. Tree trunks receiving damage from equipment shall be treated with a tree dressing.

17. **MAINTENANCE DURING CONSTRUCTION:** The CONTRACTOR shall maintain the Work from the beginning of construction operations until final acceptance. This maintenance shall continue continuous and effective work prosecuted day by day with adequate equipment and forces to the end that site and structures thereon are kept in satisfactory condition at all times, including satisfactory signing or marking as appropriate and control of traffic where required by use of traffic control devices as required by the State in which this project is located.

    Upon completion of the Work, the CONTRACTOR shall remove all construction signs and barriers before final acceptance. While undergoing improvements, the roads shall be kept open to all traffic by the CONTRACTOR. The CONTRACTOR shall keep the portion of the site being used by public traffic, whether it be through or local traffic, in such condition that traffic will be adequately accommodated. The CONTRACTOR shall bear all cost of signs and markings as required and other maintenance work during construction and before the Work is accept and of constructing and maintaining such approaches, crossings, intersections, and other features as may be necessary without direct compensation.

18. **BARRICADES, DANGER, WARNING AND DETOUR SIGNS:** The CONTRACTOR shall provide, erect, and maintain all necessary barricades, suitable and sufficient lights, danger signals, signs and other traffic control devices, and shall take all necessary precautions for the protection of the work and safety of the public. Highways and streets closed to traffic shall be protected by effective barricades, and obstructions shall be lighted during hours of darkness. Suitable warning signs shall be provided to properly control and direct traffic Barricades, danger, warning and detour signs shall be installed as per Georgia DOT Specifications, Section 107.07 – Public Convenience and Safety and Section -150 Traffic Control in accordance with "Georgia

Department of Transportation – Standard Specifications Construction of Transportation Systems – January 21, 2021 or latest revision"

The CONTRACTOR shall furnish, install, and maintain all necessary barricades, warning sings, and other protection devices in accordance with the State requirements in which the project is located. Temporary signs may be reused, provided they are in good condition and legible. All protective devices shall be kept in good, legible condition while in use. All work and materials provides shall be per the "Manual on Uniform Traffic Control Devices for Streets and Highways – 2009 MUTCD with Revisions 1 and 2, May 2012 or latest revision"

As soon as construction advances to the extent that temporary barricades, and signs are no longer needed to inform the traveling public, such signs shall be promptly removed.

The cost of furnishing, erecting, maintaining, and removing protective devices will not be paid for as a separate Bid Item. Where the CONTRACTOR is required to perform any of these functions, the cost thereof shall be included in the overall Bid submitted. Ownership of the temporary warning devices shall remain with the CONTACTOR.

19. **HIGH VOLTAGE ACT:** The CONTRACTOR acknowledges the requirement of the High Voltage Act of the General Assembly of Georgia by execution of this Contract.

20. **ACCESS FOR INSPECTION:** Access for inspection shall be provided for representatives of the OWNER, OWNER'S REPRESENTATIVE, DESIGN ENGINEER and applicable regulatory agencies.

21. **INSURANCE:** The limits of liability for the insurance required by paragraph 5.04 of the General Conditions shall provide coverage for not less than the following amounts or greater where required by Laws and Regulations:

    a. Workers' Compensation, and related coverages under Paragraphs 5.04.A.1 and A.2 of the General Conditions shall not contain an exclusion for any owner or officer that will be present on the project site at any time and provide coverage for not less than the following amounts:
        i. State: Statutory
        ii. Applicable Federal
        iii. Employer's Liability:
            1. Each Accident – $1,000,000
            2. Bodily Injury by Disease Policy Limit - $1,000,000
            3. Each Employee for Bodily Injury By Disease - $1,000,000
    b. Contractor's Commercial General Liability under Paragraphs 5.04.A.3 through A.6 of the General Conditions covering liability arising from premises, operations, products-completed operations, personal and advertising liability, and liability assumed under an insured contract (including the tort liability of another assumed in a business contract), and contractual liability coverages not less than the following amounts:

i. General Aggregate (applying per project) $2,000,000

c. Products - Completed
   i. Operations Aggregate $2,000,000
d. Personal and Advertising
   i. Injury $1,000,000
e. Each Occurrence
   i. $1,000,000
f. Property Damage liability insurance will provide Explosion, Collapse, and Under-ground coverages where applicable.
g. Excess or Umbrella Liability- Coverage is to be excess of the Commercial General Liability, Automobile Liability and Employers' Liability as underlying policies. The limits of liability may be provided by a combination of primary and excess or umbrella liability policies , but in no event may the total limits of liability available for any one occurrence or accident be less than the below limits:
   i. General Aggregate $5,000,000
   ii. Each Occurrence $5,000,000
h. Automobile Liability-Business Automobile Liability insurance covering all owned, non-owned and hired vehicles with limits not less than the following amounts:
i. Combined Single Limit
   i. Each Accident $1,000,000
j. Contractor's Liability Insurance
   i. Policy Limit:
      $1,000,000 Per Claim
      $1,000,000 Aggregate
   ii. Claims Expenses (including Defense Costs) within limits
      $25,000 Deductible per loss.
   iii. Coverage will include Bodily Injury or Property Damage, including Clean-Up costs, from a pollution event from covered operations or completed operations of the Work performed at the project Site by the Contractor or Sub-Contractors.

k. Builders Risk Insurance (Special Form)
   i. The contractor shall procure and shall maintain during the life of the contractor agreement Builder's Risk Insurance to protect the Owner as the First Named Insured along with the Contractor as a Named Insured against All-Risks perils of property insurance including flood and earthquake. The amount of insurance shall be the equal of 100% of the completed value of the project.
l. Property insurance covering the Contractors and Sub-contractors' business personal property and its equipment shall be the responsibility of the respective parties.

22. **SUBCONTRACTORS:** The Contractor shall not contract with any person or entity to whom the Owner or the OWNER'S REPRESENTATIVE has made reasonable objection. The Contractor shall not be required to contract anyone to whom he has a reasonable objection.

23. **SAFETY AND PROTECTION:** Attention is invited to the regulations issued by OSHA 2207 and the Department of Labor pursuant to Section 107 of the Contract Work Hours and Safety

Standards Act (40 U.S.C. 333) entitled "Safety and Health Regulations for Construction" (29 CFR Part 1926 910) July 1, 1993 edition, or latest revision. The Contractor shall be required to comply with those regulations to the extent that any resulting Contract involves construction.

24. **RETAINAGE OF CONTRACTORS PAYMENT:** The retainage shall be an amount equal to 10% of Contractor's partial pay estimate until 50% completion. Provided that satisfactory progress is being made toward completion of the work, no additional retainage will be held until the work is substantially complete. However, if progress is not satisfactory in the opinion of the OWNER'S REPRESENTATIVE, retainage may be reinstated to the fullest extent provided by the General Conditions. Upon substantial completion of the work, any amount retained may be paid to the CONTRACTOR. When the WORK has been substantially completed except for WORK which cannot be completed because of weather conditions, lack of materials or other reasons which in the judgement of the OWNER are valid reasons for non-completion, the OWNER may make additional payments, retaining at all times an amount sufficient to cover the estimated cost of the WORK still to be completed. Partial pay estimates may include stored materials. Contractor must submit invoices and all materials must be located at the site of work. Retainage will be held on stored materials.
    a. Retainage shall be invested at the current market rate and any interest earned on the retained amount by Owner shall be paid to the contractor when the project has been completed within the time limits specified and for the price specified in the contract, or in any amendments or change orders approved in accord with the terms of the contract, pursuant to the General Conditions.

25. **SEWER CONSTRUCTION:** Construction is to be carried out so as to prevent by-passing of flows during construction. The Contractor shall provide the necessary pumps, force mains and etc. required to handle sewage flows during construction. All work is to comply with the Clayton County Water Authority standards and specifications.

26. **SEDIMENT AND EROSION CONTROL:** Siltation and soil erosion must be minimized during construction. Contractor shall take measures necessary to stop soil erosion at the source.

27. **SITE RESTORATION:** Restore disturbed areas to original or better conditions.

28. **USE OF CHEMICALS:** All chemicals used during project construction or furnished for project operation, whether herbicide, pesticide, disinfectant, polymer, reactant or other classification, must show approval of either EPA or USDA. Use of all such chemicals and disposal of residues shall be in conformance with instructions.

29. **TESTING:** The independent geotechnical testing laboratory will be retained by the Contractor. Testing required by the plans and specifications will be performed as required by the Contract Documents and at the discretion and under the direction of the OWNER'S REPRESENTATIVE. Payment for all testing services will be made by the Contractor. Copies of all test results will be forwarded in duplicate to the OWNER'S REPRESENTATIVE. The Contractor shall maintain a current file on the jobsite of all test results for review.

SECTION XV

30. **OWNERSHIP OF DEMOLISHED EQUIPMENT:** Any major equipment removed as a result of this project shall remain the property of the OWNER. The Contractor shall take reasonable care to protect equipment during removal and shall deliver the equipment for permanent storage to a point to be designated by the OWNER.

31. **RECORD DRAWINGS:** The Contractor shall maintain a red lined set of construction drawings indicating any field changes to the Drawings. The information shall include physical measurements or coordinates for the horizontal location of key physical features such as bends in underground pipelines and vertical elevations of the equipment or pipelines. As a prerequisite to final payment of the Retainage, the Contractor shall deliver to the OWNER'S REPRESENTATIVE the marked up set of drawings for preparation of the Record Drawings of the Work. Failure to maintain this information shall not relieve the Contractor of the responsibility of obtaining the information prior to final payment.

32. **OPERATION AND MAINTENANCE MANUALS:** The Contractor shall assemble all O&M manuals called for in the various sections of the Technical Specifications into one or more volumes of either 3-ring or post and screw type binders. The binders shall be labeled, indexed and tabbed for easy location of information by Specification Section Number and Description. Three (3) copies of all O&M manuals organized into 3 separate books shall be submitted to the OWNER'S REPRESENTATIVE as a prerequisite to final payment of the retainage. Additionally, three copies of all O&M manuals shall also be provided in complete PDF format on CD's and furnished with the delivery of the hardcopy manuals.

33. **QUALIFICATIONS FOR ACCEPTABLE SURETIES:** A surety, to be acceptable, will be required to meet the following criteria:
    a. A company holding a Certificate of Authority as an acceptable surety on Federal Bonds, as published in the latest such listing in the Federal Register; and an insurance company licensed to do business within the state of Georgia as a company writing policies of insurance and/or bid bonds, payment bonds and performance bonds, regulated as such by the Georgia Department of Insurance and Solvency Pool, and meet the following additional criteria:

    1) A company with a rating in the A.M. Best Companies' most recent published rating of "A++ or A+: Class IV or Larger."

    2) A company with a rating in the A.M. Best Companies' most recent published rating of "A: Class V or Larger."

    3) A company with a rating in the A.M. Best Companies' most recent published rating of "A-: Class X or Larger."

    4) A company which can furnish an assumption certificate or cut through clause in a statement of coverage under which payment is guaranteed 100% to third-party claimants by a reinsurer with a rating in A.M. Best Companies' most recent published rating of "A or A+: Class V or Larger"

5) In lieu of the A.M. Best Company Rating, insures rated AAA, AA+, AA, AA- by Standard & Poor's Insurance Rating Services will also be acceptable.

34. OPERATION OF EXISTING FACILITIES: The Contractor shall not interrupt the operation of the existing water treatment facility. During the course of the work should an interruption become absolutely necessary, the contractor shall notify and coordinate with the Owner and the OWNER'S REPRESENTATIVE at least 72 hours in advance to minimize disruption of service. The Contractor shall cooperate fully with the Owner in minimizing interruption of operations.

Contractor shall notify and coordinate with the Owner and the OWNER'S REPRESENTATIVE at least 72 hours in advance to minimize disruption of service. The Contractor shall cooperate fully with the Owner in minimizing interruption of operations.

35. **RESIDENT OWNER'S REPRESENTATIVE OFFICE:** Not Required.

36. **PERMITS:** The Contractor shall secure and pay for all necessary construction related permits with the City of Forest Park and the Clayton County Water Authority required for completion of the work.

37. **STATED ALLOWANCES:** The following allowances shall be included in the Base Bid Proposal of the Contractor:

a. In the amount bid on the Bid Form submitted, the Bidder shall include a $25,000.00 Contingency Allowance.
b. This allowance is for additional work as directed by the Owner. Monies not utilized by the Owner for this project will be removed from the final contract price at the completion of the project by use of a Change Order.

38. ARTICLE 15: SUSPENSION OF WORK AND TERMINATION:
Termination by the Owner for Cause: Add the following subparagraphs 15.5.1 and 15.5.2 to the General Conditions.

15.5.1: "If the Owner has terminated the Contract as provided in Paragraph 15.02 and if it is subsequently determined for any reason that the Owner was not authorized to terminate the Contract as provided in said Paragraph, the rights and obligations of the parties shall be the same as if the Owner has issued a Notice of Termination to the Contractor as provided in Paragraph 15.5.2 hereinbelow."

15.5.2: "(a) The Owner may, at any time, terminate, in whole or in part, the Work under this Contract for the Owner's convenience and without cause. Any such termination shall be effected by delivery to the Contractor of a Notice of Termination specifying the extent to which performance of Work under the Contract is terminated, and the date upon which such termination becomes effective;

(b) After Receipt of a Notice or Termination, and except as otherwise directed by the Owner, the Contractor shall:

1) Stop work under the Contract on the date and to the extent specified in the Notice of Termination;

2) Place no further orders or subcontracts for materials, services or facilities except as necessary to complete the portion of the Work under the Contract which is not terminated;

3) Terminate all orders and subcontracts to the extent that they relate to the performance of the Work terminated by the Notice of Termination;

4) Assign to the Owner, in the manner, at times, and to the extent directed by the Owner, all of the right, title and interest of the Contractor under the orders and subcontracts so terminated. The Owner shall have the right, in its discretion, to settle or pay any or all claims arising out of the termination of such orders and subcontracts;

5) Settle all outstanding liabilities and all Claims arising out of such termination of orders and subcontracts, with the approval or ratification of the Owner to the extent the Owner may require. Its approval or ratification shall be final for all the purposes of this Paragraph 15.5.2;

6) Transfer title to the Owner, and deliver in the manner, at the times, and to the extent, if any, directed by the Owner, (i) the fabricated or unfabricated parts, Work in progress, completed Work, supplies, and other material produced as a part of, or acquired in connection with the performance of the Work terminated by the Notice of Termination, and (ii) the completed or partially completed plans, drawings, information, and other property which, if the Contract had been completed, would have been required to be furnished to the Owner;

7) Use his best efforts to sell, in the manner, at the times, to the extent, and at the price or prices that the Owner directs or authorizes, and property of the types referred to in Subparagraph (b) (6) of this Paragraph, but the Contractor (i) shall not be required to extend credit to any purchaser, and (ii) may acquire any such property under the conditions prescribed and at a price or prices approved by the Owner. The proceeds of any such transfer or deposition shall be applied in reduction of any payments to be made by the Owner to the Contractor under this Contract or shall otherwise be credited to the price or cost of the Work covered by this Contract or paid in such other manner as the Owner may direct;

8) Complete performance of such part of the Work as shall not have been terminated by the Notice of Termination; and,

9) Take such action as may be necessary, or as the Owner may direct, for the protection and preservation of the property related to this Contract which is in the possession of the Contractor and in which the Owner has or may acquire an interest;

c) After receipt of a Notice of Termination, the Contractor shall submit to the Owner his termination claim, in the form and with the certification the Owner prescribes. Such claims shall be submitted promptly but in no event later than one (1) year from the effective date of termination, unless one or more extensions in writing are granted by the

Owner upon request of the Contractor made in writing within such one (1) year period or authorized extension However, if the Owner determines that the facts justify such action, it may receive and act upon any such termination claim at any time after such one (1) year period or extension. If the Contractor fails to submit his termination claim within the time allowed, if any, due to the Contractor because of the termination. The Owner shall then pay to the Contractor the amount so determined.
d) Subject to the provisions of paragraph c), the Contractor and the owner may agree upon the whole or any part of the amount or amount to be paid to the Contractor because of the total or partial termination of Work under paragraph 15.5.2. The amount or amounts may include a reasonable allowance for profit on Work done. However, such agreed amount or amounts, exclusive of settlement costs, shall not exceed the Contract Sum as reduced by the amount of payments otherwise made and as further reduced by the Contract price of work not terminated. The Contract shall be amended accordingly, and the Contactor shall be paid the agreed amount. Nothing in paragraph (e) of this Paragraph 15.5.2, prescribing the amount to be paid to the Contractor in the event of failure of the Contractor and the Owner to agree upon the whole amount to be paid to the Contractor because of the termination of Work under this clause, shall be deemed to limit, restrict, or otherwise determine or affect the amount of amounts which may be agreed upon to be paid to the Contractor pursuant to this Subparagraph (d);
(e) If the Contractor and the Owner fail to agree as a paragraph (d) provides, on the whole amount to be paid to the Contractor because of the termination of Work under this Paragraph 15.5.2, the Owner shall determine, on the basis of information available to it, the amount, if any, due to the Contractor by reason of the termination and shall pay to the Contractor the amounts determined as follows:

1. For all Work performed before the effective date of the Notice of Termination, the total (without duplication of any items) of:

i) The cost of such Work;

ii) The cost of settling and paying claims arising out of the termination of Work under subcontracts or others as Paragraph 15.5.1 provides. This cost is exclusive of the amounts paid or payable on account of supplies or materials delivered or services furnished by the subcontractor before the effective date of the Notice of Termination. These amounts shall be included in the cost on account of which payment is made under (i) above; and

iii) A sum, as profits on (i), above; that the Owner determines to be fair and reasonable. But, if it appears that the Contractor would be sustained a loss on the entire Contract had it been completed, no profit shall be included or allowed under this subdivision (iii) and an appropriate adjustment shall be made reducing the amount of the settlement to reflect the indicated rate of loss.

1) The reasonable cost of the preservation and protection of property incurred under paragraph (b) (9) of this Paragraph 15.5.2; and any other reasonable cost identical to termination of Work

under this Contract, including expense incidental to the determination of the amount due to the Contractor as a result of the termination of Work under this Contract. The total sum of this Paragraph 15.5.2. shall not exceed the total Contract Sum as reduced by the amount of payments otherwise made and as further reduced by the Contract Price of Work not terminated. Except for normal spoilage, and except to the extent that the Owner shall have otherwise expressly assumed the risk of loss, there shall be excluded from the amount payable to the Contractor under (1) above, the fair value, as determined by the Owner of property which is destroyed, lost, stolen, or damaged, to the extent that it is undeliverable to the Owner, or to a buyer under Subparagraph (b) (7) of this Paragraph 15.5.2;

(f) The Contractor shall have the right to make claim from any determination the Owner makes under paragraph (c) or (e) of this Paragraph 15.5.2. But, if the Contractor has failed to submit his claim within the time provided in paragraph (c) of this Paragraph 15.5.2 and has failed to request extension of such time, he shall have no such right of appeal. In any case where the Owner has determined the amount due under Subparagraph (c) or (e) of this Paragraph 15.5.2, the Owner shall pay to the Contractor the following: (1) the amount so determined by the owner or (2) if an adverse proceeding is initiated, the amount finally determined in such proceeding;
(g) In arriving at the amount due the Contractor under this Paragraph 15.5.2, there shall be deducted (1) all unliquidated advance or other payments on account theretofore made to the Contractor, applicable to the termination portion of this Contract, (2) any claim which the Owner may have against the Contractor in connection with this Contract, and (3) the agreed price for, or the proceeds of sale of, any materials, supplies or other things kept by the Contractor or sold, under the provisions of this Paragraph 15.5.2, and not otherwise recovered by or credited to the Owner;
(h) If the termination hereunder be partial, before the settlement of the termination portion of this Contract, the Contractor may file with the Owner a request in writing for an equitable adjustment of the price or prices specified in the Contract related to the continued portion of the Contract (the portion not terminated by the Notice of Termination). Such equitable adjustments as may be agreed upon shall be made in the price or prices. Nothing contained herein shall limit the right of the Owner and the Contractor to agree upon the amount or amounts to be paid to the Contractor for the completion of the continued portion of the Contract when the Contract does not contain an established contract price for the continued portion."

39. <u>ADDITION OF TECHNICAL SPECIFICATIONS:</u>

a. Technical Specifications, in addition to those included in the Contract Documents, that will be utilized for use with the "City of Forest Park, GA – Forest Park Downtown Streetscape Phase 2A - Main Street" project shall be per the "Georgia Department of Transportation – Standard Specifications Construction of Transportation Systems – January 21, 2021 or latest revision" (Note: Local Standards take precedence over GDOT specifications related to conflicting guidelines, plans, and/or specifications related to roadways that have local jurisdiction.)
b. Technical Specifications, in addition to those included in the Contract Documents, that will be utilized for use with the "City of Forest Park, GA – Forest Park Downtown Streetscape Phase 2A - Main Street" project shall be per the "Manual on Uniform Traffic Control Devices for Streets and Highways – 2009 MUTCD with Revisions 1 and 2, May 2012 or latest revision"

c. Technical Specifications, in addition to those included in the Contract Documents, that will be utilized for use with the "City of Forest Park, GA – Forest Park Downtown Streetscape Phase 2A - Main Street" project shall be per the "Georgia Soil and Water Conservation Commission - Manual for Erosion and Sediment Control in Georgia – 2016 Edition or latest revision"

SECTION XVI

REFERENCE VERIFICATION AND RELEASE FORM

SOLICITATION NUMBER: PROJECT NO.:

PROJECT TITLE: FOREST PARK – STARR PARK – PHASE I

BIDDER: _____
(List name exactly as provided in Bid Form)

Provide at least five (5) references for the Bidder listed above of work similar to the current project being completed within the last five (5) years. Provide the information requested in the form below for the contact person who will verify the Bidder's experience and ability to perform the type of services listed in the ITB.

REFERENCE NO. 1:

Name of Company/Entity: _____

Mailing Address: _____

City/State/Zip Code: _____

Contact Person Name: _____

Contact Person Title: _____

Contract Person Phone No.: _____

Contract Person Email: _____

Date Work Performed: _____

Brief Description of Work Performed: _____

_____

_____

SECTION XVI

REFERENCE NO. 2:

Name of Company/Entity: _____

Mailing Address: _____

City/State/Zip Code: _____

Contact Person Name: _____

Contact Person Title: _____

Contract Person Phone No.: _____

Contract Person Email: _____

Date Work Performed: _____

Brief Description of Work Performed: _____

_____

_____

REFERENCE NO. 3:

Name of Company/Entity: _____

Mailing Address: _____

City/State/Zip Code: _____

Contact Person Name: _____

Contact Person Title: _____

Contract Person Phone No.: _____

Contract Person Email: _____

Date Work Performed: _____

Brief Description of Work Performed: _____

_____

_____

SECTION XVI

REFERENCE NO. 4:

Name of Company/Entity:

Mailing Address:

City/State/Zip Code:

Contact Person Name:

Contact Person Title:

Contract Person Phone No.:

Contract Person Email:

Date Work Performed:

Brief Description of Work Performed:

REFERENCE NO. 5:

Name of Company/Entity:

Mailing Address:

City/State/Zip Code:

Contact Person Name:

Contact Person Title:

Contract Person Phone No.:

Contract Person Email:

Date Work Performed:

Brief Description of Work Performed:

SECTION XVI

REFERENCE VERIFICATION RELEASE STATEMENT

The Bidder listed below hereby authorizes the City of Forest Park and its Representatives to contact the references provided for this bid and any additional parties that may be encountered/discovered during the reference conformation process.

BIDDER: _____
(List name exactly as provided in Bid Form)

SIGNED BY: _____
(Printed name and title)

AUTHORIZED SIGNATURE: _____ **DATE:** _____

Forest Park
Starr Park Phase I

CROFT

Project Manual
Bid Set 08.29.2022

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SECTION 00 0110

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END OF SECTION 00 0110

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SECTION 01 1000

SUMMARY

PART 1 GENERAL

1.01 PROJECT

A. Project Name: 2020-352 City of Forest Park - Starr Park
B. Owner's Name: City of Forest Park, Parks and Recreation
C. Architect's Name: Croft and Associates
D. The Project consists of the renovation of the existing Starr Park. The renovation includes a new walking track, walkways, playground, dog park, sports field and splash pad. The renovation will include the construction of 3 new buildings, 3 new park pavilions and a 347 S.F. addition to an existing pool equipment room.

1.02 CONTRACT DESCRIPTION

1.03 WORK BY OWNER

1.04 OWNER OCCUPANCY

A. Owner intends to occupy the Project upon Substantial Completion.
B. Cooperate with Owner to minimize conflict and to facilitate Owner's operations.
C. Schedule the Work to accommodate Owner occupancy.

1.05 CONTRACTOR USE OF SITE AND PREMISES

A. Construction Operations: Limited to areas noted on Drawings.
    1. Locate and conduct construction activities in ways that will limit disturbance to site.
B. Provide access to and from site as required by law and by Owner:
    1. Emergency Building Exits During Construction: Keep all exits required by code open during construction period; provide temporary exit signs if exit routes are temporarily altered.
    2. Do not obstruct roadways, sidewalks, or other public ways without permit.
C. Time Restrictions:
    1. Limit conduct of especially noisy exterior work to the hours of 7:00 am to 7:00 pm.
D. Utility Outages and Shutdown:
    1. Prevent accidental disruption of utility services to other facilities.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION 01 1000

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SECTION 01 2500
SUBSTITUTION PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Procedural requirements for proposed substitutions.

1.02 DEFINITIONS

A. Substitutions: See General Conditions for definition.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

A. A Substitution Request for products, assemblies, materials, and equipment constitutes a representation that the submitter:
   1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product, equipment, assembly, or system.
   2. Agrees to provide the same warranty for the substitution as for the specified product.
   3. Agrees to provide same or equivalent maintenance service and source of replacement parts, as applicable.
   4. Agrees to coordinate installation and make changes to other work that may be required for the work to be complete, with no additional cost to Owner.
   5. Waives claims for additional costs or time extension that may subsequently become apparent.
   6. Agrees to reimburse Owner and Architect for review or redesign services associated with re-approval by authorities.

B. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents. Burden of proof is on proposer.
   1. Note explicitly any non-compliant characteristics.

C. Content: Include information necessary for tracking the status of each Substitution Request, and information necessary to provide an actionable response.
   1. No specific form is required. Contractor's Substitution Request documentation must include the following:
      a. Project Information:
         1) Official project name and number, and any additional required identifiers established in Contract Documents.
         2) Owner's, Architect's, and Contractor's names.
      b. Substitution Request Information:
         1) Discrete and consecutive Substitution Request number, and descriptive subject/title.

2) Issue date.
3) Reference to particular Contract Document(s) specification section number, title, and article/paragraph(s).
4) Description of Substitution.
5) Reason why the specified item cannot be provided.
6) Differences between proposed substitution and specified item.
7) Description of how proposed substitution affects other parts of work.

c. Attached Comparative Data: Provide point-by-point, side-by-side comparison addressing essential attributes specified, as appropriate and relevant for the item:
1) Physical characteristics.
2) In-service performance.
3) Expected durability.
4) Visual effect.
5) Warranties.
6) Other salient features and requirements.
7) Include, as appropriate or requested, the following types of documentation:
(a) Product Data:
(b) Samples.
(c) Certificates, test, reports or similar qualification data.
(d) Drawings, when required to show impact on adjacent construction elements.

d. Impact of Substitution:
1) Savings to Owner for accepting substitution.
2) Change to Contract Time due to accepting substitution.

D. Limit each request to a single proposed substitution item.
1. Submit an electronic document, combining the request form with supporting data into single document.

3.02 SUBSTITUTION PROCEDURES DURING PROCUREMENT

A. Owner will consider requests for substitutions only if submitted at least 10 days prior to the date for receipt of bids.

3.03 SUBSTITUTION PROCEDURES DURING CONSTRUCTION

A. Submit request for Substitution for Cause within 14 days of discovery of need for substitution, but not later than 14 days prior to time required for review and approval by Architect, in order to stay on approved project schedule.

B. Submit request for Substitution for Convenience immediately upon discovery of its potential advantage to the project, but not later than 14 days prior to time required for review and approval by Architect, in order to stay on approved project schedule.
   1. In addition to meeting general documentation requirements, document how the requested substitution benefits the Owner through cost savings, time savings, greater energy conservation, or in other specific ways.
   2. Document means of coordinating of substitution item with other portions of the work, including work by affected subcontractors.
   3. Bear the costs engendered by proposed substitution of:
      a. Owner's compensation to the Architect for any required redesign, time spent processing and evaluating the request.

C. Substitutions will not be considered under one or more of the following circumstances:
   1. When they are indicated or implied on shop drawing or product data submittals, without having received prior approval.
   2. Without a separate written request.

3.04 RESOLUTION

A. Architect may request additional information and documentation prior to rendering a decision. Provide this data in an expeditious manner.

B. Architect will notify Contractor in writing of decision to accept or reject request.
   1. Architect's decision following review of proposed substitution will be noted on the submitted form.

3.05 ACCEPTANCE

A. Accepted substitutions change the work of the Project. They will be documented and incorporated into work of the project by Change Order, Construction Change Directive, Architectural Supplementary Instructions, or similar instruments provided for in the Conditions of the Contract.

3.06 CLOSEOUT ACTIVITIES

A. See Section 01 7800 - Closeout Submittals, for closeout submittals.

END OF SECTION 01 2500

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SECTION 01 3000
ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General administrative requirements.
B. Preconstruction meeting.
C. Site mobilization meeting.
D. Progress meetings.
E. Construction progress schedule.
F. Submittals for review, information, and project closeout.
G. Number of copies of submittals.
H. Requests for Interpretation (RFI) procedures.
I. Submittal procedures.

1.02 RELATED REQUIREMENTS

A. Section 01 6000 - Product Requirements: General product requirements.

1.03 GENERAL ADMINISTRATIVE REQUIREMENTS

A. Comply with requirements of Section 01 7000 - Execution and Closeout Requirements for coordination of execution of administrative tasks with timing of construction activities.
B. Make the following types of submittals to Architect:
    1. Requests for Interpretation (RFI).
    2. Requests for substitution.
    3. Shop drawings, product data, and samples.
    4. Test and inspection reports.
    5. Design data.
    6. Manufacturer's instructions and field reports.
    7. Applications for payment and change order requests.
    8. Progress schedules.
    9. Coordination drawings.
    10. Correction Punch List and Final Correction Punch List for Substantial Completion.
    11. Closeout submittals.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 SITE MOBILIZATION MEETING

A. Schedule meeting at the Project site prior to Contractor occupancy.
B. Attendance Required:
    1. Contractor.
    2. Owner.

3. Architect.
4. Contractor's superintendent.

C. Agenda:
1. Use of premises by Owner and Contractor.
2. Owner's requirements.
3. Construction facilities and controls provided by Owner.
4. Temporary utilities provided by Owner.
5. Survey and building layout.
6. Security and housekeeping procedures.
7. Schedules.
8. Application for payment procedures.
9. Procedures for testing.
10. Procedures for maintaining record documents.
11. Requirements for start-up of equipment.
12. Inspection and acceptance of equipment put into service during construction period.

D. Record minutes and distribute copies within two days after meeting to participants, with electronic copies to Architect, Owner, participants, and those affected by decisions made.

3.02 PROGRESS MEETINGS

A. Attendance Required:
1. Contractor.
2. Owner.
3. Architect.
4. Contractor's superintendent.

B. Agenda:
1. Review minutes of previous meetings.
2. Review of work progress.
3. Field observations, problems, and decisions.
4. Identification of problems that impede, or will impede, planned progress.
5. Review of submittals schedule and status of submittals.
6. Review of RFIs log and status of responses.
7. Maintenance of progress schedule.
8. Corrective measures to regain projected schedules.
9. Planned progress during succeeding work period.
10. Maintenance of quality and work standards.
11. Effect of proposed changes on progress schedule and coordination.
12. Other business relating to work.

C. Record minutes and distribute copies within two days after meeting to participants, with electronic copies to Architect, Owner, participants, and those affected by decisions made.

3.03 CONSTRUCTION PROGRESS SCHEDULE

A. Within 10 days after date of the Agreement, submit preliminary schedule defining planned operations for the first 60 days of work, with a general outline for remainder of work.

B. If preliminary schedule requires revision after review, submit revised schedule within 10 days.

C. Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review.

1. Include written certification that major contractors have reviewed and accepted proposed schedule.

D. Within 10 days after joint review, submit complete schedule.

E. Submit updated schedule with each Application for Payment.

3.04 REQUESTS FOR INTERPRETATION (RFI)

A. Definition: A request seeking one of the following:

1. An interpretation, amplification, or clarification of some requirement of Contract Documents arising from inability to determine from them the exact material, process, or system to be installed; or when the elements of construction are required to occupy the same space (interference); or when an item of work is described differently at more than one place in Contract Documents.
2. A resolution to an issue which has arisen due to field conditions and affects design intent.

B. Preparation: Prepare an RFI immediately upon discovery of a need for interpretation of Contract Documents. Failure to submit a RFI in a timely manner is not a legitimate cause for claiming additional costs or delays in execution of the work.

1. Prepare a separate RFI for each specific item.
    a. Review, coordinate, and comment on requests originating with subcontractors and/or materials suppliers.
    b. Do not forward requests which solely require internal coordination between subcontractors.
2. Prepare in a format and with content acceptable to Owner.
3. Combine RFI and its attachments into a single electronic file. PDF format is preferred.

C. Reason for the RFI: Prior to initiation of an RFI, carefully study all Contract Documents to confirm that information sufficient for their interpretation is definitely not included.

1. Unacceptable Uses for RFIs: Do not use RFIs to request the following::

a. Approval of submittals (use procedures specified elsewhere in this section).
b. Approval of substitutions (see Section - 01 6000 - Product Requirements)
c. Changes that entail change in Contract Time and Contract Sum (comply with provisions of the Conditions of the Contract).

2. Improper RFIs: Requests not prepared in compliance with requirements of this section, and/or missing key information required to render an actionable response. They will be returned without a response.

D. Content: Include identifiers necessary for tracking the status of each RFI, and information necessary to provide an actionable response.
1. Official Project name and number, and any additional required identifiers established in Contract Documents.
2. Owner's, Architect's, and Contractor's names.
3. Discrete and consecutive RFI number, and descriptive subject/title.
4. Issue date, and requested reply date.
5. Reference to particular Contract Document(s) requiring additional information/interpretation. Identify pertinent drawing and detail number and/or specification section number, title, and paragraph(s).
6. Annotations: Field dimensions and/or description of conditions which have engendered the request.
7. Contractor's suggested resolution: A written and/or a graphic solution, to scale, is required in cases where clarification of coordination issues is involved, for example; routing, clearances, and/or specific locations of work shown diagrammatically in Contract Documents. If applicable, state the likely impact of the suggested resolution on Contract Time or the Contract Sum.

E. Attachments: Include sketches, coordination drawings, descriptions, photos, submittals, and other information necessary to substantiate the reason for the request.

F. RFI Log: Prepare and maintain a tabular log of RFIs for the duration of the project.
1. Indicate current status of every RFI. Update log promptly and on a regular basis.
2. Note dates of when each request is made, and when a response is received.

G. Review Time: Architect will respond and return RFIs to Contractor within three business days of receipt. For the purpose of establishing the start of the mandated response period, RFIs received after 2 pm will be considered as having been received on the following regular working day.

H. Responses: Content of answered RFIs will not constitute in any manner a directive or authorization to perform extra work or delay the project. If in Contractor's belief it is likely to lead to a change to Contract Sum or Contract Time, promptly issue a notice to this effect, and follow up with an appropriate Change Order request to Owner.

1. Response may include a request for additional information, in which case the original RFI will be deemed as having been answered, and an amended one is to be issued forthwith. Identify the amended RFI with an R suffix to the original number.
2. Do not extend applicability of a response to specific item to encompass other similar conditions, unless specifically so noted in the response.
3. Upon receipt of a response, promptly review and distribute it to all affected parties, and update the RFI Log.
4. Notify Architect within seven calendar days if an additional or corrected response is required by submitting an amended version of the original RFI, identified as specified above.

3.05 SUBMITTAL SCHEDULE

A. Submit to Architect for review a schedule for submittals in tabular format.
   1. Coordinate with Contractor's Schedule.
   2. Format schedule to allow tracking of status of submittals throughout duration of construction.
   3. Arrange information to include scheduled date for initial submittal, specification number and title, submittal category (for review or for information), description of item of work covered, and role and name of subcontractor.
   4. Account for time required for preparation, review, manufacturing, fabrication and delivery when establishing submittal delivery and review deadline dates.

3.06 SUBMITTALS FOR REVIEW

A. When the following are specified in individual sections, submit them for review:
   1. Product data.
   2. Shop drawings.
   3. Samples for selection.
   4. Samples for verification.
B. Submit to Architect for review for the limited purpose of checking for compliance with information given and the design concept expressed in Contract Documents.
C. Samples will be reviewed for aesthetic, color, or finish selection.
D. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below and for record documents purposes described in Section 01 7800 - Closeout Submittals.

3.07 SUBMITTALS FOR INFORMATION

A. When the following are specified in individual sections, submit them for information:
   1. Design data.
   2. Certificates.
   3. Test reports.

4. Inspection reports.
5. Manufacturer's instructions.
6. Manufacturer's field reports.
7. Other types indicated.

B. Submit for Architect's knowledge as contract administrator or for Owner.

3.08 SUBMITTALS FOR PROJECT CLOSEOUT

A. Submit Correction Punch List for Substantial Completion.

B. Submit Final Correction Punch List for Substantial Completion.

C. When the following are specified in individual sections, submit them at project closeout in compliance with requirements of Section 01 7800 - Closeout Submittals:

1. Project record documents.
2. Operation and maintenance data.
3. Warranties.
4. Bonds.
5. Other types as indicated.

D. Submit for Owner's benefit during and after project completion.

3.09 NUMBER OF COPIES OF SUBMITTALS

A. Electronic Documents: Submit one electronic copy in PDF format; an electronically-marked up file will be returned. Create PDFs at native size and right-side up; illegible files will be rejected.

B. Samples: Submit the number specified in individual specification sections; one of which will be retained by Architect.

1. After review, produce duplicates.
2. Retained samples will not be returned to Contractor unless specifically so stated.

3.10 SUBMITTAL PROCEDURES

A. General Requirements:

1. Use a separate transmittal for each item.
2. Submit separate packages of submittals for review and submittals for information, when included in the same specification section.
3. Sequentially identify each item. For revised submittals use original number and a sequential numerical suffix.
4. Identify: Project; Contractor; subcontractor or supplier; pertinent drawing and detail number; and specification section number and article/paragraph, as appropriate on each copy.
5. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction work, and coordination of information is in accordance with the requirements of the work and Contract Documents.

6. Schedule submittals to expedite the Project, and coordinate submission of related items.
    a. For each submittal for review, allow 10 business days excluding delivery time to and from the Contractor.
7. Identify variations from Contract Documents and product or system limitations that may be detrimental to successful performance of the completed work.
8. Provide space for Contractor and Architect review stamps.
9. When revised for resubmission, identify all changes made since previous submission.
10. Distribute reviewed submittals. Instruct parties to promptly report inability to comply with requirements.
11. Submittals not requested will be recognized, and will be returned "Not Reviewed",

B. Product Data Procedures:
1. Submit only information required by individual specification sections.
2. Collect required information into a single submittal.
3. Do not submit (Material) Safety Data Sheets for materials or products.

C. Shop Drawing Procedures:
1. Prepare accurate, drawn-to-scale, original shop drawing documentation by interpreting Contract Documents and coordinating related work.
2. Do not reproduce Contract Documents to create shop drawings.
3. Generic, non-project-specific information submitted as shop drawings do not meet the requirements for shop drawings.

D. Samples Procedures:
1. Transmit related items together as single package.
2. Identify each item to allow review for applicability in relation to shop drawings showing installation locations.

3.11 SUBMITTAL REVIEW

A. Submittals for Review: Architect will review each submittal, and approve, or take other appropriate action.
B. Submittals for Information: Architect will acknowledge receipt and review. See below for actions to be taken.
C. Architect's actions will be reflected by marking each returned submittal using virtual stamp on electronic submittals.
D. Architect's and consultants' actions on items submitted for review:
1. Authorizing purchasing, fabrication, delivery, and installation:
    a. "No Exceptions Taken", or language with same legal meaning.

b. "Exceptions Noted, No Re-Submittal Required", or language with same legal meaning.
    1) At Contractor's option, submit corrected item, with review notations acknowledged and incorporated.
c. "Exceptions Noted, Re-Submit Record Copy", or language with same legal meaning.
    1) Resubmit corrected item, with review notations acknowledged and incorporated. Resubmit separately, or as part of project record documents.

2. Not Authorizing fabrication, delivery, and installation:
    a. "Revise and Resubmit".
        1) Resubmit revised item, with review notations acknowledged and incorporated.
    b. "Rejected".
        1) Submit item complying with requirements of Contract Documents.

E. Architect's and consultants' actions on items submitted for information:
1. Items for which no action was taken:
    a. "Received" - to notify the Contractor that the submittal has been received for record only.
2. Items for which action was taken:
    a. "Reviewed" - no further action is required from Contractor.

END OF SECTION 01 3000

SECTION 01 4000
QUALITY REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Submittals.
B. Quality assurance.
C. References and standards.
D. Testing and inspection agencies and services.
E. Control of installation.
F. Mock-ups.
G. Tolerances.
H. Manufacturers' field services.
I. Defect Assessment.

1.02 RELATED REQUIREMENTS

A. Section 01 4216 - Definitions.

1.03 DEFINITIONS

A. Design Data: Design-related, signed and sealed drawings, calculations, specifications, certifications, shop drawings and other submittals provided by Contractor, and prepared directly by, or under direct supervision of, appropriately licensed design professional.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Design Data: Submit for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents, or for Owner's information.
C. Test Reports: After each test/inspection, promptly submit two copies of report to Architect and to Contractor.
    1. Include:
        a. Date issued.
        b. Project title and number.
        c. Name of inspector.
        d. Date and time of sampling or inspection.
        e. Identification of product and specifications section.
        f. Location in the Project.
        g. Type of test/inspection.
        h. Date of test/inspection.
        i. Results of test/inspection.
        j. Compliance with Contract Documents.

k. When requested by Architect, provide interpretation of results.

2. Test report submittals are for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents, or for Owner's information.

D. Certificates: When specified in individual specification sections, submit certification by the manufacturer and Contractor or installation/application subcontractor to Architect, in quantities specified for Product Data.

1. Indicate material or product complies with or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
2. Certificates may be recent or previous test results on material or product, but must be acceptable to Architect.

E. Manufacturer's Instructions: When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, for the Owner's information. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

F. Manufacturer's Field Reports: Submit reports for Architect's benefit as contract administrator or for Owner.

1. Submit report within 30 days of observation to Architect for information.
2. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents.

1.05 QUALITY ASSURANCE

A. Designer Qualifications: Where professional engineering design services and design data submittals are specifically required of Contractor by Contract Documents, provide services of a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

1.06 REFERENCES AND STANDARDS

A. For products and workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

B. Comply with reference standard of date of issue current on date of Contract Documents, except where a specific date is established by applicable code.

C. Obtain copies of standards where required by product specification sections.

D. Maintain copy at project site during submittals, planning, and progress of the specific work, until Substantial Completion.

E. Should specified reference standards conflict with Contract Documents, request clarification from Architect before proceeding.

F. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of Architect shall be altered from Contract Documents by mention or inference otherwise in any reference document.

1.07 TESTING AND INSPECTION AGENCIES AND SERVICES

A. Owner will employ and pay for services of an independent testing agency to perform specified testing.

B. Employment of agency in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 CONTROL OF INSTALLATION

A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce work of specified quality.

B. Comply with manufacturers' instructions, including each step in sequence.

C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect before proceeding.

D. Comply with specified standards as minimum quality for the work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

E. Have work performed by persons qualified to produce required and specified quality.

F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.

G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

3.02 MOCK-UPS

A. Before installing portions of the Work where mock-ups are required, construct mock-ups in location and size indicated for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work. The purpose of mock-up is to demonstrate the proposed range of aesthetic effects and workmanship.

B. Accepted mock-ups establish the standard of quality the Architect will use to judge the Work.

C. Provide supervisory personnel who will oversee mock-up construction. Provide workers that will be employed during the construction at Project.

D. Tests shall be performed under provisions identified in this section and identified in the respective product specification sections.

E. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.

F. Obtain Architect's approval of mock-ups before starting work, fabrication, or construction.
   1. Architect will issue written comments within seven (7) working days of initial review and each subsequent follow up review of each mock-up.
   2. Make corrections as necessary until Architect's approval is issued.
G. Accepted mock-ups shall be a comparison standard for the remaining Work.
H. Where mock-up has been accepted by Architect and is specified in product specification sections to be removed, protect mock-up throughout construction, remove mock-up and clear area when directed to do so by Architect.

3.03 TOLERANCES

A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.
B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Architect before proceeding.
C. Adjust products to appropriate dimensions; position before securing products in place.

3.04 TESTING AND INSPECTION

A. Testing Agency Duties:
   1. Test samples of mixes submitted by Contractor.
   2. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
   3. Perform specified sampling and testing of products in accordance with specified standards.
   4. Ascertain compliance of materials and mixes with requirements of Contract Documents.
   5. Promptly notify Architect and Contractor of observed irregularities or non-compliance of Work or products.
   6. Perform additional tests and inspections required by Architect.
   7. Submit reports of all tests/inspections specified.
B. Limits on Testing/Inspection Agency Authority:
   1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
   2. Agency may not approve or accept any portion of the Work.
   3. Agency may not assume any duties of Contractor.
   4. Agency has no authority to stop the Work.
C. Contractor Responsibilities:
   1. Deliver to agency at designated location, adequate samples of materials proposed to be used that require testing, along with proposed mix designs.

2. Cooperate with laboratory personnel, and provide access to the Work and to manufacturers' facilities.
3. Provide incidental labor and facilities:
    a. To provide access to Work to be tested/inspected.
    b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
    c. To facilitate tests/inspections.
    d. To provide storage and curing of test samples.
4. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing/inspection services.
5. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
6. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.

D. Re-testing required because of non-compliance with specified requirements shall be performed by the same agency on instructions by Architect.

E. Re-testing required because of non-compliance with specified requirements shall be paid for by Contractor.

3.05 MANUFACTURERS' FIELD SERVICES

A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust, and balance equipment as applicable, and to initiate instructions when necessary.

B. Submit qualifications of observer to Architect 30 days in advance of required observations.
1. Observer subject to approval of Architect.
2. Observer subject to approval of Owner.

C. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

3.06 DEFECT ASSESSMENT

A. Replace Work or portions of the Work not complying with specified requirements.

B. If, in the opinion of Architect, it is not practical to remove and replace the work, Architect will direct an appropriate remedy or adjust payment.

END OF SECTION 01 4000

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SECTION 01 4216
DEFINITIONS

PART 1 GENERAL

1.01 SUMMARY

A. This section supplements the definitions contained in the General Conditions.

B. Other definitions are included in individual specification sections.

1.02 DEFINITIONS

A. Furnish: To supply, deliver, unload, and inspect for damage.

B. Install: To unpack, assemble, erect, apply, place, finish, cure, protect, clean, start up, and make ready for use.

C. Product: Material, machinery, components, equipment, fixtures, and systems forming the work result. Not materials or equipment used for preparation, fabrication, conveying, or erection and not incorporated into the work result. Products may be new, never before used, or re-used materials or equipment.

D. Project Manual: The book-sized volume that includes the procurement requirements (if any), the contracting requirements, and the specifications.

E. Provide: To furnish and install.

F. Supply: Same as Furnish.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION 01 4216

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SECTION 01 5000
TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Temporary utilities.
B. Temporary telecommunications services.
C. Temporary sanitary facilities.
D. Temporary Controls: Barriers and fencing.
E. Security requirements.
F. Vehicular access and parking.
G. Waste removal facilities and services.
H. Project identification sign.
I. Field offices.

1.02 TEMPORARY UTILITIES

A. Owner will provide the following:
    1. Water supply, consisting of connection to existing facilities.
B. Provide and pay for all electrical power, lighting, and water required for construction purposes.
C. New permanent facilities may not be used.
D. Use trigger-operated nozzles for water hoses, to avoid waste of water.

1.03 TELECOMMUNICATIONS SERVICES

A. Provide, maintain, and pay for telecommunications services to field office at time of project mobilization.
B. Telecommunications services shall include:
    1. Windows-based personal computer dedicated to project telecommunications, with necessary software and laser printer.
    2. Internet Connections: Minimum of one; DSL modem or faster.
    3. Facsimile Service: Fax-to-email software on personal computer.

1.04 TEMPORARY SANITARY FACILITIES

A. Provide and maintain required facilities and enclosures. Provide at time of project mobilization.
B. New permanent facilities may not be used during construction operations.
C. Maintain daily in clean and sanitary condition.

1.05 BARRIERS

A. Provide barriers to prevent unauthorized entry to construction areas, to prevent access to areas that could be hazardous to workers or the public, to allow for owner's use of site and to protect existing facilities and adjacent properties from damage from construction operations.

B. Provide barricades and covered walkways required by governing authorities for public rights-of-way.
C. Provide protection for plants designated to remain. Replace damaged plants.
D. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

1.06 FENCING

A. Construction: Commercial grade chain link fence with privacy screen.
B. Provide 6 foot high fence around construction site; equip with vehicular and pedestrian gates with locks.

1.07 SECURITY

A. Provide security and facilities to protect Work, and Owner's operations from unauthorized entry, vandalism, or theft.
B. Coordinate with Owner's security program.

1.08 VEHICULAR ACCESS AND PARKING

A. Comply with regulations relating to use of streets and sidewalks, access to emergency facilities, and access for emergency vehicles.
B. Coordinate access and haul routes with governing authorities and Owner.
C. Provide and maintain access to fire hydrants, free of obstructions.
D. Provide means of removing mud from vehicle wheels before entering streets.
E. Designated existing on-site roads may be used for construction traffic.
F. Provide temporary parking areas to accommodate construction personnel. When site space is not adequate, provide additional off-site parking.
G. Existing parking areas may be used for construction parking to the etent allowed by the Owner and only in areas designated by the Owner.

1.09 WASTE REMOVAL

A. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.
B. Provide containers with lids. Remove trash from site periodically.
C. If materials to be recycled or re-used on the project must be stored on-site, provide suitable non-combustible containers; locate containers holding flammable material outside the structure unless otherwise approved by the authorities having jurisdiction.
D. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

1.10 PROJECT IDENTIFICATION

A. Provide project identification sign of design and construction indicated on drawings.
B. Erect on site at location indicated.
C. No other signs are allowed without Owner permission except those required by law.

1.11 FIELD OFFICES

A. Office: Weathertight, with lighting, electrical outlets, heating, cooling equipment, and equipped with sturdy furniture, drawing rack, and drawing display table.
B. Provide space for Project meetings, with table and chairs to accommodate 6 persons.
C. Locate offices a minimum distance of 30 feet from existing and new structures.

1.12 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

A. Remove temporary utilities, equipment, facilities, materials, prior to Date of Substantial Completion inspection.
B. Remove underground installations to a minimum depth of 2 feet. Grade site as indicated.
C. Clean and repair damage caused by installation or use of temporary work.
D. Restore existing facilities used during construction to original condition.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION 01 5000

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SECTION 01 5719
TEMPORARY ENVIRONMENTAL CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Construction procedures to promote adequate indoor air quality after construction.

1.02 PROJECT GOALS

A. Dust and Airborne Particulates: Prevent deposition of dust and other particulates in HVAC ducts and equipment.
   1. Cleaning of ductwork is not contemplated under this Contract.
   2. Contractor shall bear the cost of cleaning required due to failure to protect ducts and equipment from construction dust.
   3. Establish condition of existing ducts and equipment prior to start of alterations.

B. Airborne Contaminants: Procedures and products have been specified to minimize indoor air pollutants.
   1. Furnish products meeting the specifications.
   2. Avoid construction practices that could result in contamination of installed products leading to indoor air pollution.

1.03 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

1.04 DEFINITIONS

A. Adsorptive Materials: Gypsum board, acoustical ceiling tile and panels, carpet and carpet tile, fabrics, fibrous insulation, and other similar products.

B. Contaminants: Gases, vapors, regulated pollutants, airborne mold and mildew, and the like, as specified.

C. Particulates: Dust, dirt, and other airborne solid matter.

D. Wet Work: Concrete, plaster, coatings, and other products that emit water vapor or volatile organic compounds during installation, drying, or curing.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Indoor Air Quality Management Plan: Describe in detail measures to be taken to promote adequate indoor air quality upon completion; use SMACNA (OCC) as a guide.
   1. Submit not less than 60 days before enclosure of building.
   2. Identify potential sources of odor and dust.
   3. Identify construction activities likely to produce odor or dust.
   4. Identify areas of project potentially affected, especially occupied areas.
   5. Evaluate potential problems by severity and describe methods of control.

6. Describe construction ventilation to be provided, including type and duration of ventilation, use of permanent HVAC systems, types of filters and schedule for replacement of filters.
7. Describe cleaning and dust control procedures.

C. Interior Finishes Installation Schedule: Identify each interior finish that either generates odors, moisture, or vapors or is susceptible to adsorption of odors and vapors, and indicate air handling zone, sequence of application, and curing times.

D. Duct and Terminal Unit Inspection Report.

PART 2 PRODUCTS

2.01 MATERIALS

A. Low VOC Materials: See Section 01 6116.

B. Low VOC Materials: See other sections for specific requirements for materials with low VOC content.

C. Auxiliary Air Filters: MERV of 8, minimum, when tested in accordance with ASHRAE Std 52.2.

PART 3 EXECUTION

3.01 CONSTRUCTION PROCEDURES

A. Prevent the absorption of moisture and humidity by adsorptive materials by:
1. Sequencing the delivery of such materials so that they are not present in the building until wet work is completed and dry.
2. Delivery and storage of such materials in fully sealed moisture-impermeable packaging.
3. Provide sufficient ventilation for drying within reasonable time frame.

B. Begin construction ventilation when building is substantially enclosed.

C. If extremely dusty or dirty work must be conducted inside the building, shut down HVAC systems for the duration; remove dust and dirt completely before restarting systems.

D. When working in a portion of an occupied building, prevent movement of air from construction area to occupied area.

E. HVAC equipment and supply air ductwork may be used for ventilation during construction:
1. Operate HVAC system on 100 percent outside air, with 1.5 air changes per hour, minimum.
2. Ensure that air filters are correctly installed prior to starting use; replace filters when they lose efficiency.
3. Do not use return air ductwork for ventilation.
4. Seal return air inlets or otherwise positively isolate return air system to prevent recirculation of air; provide alternate return air pathways.

F. Do not store construction materials or waste in mechanical or electrical rooms.

G. Prior to use of return air ductwork without intake filters clean up and remove dust and debris generated by construction activities.
   1. Inspect duct intakes, return air grilles, and terminal units for dust.
   2. Clean plenum spaces, including top sides of lay-in ceilings, outsides of ducts, tops of pipes and conduit.
   3. Clean tops of doors and frames.
   4. Clean mechanical and electrical rooms, including tops of pipes, ducts, and conduit, equipment, and supports.
   5. Clean return plenums of air handling units.
   6. Remove intake filters last, after cleaning is complete.

H. Do not perform dusty or dirty work after starting use of return air ducts without intake filters.

I. Use other relevant recommendations of SMACNA (OCC) for avoiding unnecessary contamination due to construction procedures.

END OF SECTION 01 5719

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SECTION 01 6000
PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General product requirements.
B. Transportation, handling, storage and protection.
C. Product option requirements.
D. Substitution limitations.
E. Procedures for Owner-supplied products.
F. Maintenance materials, including extra materials, spare parts, tools, and software.

1.02 RELATED REQUIREMENTS

A. Section 01 2500 - Substitution Procedures: Substitutions made during procurement and/or construction phases.
B. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions: Requirements for VOC-restricted product categories.
C. Section 01 7419 - Construction Waste Management and Disposal: Waste disposal requirements potentially affecting product selection, packaging and substitutions.

1.03 SUBMITTALS

A. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.
B. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
C. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
    1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

PART 2 PRODUCTS

2.01 NEW PRODUCTS

A. Provide new products unless specifically required or permitted by Contract Documents.
B. Use of products having any of the following characteristics is not permitted:
    1. Made using or containing CFC's or HCFC's.
    2. Made of wood from newly cut old growth timber.
    3. Containing lead, cadmium, or asbestos.
C. Where other criteria are met, Contractor shall give preference to products that:

1. If used on interior, have lower emissions, as defined in Section 01 6116.
2. If wet-applied, have lower VOC content, as defined in Section 01 6116.
3. Are extracted, harvested, and/or manufactured closer to the location of the project.
4. Have longer documented life span under normal use.
5. Result in less construction waste. See Section 01 7419
6. Are Cradle-to-Cradle Certified.
7. Have a published Environmental Product Declaration (EPD).
8. Have a published Health Product Declaration (HPD).
9. Have a published Manufacturer's Inventory of Chemical Content.

2.02 PRODUCT OPTIONS

A. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.

B. Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.

C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

2.03 MAINTENANCE MATERIALS

A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.

B. Deliver to Project site; obtain receipt prior to final payment.

PART 3 EXECUTION

3.01 SUBSTITUTION LIMITATIONS

A. See Section 01 2500 - Substitution Procedures.

3.02 OWNER-SUPPLIED PRODUCTS

A. Owner's Responsibilities:
   1. Arrange for and deliver Owner reviewed shop drawings, product data, and samples, to Contractor.
   2. Arrange and pay for product delivery to site.
   3. On delivery, inspect products jointly with Contractor.
   4. Submit claims for transportation damage and replace damaged, defective, or deficient items.
   5. Arrange for manufacturers' warranties, inspections, and service.

B. Contractor's Responsibilities:
   1. Review Owner reviewed shop drawings, product data, and samples.
   2. Receive and unload products at site; inspect for completeness or damage jointly with Owner.

3. Handle, store, install and finish products.
4. Repair or replace items damaged after receipt.

3.03 TRANSPORTATION AND HANDLING

A. Package products for shipment in manner to prevent damage; for equipment, package to avoid loss of factory calibration.
B. If special precautions are required, attach instructions prominently and legibly on outside of packaging.
C. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.
D. Transport and handle products in accordance with manufacturer's instructions.
E. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.
F. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.
G. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage, and to minimize handling.
H. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

3.04 STORAGE AND PROTECTION

A. Provide protection of stored materials and products against theft, casualty, or deterioration.
B. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication. See Section 01 7419.
C. Store and protect products in accordance with manufacturers' instructions.
D. Store with seals and labels intact and legible.
E. Store sensitive products in weathertight, climate-controlled enclosures in an environment favorable to product.
F. For exterior storage of fabricated products, place on sloped supports above ground.
G. Provide off-site storage and protection when site does not permit on-site storage or protection.
H. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.
I. Comply with manufacturer's warranty conditions, if any.
J. Do not store products directly on the ground.

K. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.
L. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.
M. Prevent contact with material that may cause corrosion, discoloration, or staining.
N. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.
O. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

END OF SECTION 01 6000

SECTION 01 6116
VOLATILE ORGANIC COMPOUND (VOC) CONTENT RESTRICTIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Requirements for Indoor-Emissions-Restricted products.

B. Requirements for VOC-Content-Restricted products.

1.02 RELATED REQUIREMENTS

A. Section 01 3000 - Administrative Requirements: Submittal procedures.

1.03 DEFINITIONS

A. Indoor-Emissions-Restricted Products: All products in the following product categories, whether specified or not:

1. Interior paints and coatings applied on site.
2. Interior adhesives and sealants applied on site, including flooring adhesives.
3. Flooring.
4. Products making up wall and ceiling assemblies.
5. Thermal and acoustical insulation.

B. VOC-Content-Restricted Products: All products in the following product categories, whether specified or not:

1. Exterior and interior paints and coatings applied on site.
2. Exterior and interior adhesives and sealants applied on site, including flooring adhesives.
3. Wet-applied roofing and waterproofing.
4. Other products when specifically stated in the specifications.

C. Interior of Building: Anywhere inside the exterior weather barrier.

D. Adhesives: All gunnable, trowelable, liquid-applied, and aerosol adhesives, whether specified or not; including flooring adhesives, resilient base adhesives, and pipe jointing adhesives.

E. Sealants: All gunnable, trowelable, and liquid-applied joint sealants and sealant primers, whether specified or not; including firestopping sealants and duct joint sealers.

F. Inherently Non-Emitting Materials: Products composed wholly of minerals or metals, unless they include organic-based surface coatings, binders, or sealants; and specifically the following:

1. Stone.
2. Concrete.
3. Clay brick.
4. Metals that are plated, anodized, or powder-coated.

5. Glass.
6. Ceramics.
7. Solid wood flooring that is unfinished and untreated.

1.04 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency current edition.
B. ASTM D3960 - Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings 2005 (Reapproved 2018).
C. CAL (CDPH SM) - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions From Indoor Sources Using Environmental Chambers 2017, v1.2.
D. CARB (SCM) - Suggested Control Measure for Architectural Coatings; California Air Resources Board 2007.
E. CHPS (HPPD) - High Performance Products Database Current Edition at www.chps.net/.
F. CRI (GLP) - Green Label Plus Testing Program - Certified Products Current Edition.
G. SCAQMD 1113 - Architectural Coatings 1977 (Amended 2016).
H. SCAQMD 1168 - Adhesive and Sealant Applications 1989 (Amended 2017).
I. SCS (CPD) - SCS Certified Products Current Edition.
J. UL (GGG) - GREENGUARD Gold Certified Products Current Edition.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: For each VOC-restricted product used in the project, submit evidence of compliance.

1.06 QUALITY ASSURANCE

A. Indoor Emissions Standard and Test Method: CAL (CDPH SM), using Standard Private Office exposure scenario and the allowable concentrations specified in the method, and range of total VOC's after 14 days.
    1. Wet-Applied Products: State amount applied in mass per surface area.
    2. Paints and Coatings: Test tinted products, not just tinting bases.
    3. Evidence of Compliance: Acceptable types of evidence are the following;
        a. Current UL (GGG) certification.
        b. Current SCS (CPD) Floorscore certification.
        c. Current SCS (CPD) Indoor Advantage Gold certification.
        d. Current listing in CHPS (HPPD) as a low-emitting product.
        e. Current CRI (GLP) certification.
        f. Test report showing compliance and stating exposure scenario used.
    4. Product data submittal showing VOC content is NOT acceptable evidence.

5. Manufacturer's certification without test report by independent agency is NOT acceptable evidence.

B. VOC Content Test Method: 40 CFR 59, Subpart D (EPA Method 24), or ASTM D3960, unless otherwise indicated.
   1. Evidence of Compliance: Acceptable types of evidence are:
      a. Report of laboratory testing performed in accordance with requirements.

C. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

PART 2 PRODUCTS

2.01 MATERIALS

A. All Products: Comply with the most stringent of federal, State, and local requirements, or these specifications.

B. Indoor-Emissions-Restricted Products: Comply with Indoor Emissions Standard and Test Method, except for:
   1. Inherently Non-Emitting Materials.

C. VOC-Content-Restricted Products: VOC content not greater than required by the following:
   1. Adhesives, Including Flooring Adhesives: SCAQMD 1168 Rule.
   2. Joint Sealants: SCAQMD 1168 Rule.
   3. Paints and Coatings: Each color; most stringent of the following:
      a. 40 CFR 59, Subpart D.
      b. SCAQMD 1113 Rule.
      c. CARB (SCM).
   4. Wet-Applied Roofing and Waterproofing: Comply with requirements for paints and coatings.

PART 3 EXECUTION

3.01 FIELD QUALITY CONTROL

A. Owner reserves the right to reject non-compliant products, whether installed or not, and require their removal and replacement with compliant products at no extra cost to Owner.

B. Additional costs to restore indoor air quality due to installation of non-compliant products will be borne by Contractor.

END OF SECTION 01 6116

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SECTION 01 7000
EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Examination, preparation, and general installation procedures.
B. Requirements for alterations work, including selective demolition, except removal, disposal and/or remediation of hazardous materials and toxic substances.
C. Pre-installation meetings.
D. Cutting and patching.
E. Surveying for laying out the work.
F. Cleaning and protection.
G. Closeout procedures, including Contractor's Correction Punch List, except payment procedures.
H. General requirements for maintenance service.

1.02 RELATED REQUIREMENTS

A. Section 01 3000 - Administrative Requirements: Submittals procedures.
B. Section 01 7900 - Demonstration and Training: Demonstration of products and systems to be commissioned and where indicated in specific specification sections

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Survey work: Submit name, address, and telephone number of Surveyor before starting survey work.
    1. On request, submit documentation verifying accuracy of survey work.
    2. Submit a copy of site drawing signed by the Land Surveyor, that the elevations and locations of the work are in compliance with Contract Documents.
    3. Submit surveys and survey logs for the project record.
C. Demolition Plan: Submit demolition plan as specified by OSHA and local authorities.
    1. Indicate extent of demolition, removal sequence, bracing and shoring, and location and construction of barricades and fences. Include design drawings and calculations for bracing and shoring.
    2. Identify demolition firm and submit qualifications.
    3. Include a summary of safety procedures.
D. Cutting and Patching: Submit written request in advance of cutting or alteration that affects:
    1. Structural integrity of any element of Project.
    2. Integrity of weather exposed or moisture resistant element.
    3. Efficiency, maintenance, or safety of any operational element.
    4. Visual qualities of sight exposed elements.

5. Work of Owner or separate Contractor.
6. Include in request:
    a. Identification of Project.
    b. Location and description of affected work.
    c. Necessity for cutting or alteration.
    d. Description of proposed work and products to be used.
    e. Effect on work of Owner or separate Contractor.
    f. Written permission of affected separate Contractor.
    g. Date and time work will be executed.

E. Project Record Documents: Accurately record actual locations of capped and active utilities.

1.04 QUALIFICATIONS

A. For demolition work, employ a firm specializing in the type of work required.
    1. Minimum of three years of documented experience.
B. For surveying work, employ a land surveyor registered in the State in which the Project is located and acceptable to Architect. Submit evidence of surveyor's Errors and Omissions insurance coverage in the form of an Insurance Certificate. Employ only individual(s) trained and experienced in collecting and recording accurate data relevant to ongoing construction activities,
C. For field engineering, employ a professional engineer of the discipline required for specific service on Project, licensed in the State in which the Project is located. Employ only individual(s) trained and experienced in establishing and maintaining horizontal and vertical control points necessary for laying out construction work on project of similar size, scope and/or complexity.
D. For design of temporary shoring and bracing, employ a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

1.05 PROJECT CONDITIONS

A. Use of explosives is not permitted.
B. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.
C. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.
D. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.
E. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere and over adjacent property.

F. Erosion and Sediment Control: Plan and execute work by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.
   1. Minimize amount of bare soil exposed at one time.
   2. Provide temporary measures such as berms, dikes, and drains, to prevent water flow.
   3. Construct fill and waste areas by selective placement to avoid erosive surface silts or clays.
   4. Periodically inspect earthwork to detect evidence of erosion and sedimentation; promptly apply corrective measures.

G. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations.
   1. Outdoors: Limit conduct of especially noisy exterior work to the hours of 8 am to 5 pm unless approved by the Authority Having Jurisdiction.

H. Pest and Rodent Control: Provide methods, means, and facilities to prevent pests and insects from damaging the work.
   1. Pest Control Service: Weekly treatments.

I. Rodent Control: Provide methods, means, and facilities to prevent rodents from accessing or invading premises.

J. Pollution Control: Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations. Comply with federal, state, and local regulations.

1.06 COORDINATION

A. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.

B. Notify affected utility companies and comply with their requirements.

C. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.

D. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on drawings. Follow routing indicated for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

E. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.
F. Coordinate completion and clean-up of work of separate sections.
G. After Owner occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

PART 2 PRODUCTS

2.01 PATCHING MATERIALS

A. New Materials: As specified in product sections; match existing products and work for patching and extending work.
B. Type and Quality of Existing Products: Determine by inspecting and testing products where necessary, referring to existing work as a standard.
C. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.
B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.
C. Examine and verify specific conditions described in individual specification sections.
D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.
E. Verify that utility services are available, of the correct characteristics, and in the correct locations.
F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

3.02 PREPARATION

A. Clean substrate surfaces prior to applying next material or substance.
B. Seal cracks or openings of substrate prior to applying next material or substance.
C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

3.03 PREINSTALLATION MEETINGS

A. When required in individual specification sections, convene a preinstallation meeting at the site prior to commencing work of the section.

B. Require attendance of parties directly affecting, or affected by, work of the specific section.
C. Notify Architect four days in advance of meeting date.
D. Prepare agenda and preside at meeting:
    1. Review conditions of examination, preparation and installation procedures.
    2. Review coordination with related work.
E. Record minutes and distribute copies within two days after meeting to participants, with electronic copies to Architect, Owner, participants, and those affected by decisions made.

3.04 LAYING OUT THE WORK

A. Verify locations of survey control points prior to starting work.
B. Promptly notify Architect of any discrepancies discovered.
C. Protect survey control points prior to starting site work; preserve permanent reference points during construction.
D. Promptly report to Architect the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.
E. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Architect.
F. Utilize recognized engineering survey practices.
G. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:
    1. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations.
    2. Grid or axis for structures.
    3. Building foundation, column locations, ground floor elevations.
H. Periodically verify layouts by same means.
I. Maintain a complete and accurate log of control and survey work as it progresses.

3.05 GENERAL INSTALLATION REQUIREMENTS

A. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.
B. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.
C. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.
D. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.

E. Make neat transitions between different surfaces, maintaining texture and appearance.

3.06 ALTERATIONS

A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
   1. Verify that construction and utility arrangements are as indicated.
   2. Report discrepancies to Architect before disturbing existing installation.
   3. Beginning of alterations work constitutes acceptance of existing conditions.

B. Maintain weatherproof exterior building enclosure except for interruptions required for replacement or modifications; take care to prevent water and humidity damage.
   1. Where openings in exterior enclosure exist, provide construction to make exterior enclosure weatherproof.
   2. Insulate existing ducts or pipes that are exposed to outdoor ambient temperatures by alterations work.

C. Remove existing work as indicated and as required to accomplish new work.
   1. Remove rotted wood, corroded metals, and deteriorated masonry and concrete; replace with new construction specified.
   2. Remove items indicated on drawings.
   3. Relocate items indicated on drawings.
   4. Where new surface finishes are to be applied to existing work, perform removals, patch, and prepare existing surfaces as required to receive new finish; remove existing finish if necessary for successful application of new finish.
   5. Where new surface finishes are not specified or indicated, patch holes and damaged surfaces to match adjacent finished surfaces as closely as possible.

D. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove, relocate, and extend existing systems to accommodate new construction.
   1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components; if necessary, modify installation to allow access or provide access panel.
   2. Where existing systems or equipment are not active and Contract Documents require reactivation, put back into operational condition; repair supply, distribution, and equipment as required.
   3. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
      a. Disable existing systems only to make switchovers and connections; minimize duration of outages.

b. Provide temporary connections as required to maintain existing systems in service.

4. Verify that abandoned services serve only abandoned facilities.
5. Remove abandoned pipe, ducts, conduits, and equipment , including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification; patch holes left by removal using materials specified for new construction.

E. Protect existing work to remain.
1. Prevent movement of structure; provide shoring and bracing if necessary.
2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
3. Repair adjacent construction and finishes damaged during removal work.

F. Adapt existing work to fit new work: Make as neat and smooth transition as possible.
1. When existing finished surfaces are cut so that a smooth transition with new work is not possible, terminate existing surface along a straight line at a natural line of division and make recommendation to Architect.
2. Where removal of partitions or walls results in adjacent spaces becoming one, rework floors, walls, and ceilings to a smooth plane without breaks, steps, or bulkheads.
3. Where a change of plane of 1/4 inch or more occurs in existing work, submit recommendation for providing a smooth transition for Architect review and request instructions.
4. Trim existing wood doors as necessary to clear new floor finish. Refinish trim as required.

G. Patching: Where the existing surface is not indicated to be refinished, patch to match the surface finish that existed prior to cutting. Where the surface is indicated to be refinished, patch so that the substrate is ready for the new finish.

H. Refinish existing surfaces as indicated:
1. Where rooms or spaces are indicated to be refinished, refinish all visible existing surfaces to remain to the specified condition for each material, with a neat transition to adjacent finishes.
2. If mechanical or electrical work is exposed accidentally during the work, re-cover and refinish to match.

I. Clean existing systems and equipment.

J. Remove demolition debris and abandoned items from alterations areas and dispose of off-site; do not burn or bury.

K. Do not begin new construction in alterations areas before demolition is complete.

L. Comply with all other applicable requirements of this section.

3.07 CUTTING AND PATCHING

A. Whenever possible, execute the work by methods that avoid cutting or patching.
B. See Alterations article above for additional requirements.
C. Perform whatever cutting and patching is necessary to:
    1. Complete the work.
    2. Fit products together to integrate with other work.
    3. Provide openings for penetration of mechanical, electrical, and other services.
    4. Match work that has been cut to adjacent work.
    5. Repair areas adjacent to cuts to required condition.
    6. Repair new work damaged by subsequent work.
    7. Remove samples of installed work for testing when requested.
    8. Remove and replace defective and non-complying work.
D. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.
E. Employ original installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.
F. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.
G. Restore work with new products in accordance with requirements of Contract Documents.
H. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
I. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material , to full thickness of the penetrated element.
J. Patching:
    1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
    2. Match color, texture, and appearance.
    3. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.

3.08 PROGRESS CLEANING

A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.
B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.

C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.
D. Collect and remove waste materials, debris, and trash/rubbish from site periodically and dispose off-site; do not burn or bury.

3.09 PROTECTION OF INSTALLED WORK

A. Protect installed work from damage by construction operations.
B. Provide special protection where specified in individual specification sections.
C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.
D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.
E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.
F. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.
G. Prohibit traffic from landscaped areas.
H. Remove protective coverings when no longer needed; reuse or recycle coverings if possible.

3.10 ADJUSTING

A. Adjust operating products and equipment to ensure smooth and unhindered operation.

3.11 FINAL CLEANING

A. Execute final cleaning prior to final project assessment.
B. Use cleaning materials that are nonhazardous.
C. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.
D. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.
E. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.
F. Clean filters of operating equipment.
G. Clean debris from roofs, gutters, downspouts, scuppers, overflow drains, area drains, and drainage systems.
H. Clean site; sweep paved areas, rake clean landscaped surfaces.
I. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

3.12 CLOSEOUT PROCEDURES

A. Make submittals that are required by governing or other authorities.
B. Notify Architect when work is considered ready for Architect's Substantial Completion inspection.
C. Submit written certification containing Contractor's Correction Punch List, that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for Architect's Substantial Completion inspection.
D. Conduct Substantial Completion inspection and create Final Correction Punch List containing Architect's and Contractor's comprehensive list of items identified to be completed or corrected and submit to Architect.
E. Correct items of work listed in Final Correction Punch List and comply with requirements for access to Owner-occupied areas.
F. Notify Architect when work is considered finally complete and ready for Architect's Substantial Completion final inspection.
G. Complete items of work determined by Architect listed in executed Certificate of Substantial Completion.

3.13 MAINTENANCE

A. Provide service and maintenance of components indicated in specification sections.
B. Maintenance Period: As indicated in specification sections or, if not indicated, not less than one year from the Date of Substantial Completion or the length of the specified warranty, whichever is longer.
C. Examine system components at a frequency consistent with reliable operation. Clean, adjust, and lubricate as required.
D. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by the manufacturer of the original component.
E. Maintenance service shall not be assigned or transferred to any agent or subcontractor without prior written consent of the Owner.

END OF SECTION 01 7000

SECTION 01 7419

CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 GENERAL

1.01 WASTE MANAGEMENT REQUIREMENTS

A. Employ processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors.

B. Minimize trash/waste disposal in landfills; reuse, salvage, or recycle as much waste as economically feasible.

C. Required Recycling, Salvage, and Reuse: The following may not be disposed of in landfills or by incineration:
   1. Aluminum and plastic beverage containers.
   2. Corrugated cardboard.
   3. Wood pallets.
   4. Clean dimensional wood.
   5. Metals, including packaging banding, metal studs, sheet metal, structural steel, piping, reinforcing bars, door frames, and other items made of steel, iron, galvanized steel, stainless steel, aluminum, copper, zinc, lead, brass, and bronze.

D. Methods of trash/waste disposal that are not acceptable are:
   1. Burning on the project site.
   2. Burying on the project site.
   3. Dumping or burying on other property, public or private.
   4. Other illegal dumping or burying.

E. Regulatory Requirements: Contractor is responsible for knowing and complying with regulatory requirements, including but not limited to Federal, state and local requirements, pertaining to legal disposal of all construction and demolition waste materials.

1.02 DEFINITIONS

A. Clean: Untreated and unpainted; not contaminated with oils, solvents, caulk, or the like.

B. Construction and Demolition Waste: Solid wastes typically including building materials, packaging, trash, debris, and rubble resulting from construction, remodeling, repair and demolition operations.

C. Hazardous: Exhibiting the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity or reactivity.

D. Nonhazardous: Exhibiting none of the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity, or reactivity.

E. Nontoxic: Neither immediately poisonous to humans nor poisonous after a long period of exposure.
F. Recyclable: The ability of a product or material to be recovered at the end of its life cycle and remanufactured into a new product for reuse by others.
G. Recycle: To remove a waste material from the project site to another site for remanufacture into a new product for reuse by others.
H. Recycling: The process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for the purpose of using the altered form. Recycling does not include burning, incinerating, or thermally destroying waste.
I. Return: To give back reusable items or unused products to vendors for credit.
J. Reuse: To reuse a construction waste material in some manner on the project site.
K. Salvage: To remove a waste material from the project site to another site for resale or reuse by others.
L. Sediment: Soil and other debris that has been eroded and transported by storm or well production run-off water.
M. Source Separation: The act of keeping different types of waste materials separate beginning from the first time they become waste.
N. Toxic: Poisonous to humans either immediately or after a long period of exposure.
O. Trash: Any product or material unable to be reused, returned, recycled, or salvaged.
P. Waste: Extra material or material that has reached the end of its useful life in its intended use. Waste includes salvageable, returnable, recyclable, and reusable material.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 WASTE MANAGEMENT PROCEDURES

A. See Section 01 3000 for additional requirements for project meetings, reports, submittal procedures, and project documentation.
B. See Section 01 5000 for additional requirements related to trash/waste collection and removal facilities and services.
C. See Section 01 6000 for waste prevention requirements related to delivery, storage, and handling.
D. See Section 01 7000 for trash/waste prevention procedures related to demolition, cutting and patching, installation, protection, and cleaning.

3.02 WASTE MANAGEMENT PLAN IMPLEMENTATION

A. Instruction: Provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the project.

B. Meetings: Discuss trash/waste management goals and issues at project meetings.
C. Facilities: Provide specific facilities for separation and storage of materials for recycling, salvage, reuse, return, and trash disposal, for use by all contractors and installers.
    1. As a minimum, provide:
        a. Separate area for storage of materials to be reused on-site, such as wood cut-offs for blocking.
        b. Separate dumpsters for each category of recyclable.
        c. Recycling bins at worker lunch area.
    2. Provide containers as required.
    3. Provide adequate space for pick-up and delivery and convenience to subcontractors.
    4. Keep recycling and trash/waste bin areas neat and clean and clearly marked in order to avoid contamination of materials.
D. Hazardous Wastes: Separate, store, and dispose of hazardous wastes according to applicable regulations.
E. Recycling: Separate, store, protect, and handle at the site identified recyclable waste products in order to prevent contamination of materials and to maximize recyclability of identified materials. Arrange for timely pickups from the site or deliveries to recycling facility in order to prevent contamination of recyclable materials.
F. Reuse of Materials On-Site: Set aside, sort, and protect separated products in preparation for reuse.
G. Salvage: Set aside, sort, and protect products to be salvaged for reuse off-site.

END OF SECTION 01 7419

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SECTION 01 7800
CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Project Record Documents.
B. Operation and Maintenance Data.
C. Warranties and bonds.

1.02 RELATED REQUIREMENTS

A. Section 01 3000 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.
B. Section 01 7000 - Execution and Closeout Requirements: Contract closeout procedures.
C. Individual Product Sections: Specific requirements for operation and maintenance data.
D. Individual Product Sections: Warranties required for specific products or Work.

1.03 SUBMITTALS

A. Project Record Documents: Submit documents to Architect with claim for final Application for Payment.
B. Operation and Maintenance Data:
    1. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. Architect will review draft and return one copy with comments.
    2. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit completed documents within ten days after acceptance.
    3. Submit one copy of completed documents 15 days prior to final inspection. This copy will be reviewed and returned after final inspection, with Architect comments. Revise content of all document sets as required prior to final submission.
    4. Submit two sets of revised final documents in final form within 10 days after final inspection.
C. Warranties and Bonds:
    1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 10 days after acceptance.
    2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.

3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PROJECT RECORD DOCUMENTS

A. Maintain on site one set of the following record documents; record actual revisions to the Work:
   1. Drawings.
   2. Specifications.
   3. Addenda.
   4. Change Orders and other modifications to the Contract.
   5. Reviewed shop drawings, product data, and samples.
   6. Manufacturer's instruction for assembly, installation, and adjusting.

B. Ensure entries are complete and accurate, enabling future reference by Owner.

C. Store record documents separate from documents used for construction.

D. Record information concurrent with construction progress.

E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
   1. Manufacturer's name and product model and number.
   2. Product substitutions or alternates utilized.
   3. Changes made by Addenda and modifications.

F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
   1. Measured depths of foundations in relation to finish first floor datum.
   2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
   3. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
   4. Field changes of dimension and detail.
   5. Details not on original Contract drawings.

3.02 OPERATION AND MAINTENANCE DATA

A. Source Data: For each product or system, list names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.

B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.

C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.

D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

3.03 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES

A. For Each Product, Applied Material, and Finish:
   1. Product data, with catalog number, size, composition, and color and texture designations.
   2. Information for re-ordering custom manufactured products.

B. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.

C. Moisture protection and weather-exposed products: Include product data listing applicable reference standards, chemical composition, and details of installation. Provide recommendations for inspections, maintenance, and repair.

D. Additional information as specified in individual product specification sections.

E. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

3.04 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

A. For Each Item of Equipment and Each System:
   1. Description of unit or system, and component parts.
   2. Identify function, normal operating characteristics, and limiting conditions.
   3. Include performance curves, with engineering data and tests.
   4. Complete nomenclature and model number of replaceable parts.

B. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

C. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.

D. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

E. Provide servicing and lubrication schedule, and list of lubricants required.

F. Include manufacturer's printed operation and maintenance instructions.

G. Include sequence of operation by controls manufacturer.
H. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
I. Additional Requirements: As specified in individual product specification sections.

3.05 ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS

A. Assemble operation and maintenance data into durable manuals for Owner's personnel use, with data arranged in the same sequence as, and identified by, the specification sections.
B. Where systems involve more than one specification section, provide separate tabbed divider for each system.
C. Binders: Commercial quality, 8-1/2 by 11 inch three D side ring binders with durable plastic covers; 2 inch maximum ring size. When multiple binders are used, correlate data into related consistent groupings.
D. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.
E. Project Directory: Title and address of Project; names, addresses, and telephone numbers of Architect, Consultants, Contractor and subcontractors, with names of responsible parties.
F. Tables of Contents: List every item separated by a divider, using the same identification as on the divider tab; where multiple volumes are required, include all volumes Tables of Contents in each volume, with the current volume clearly identified.
G. Dividers: Provide tabbed dividers for each separate product and system; identify the contents on the divider tab; immediately following the divider tab include a description of product and major component parts of equipment.
H. Text: Manufacturer's printed data, or typewritten data on 20 pound paper.
I. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
J. Arrangement of Contents: Organize each volume in parts as follows:
    1. Project Directory.
    2. Table of Contents, of all volumes, and of this volume.
    3. Operation and Maintenance Data: Arranged by system, then by product category.
        a. Source data.
        b. Operation and maintenance data.
        c. Field quality control data.
        d. Photocopies of warranties and bonds.

3.06 WARRANTIES AND BONDS

A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Substantial completion is determined.

B. Verify that documents are in proper form, contain full information, and are notarized.

C. Co-execute submittals when required.

D. Retain warranties and bonds until time specified for submittal.

END OF SECTION 01 7800

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SECTION 01 7900
DEMONSTRATION AND TRAINING

PART 1 GENERAL

1.01 SUMMARY

A. Demonstration of products and systems to be commissioned and where indicated in specific specification sections.

B. Training of Owner personnel in operation and maintenance is required for:
   1. All software-operated systems.
   2. Amphetheater Sound System
   3. HVAC systems and equipment.
   4. Plumbing equipment.
   5. Electrical systems and equipment.
   6. Items specified in individual product Sections.

1.02 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures; except:

B. Training Plan: Owner will designate personnel to be trained; tailor training to needs and skill-level of attendees.
   1. Submit to Architect for transmittal to Owner.
   2. Submit not less than four weeks prior to start of training.
   3. Revise and resubmit until acceptable.
   4. Provide an overall schedule showing all training sessions.
   5. Include at least the following for each training session:
      a. Identification, date, time, and duration.
      b. Description of products and/or systems to be covered.
      c. Name of firm and person conducting training; include qualifications.
      d. Intended audience, such as job description.
      e. Objectives of training and suggested methods of ensuring adequate training.
      f. Methods to be used, such as classroom lecture, live demonstrations, hands-on, etc.
      g. Media to be used, such a slides, hand-outs, etc.
      h. Training equipment required, such as projector, projection screen, etc., to be provided by Contractor.

C. Training Manuals: Provide training manual for each attendee; allow for minimum of two attendees per training session.
   1. Include applicable portion of O&M manuals.
   2. Include copies of all hand-outs, slides, overheads, video presentations, etc., that are not included in O&M manuals.

3. Provide one extra copy of each training manual to be included with operation and maintenance data.

D. Training Reports:
1. Identification of each training session, date, time, and duration.
2. Sign-in sheet showing names and job titles of attendees.
3. List of attendee questions and written answers given, including copies of and references to supporting documentation required for clarification; include answers to questions that could not be answered in original training session.

E. Video Recordings: Submit digital video recording of each demonstration and training session for Owner's subsequent use.
1. Format: DVD Disc.
2. Label each disc and container with session identification and date.

1.03 QUALITY ASSURANCE

A. Instructor Qualifications: Familiar with design, operation, maintenance and troubleshooting of the relevant products and systems.
1. Provide as instructors the most qualified trainer of those contractors and/or installers who actually supplied and installed the systems and equipment.
2. Where a single person is not familiar with all aspects, provide specialists with necessary qualifications.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 DEMONSTRATION - GENERAL

A. Demonstrations conducted during system start-up do not qualify as demonstrations for the purposes of this section, unless approved in advance by Owner.

B. Demonstration may be combined with Owner personnel training if applicable.

C. Operating Equipment and Systems: Demonstrate operation in all modes, including start-up, shut-down, seasonal changeover, emergency conditions, and troubleshooting, and maintenance procedures, including scheduled and preventive maintenance.
1. Perform demonstrations not less than two weeks prior to Substantial Completion.
2. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.

D. Non-Operating Products: Demonstrate cleaning, scheduled and preventive maintenance, and repair procedures.
1. Perform demonstrations not less than two weeks prior to Substantial Completion.

3.02 TRAINING - GENERAL

A. Conduct training on-site unless otherwise indicated.

B. Owner will provide classroom and seating at no cost to Contractor.

C. Provide training in minimum two hour segments.

D. Training schedule will be subject to availability of Owner's personnel to be trained; re-schedule training sessions as required by Owner; once schedule has been approved by Owner failure to conduct sessions according to schedule will be cause for Owner to charge Contractor for personnel "show-up" time.

E. Review of Facility Policy on Operation and Maintenance Data: During training discuss:
   1. The location of the O&M manuals and procedures for use and preservation; backup copies.
   2. Typical contents and organization of all manuals, including explanatory information, system narratives, and product specific information.
   3. Typical uses of the O&M manuals.

F. Product- and System-Specific Training:
   1. Review the applicable O&M manuals.
   2. For systems, provide an overview of system operation, design parameters and constraints, and operational strategies.
   3. Review instructions for proper operation in all modes, including start-up, shut-down, seasonal changeover and emergency procedures, and for maintenance, including preventative maintenance.
   4. Provide hands-on training on all operational modes possible and preventive maintenance.
   5. Emphasize safe and proper operating requirements; discuss relevant health and safety issues and emergency procedures.
   6. Discuss common troubleshooting problems and solutions.
   7. Discuss any peculiarities of equipment installation or operation.
   8. Discuss warranties and guarantees, including procedures necessary to avoid voiding coverage.
   9. Review recommended tools and spare parts inventory suggestions of manufacturers.
   10. Review spare parts and tools required to be furnished by Contractor.
   11. Review spare parts suppliers and sources and procurement procedures.

G. Be prepared to answer questions raised by training attendees; if unable to answer during training session, provide written response within three days.

END OF SECTION 01 7900

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SECTION 02 0100
SITEWORK – GENERAL REQUIREMENTS

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Site work includes the work shown and reasonably inferred from the drawings, technical specifications, and contract documents. Provide materials, labor, equipment and supervision required to perform the work complete.

B. The scope of site work includes, but is not limited to the following:
   1. Construction staking and other construction engineering required to control the work.
   2. Erosion and sedimentation control construction.
   3. Temporary groundwater control.
   4. Site preparation, including stripping and undercutting unsuitable subgrade soils, demolition, and removal from the project lands of materials not to be used for construction.
   5. Site grading, including excavation, filling, compaction, and preparation of subgrades for paving. Site grading includes importing material, stockpiling and hauling from stockpiles, and other work necessary to construct embankments and excavations as shown and specified.
   6. Construction of building pads and staging areas.
   7. Coordination of temporary utilities.
   8. Installation of the complete site drainage system complete, including building roof drain laterals.
   9. Installation of the complete water distribution and sanitary sewer system complete, including service laterals.
   10. Construction of curbs.
   11. Construction of paving.
   12. Striping and traffic control.
   13. Backfilling curbs and islands with approved soils for planting.
   14. Backfilling walls.
   15. Installation and coordination of temporary warning signs, directional signs, barricades and fences required to direct, control and protect the public throughout the construction period.
   16. Coordination of installation of light poles, irrigation systems, and associated conduits.

1.02 SAFETY

A. Safety & Protection: Initiate, maintain, and supervise safety precautions and programs in connection with the Work. Take necessary precautions for the safety of, and provide

the necessary protection to prevent damage, injury or loss to employees on the job and other persons or organizations.

B. Safe trench construction is mandatory. Lay back slopes or shore as necessary.

C. Control traffic during operations on existing streets.

D. Erect and maintain barricades, fences, and other physical blockages sufficient to exclude the public from construction areas.

1.03 PROTECTION OF ADJACENT LANDS

A. Limit construction to areas so indicated on the drawings and designated by the Owner. Protect areas beyond the construction which are subject to the effect or byproduct of the construction effort.

B. Make special effort to prevent soil erosion and sediment transport onto adjacent lands. Restore disturbance to areas outside the designated construction limits to a satisfactory condition, as determined by the Owner at no cost to the Owner.

C. Take precautionary measures to prevent damage to the adjoining public street system. Clean mud or debris deposited as a result of this construction.

D. Perform construction on the right-of-way or on other properties not in possession of the Owner in strict accordance with the terms of the permits or easements. Obtain copies of permit and easement conditions affecting the work.

1.04 CONSTRUCTION ENGINEERING

A. Provide construction staking, dimensional control, and related construction engineering for phases of the Work.

1.05 GEOTECHNICAL ENGINEERING

A. Geotechnical quality control services will be performed by a geotechnical engineering firm (referred to as the Geotechnical Engineer) retained by the Owner.

B. Provide in cooperation with the Geotechnical Engineer, as a minimum, monitoring and testing services of earthwork, drainage, utility construction, site preparation and demucking, underdrain construction, and pavement construction. Report results of tests verbally on completion of the work and provide daily written reports at the job site.

1. Fill Placement: Monitor placement of fill for suitability of fill materials, uniformity of compaction operations, and compliance with aspects of these Specifications. Test soil fill for compliance with compaction requirements. Monitor rock fill for appropriate placement procedures, particle size, and lift thickness.
2. Stripping and Demucking: Evaluate subgrades upon which fill is to be placed prior to fill placement. Monitor conditions and make appropriate recommendations. In

the event of unstable subgrades, soil bridging, or provide stabilization stone as required. Discuss with the Owner, who will then authorize the procedure to be used.

3. Underdrains: Monitor underdrain construction for compliance with the plans and specifications. If unforeseen conditions which impact the design and construction of underdrains are encountered, make appropriate recommendations to the Owner.
4. Underground Utilities: Monitor installation of underground utilities and structures for compliance to specifications for materials, procedures, and workmanship. Evaluate the suitability of the subgrade upon which the pipes are to be constructed. Issue appropriate recommendations if unsuitable conditions are detected.
5. Backfilling: Monitor backfills and test to evaluate compliance with the specifications.
6. Retaining Walls: Provide monitoring and testing services during construction of retaining walls. The actual scope of these services will be dependent upon the type of wall used. Comply with the practice recommended by the designer of the wall system.
7. Pavements: Monitor preparation and proofrolling of the soil subgrade upon which pavements are to be constructed. When unstable soils are encountered, recommend appropriate remedial action to the Owner, who will then direct the Contractor as to the course of action. Monitor construction of the pavement system. Test thickness, gradations, and compactions of base course and surface course.

1.06 RESPONSIBILITY OF THE CONTRACTOR

A. The Contractor is responsible for compliance with the Contract Documents. Monitoring and testing by the Geotechnical Engineer does not infer acceptance of responsibility by the Geotechnical Engineer, the Architect, the Engineer, or the Owner. When monitoring and testing indicates that construction does not meet Specification requirements, rework to obtain compliance.

1.07 AS-BUILT PLANS

A. Maintain "Contractor's mark-up as-built" plans of construction. Certify the accuracy and completeness of these plans and deliver to the Owner.

B. Prepare as-built plans of construction to be dedicated to Governmental entities and deliver in a form that is acceptable to the receiving agency.

C. As-built topographic maps of detention structures may be required by governmental jurisdictions. If required, provide a topographic survey sufficient to confirm structure volume as well as dimensions and deviations of outlet structures.

D. Retain a registered surveyor to certify as-built surveys required by governmental jurisdictions.

END OF SECTION

SECTION 02 4100
DEMOLITION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Selective demolition of built site elements.

B. Selective demolition of building elements for alteration purposes.

1.02 RELATED REQUIREMENTS

A. Section 01 1000 - Summary: Limitations on Contractor's use of site and premises.

B. Section 01 1000 - Summary: Description of items to be salvaged or removed for re-use by Contractor.

C. Section 01 5000 - Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.

D. Section 01 6000 - Product Requirements: Handling and storage of items removed for salvage and relocation.

E. Section 01 7000 - Execution and Closeout Requirements: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products; temporary bracing and shoring.

F. Section 31 2323 - Fill: Fill material for filling holes, pits, and excavations generated as a result of removal operations.

1.03 REFERENCE STANDARDS

A. 29 CFR 1926 - U.S. Occupational Safety and Health Standards current edition.

B. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations 2019.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Site Plan: Showing:

1. Areas for temporary construction and field offices.
2. Areas for temporary and permanent placement of removed materials.

C. Project Record Documents: Accurately record actual locations of capped and active utilities and subsurface construction.

PART 3 EXECUTION

2.01 SCOPE

A. Remove other items indicated, for salvage, relocation, recycling, and [_____].

B. Fill excavations, open pits, and holes in ground areas generated as result of removals, using specified fill; compact fill as specified in Section 31 2200.

2.02 GENERAL PROCEDURES AND PROJECT CONDITIONS

A. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.

1. Obtain required permits.
2. Comply with applicable requirements of NFPA 241.
3. Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.
4. Provide, erect, and maintain temporary barriers and security devices.
5. Use physical barriers to prevent access to areas that could be hazardous to workers or the public.
6. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
7. Do not close or obstruct roadways or sidewalks without permit.
8. Conduct operations to minimize obstruction of public and private entrances and exits; do not obstruct required exits at any time; protect persons using entrances and exits from removal operations.
9. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon or limit access to their property.

B. Do not begin removal until receipt of notification to proceed from Owner.

C. Protect existing structures and other elements that are not to be removed.
1. Provide bracing and shoring.
2. Prevent movement or settlement of adjacent structures.
3. Stop work immediately if adjacent structures appear to be in danger.

D. If hazardous materials are discovered during removal operations, stop work and notify Architect and Owner; hazardous materials include regulated asbestos containing materials, lead, PCB's, and mercury.

E. Partial Removal of Paving and Curbs: Neatly saw cut at right angle to surface.

2.03 EXISTING UTILITIES

A. Coordinate work with utility companies; notify before starting work and comply with their requirements; obtain required permits.

B. Protect existing utilities to remain from damage.

C. Do not disrupt public utilities without permit from authority having jurisdiction.

D. Do not close, shut off, or disrupt existing life safety systems that are in use without prior written notification to Owner.

E. Do not close, shut off, or disrupt existing utility branches or take-offs that are in use without prior written notification to Owner.

F. Locate and mark utilities to remain; mark using highly visible tags or flags, with identification of utility type; protect from damage due to subsequent construction, using substantial barricades if necessary.

2.04 SELECTIVE DEMOLITION FOR ALTERATIONS

A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
   1. Verify that construction and utility arrangements are as indicated.
   2. Report discrepancies to Architect before disturbing existing installation.
   3. Beginning of demolition work constitutes acceptance of existing conditions that would be apparent upon examination prior to starting demolition.

B. Maintain weatherproof exterior building enclosure except for interruptions required for replacement or modifications; take care to prevent water and humidity damage.

C. Remove existing work as indicated and as required to accomplish new work.
   1. Remove rotted wood, corroded metals, and deteriorated masonry and concrete; replace with new construction specified.
   2. Remove items indicated on drawings.

D. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, Telecommunications, and [_____]): Remove existing systems and equipment as indicated.
   1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components.
   2. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
   3. Verify that abandoned services serve only abandoned facilities before removal.
   4. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification.

E. Protect existing work to remain.
   1. Prevent movement of structure; provide shoring and bracing if necessary.
   2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
   3. Repair adjacent construction and finishes damaged during removal work.
   4. Patch as specified for patching new work.

2.05 DEBRIS AND WASTE REMOVAL

A. Remove debris, junk, and trash from site.

B. Leave site in clean condition, ready for subsequent work.

C. Clean up spillage and wind-blown debris from public and private lands.

END OF SECTION 02 4100

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SECTION 02 4116
SITE DEMOLITION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

2.01 SUMMARY

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

B. Related Requirements:
   1. Section 011000 "Summary" for use of the premises and phasing requirements.
   2. Section 013200 "Construction Progress Documentation" for preconstruction photographs taken before building demolition.
   3. Section 024119 "Selective Demolition" for partial demolition of buildings, structures, and site improvements.
   4. Section 311000 "Site Clearing" for site clearing and removal of above- and below-grade site improvements not part of building demolition.

3.01 DEFINITIONS

A. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged.

B. Remove and Salvage: Detach items from existing construction, in a manner to prevent damage, and deliver to Owner ready for reuse. Include fasteners or brackets needed for reattachment elsewhere.

4.01 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.

5.01 PREINSTALLATION MEETINGS

A. Predemolition Conference: Conduct conference at Project site.
   1. Inspect and discuss condition of construction to be demolished.
   2. Review structural load limitations of existing structures.
   3. Review and finalize building demolition schedule and verify availability of demolition personnel, equipment, and facilities needed to make progress and avoid delays.
   4. Review and finalize protection requirements.
   5. Review procedures for noise control and dust control.

6. Review procedures for protection of adjacent buildings.
7. Review items to be salvaged and returned to Owner.

6.01 INFORMATIONAL SUBMITTALS

A. Qualification Data: For refrigerant recovery technician.

B. Engineering Survey: Submit engineering survey of condition of building.

C. 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.

D. Schedule of Building Demolition Activities: Indicate the following:

1. Detailed sequence of demolition work, with starting and ending dates for each activity.
2. Temporary interruption of utility services.
3. Shutoff and capping or re-routing of utility services.

E. Predemolition Photographs or Video: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by salvage and demolition operations. Comply with Section 013233 "Photographic Documentation." Submit before the Work begins.

F. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

7.01 CLOSEOUT SUBMITTALS

A. Inventory: Submit a list of items that have been removed and salvaged.

8.01 QUALITY ASSURANCE

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

9.01 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. Hazardous Materials: If present in buildings and structures to be demolished, a report on the presence of hazardous materials is on file for review and use. Examine report to become aware of locations where hazardous materials are present.
   1. Hazardous material remediation is specified elsewhere in the Contract Documents.
   2. Do not disturb hazardous materials or items suspected of containing hazardous materials except under procedures specified elsewhere in the Contract Documents.
   3. Owner will provide material safety data sheets for materials that are known to be present in buildings and structures to be demolished because of building operations or processes performed there.

D. On-site storage or sale of removed items or materials is not permitted.

10.01 COORDINATION

A. Arrange demolition schedule so as not to interfere with Owner's on-site operations or operations of adjacent occupied buildings.

PART 2 - PRODUCTS

1.01 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 ANSI/ASSE A10.6 and NFPA 241.

2.01 SOIL MATERIALS

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

PART 3 - EXECUTION

1.01 EXAMINATION

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

B. Review Project Record Documents of existing construction or other existing condition and hazardous material information provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.

C. Perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during building demolition operations.

D. Steel Tendons: Locate tensioned steel tendons and include recommendations for de-tensioning.

E. Verify that hazardous materials have been remediated before proceeding with building demolition operations.

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

2.01 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.

3.01 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. Arrange to shut off utilities with utility companies.
   2. 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.
   3. 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.
   4. Do not start demolition work until utility disconnecting and sealing have been completed and verified in writing.
   5. Contractor to coordinate with utility provider for any and all public and/or private utilities within the project area prior to removal, relocation or repair of existing utility.

4.01 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.
   1. Strengthen or add new supports when required during progress of demolition.

C. Existing Utilities to Remain: Maintain utility services to remain and protect from damage during demolition operations.
   1. Do not interrupt existing utilities serving adjacent occupied or operating facilities unless authorized in writing by Owner and authorities having jurisdiction.
   2. Provide temporary services during interruptions to existing utilities, as acceptable to Owner and authorities having jurisdiction.
      a. Provide at least 72 hours' notice to occupants of affected buildings if shutdown of service is required during changeover.

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, if provided."
   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.

5.01 DEMOLITION, GENERAL

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 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. Do not use water when it may damage adjacent construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.

C. Explosives: Use of explosives is not permitted.

6.01 DEMOLITION BY MECHANICAL MEANS

A. 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.

B. 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.
   1. Remove structural framing members and lower to ground by method suitable to minimize ground impact and dust generation.

C. Salvage: Items to be removed and salvaged to be indicated on a list from Owner.

D. Below-Grade Construction: Demolish foundation walls and other below-grade construction.
   1. Remove below-grade construction, including basements, foundation walls, and footings, completely to at least 12 inches below grade.

E. Existing Utilities: Abandon existing utilities and below-grade utility structures. Cut utilities flush with grade.

F. Existing Utilities: Demolish existing utilities and below-grade utility structures that are 5 feet of the footprint indicated for new construction, unless otherwise directed by Geotechnical Engineer. Abandon utilities outside this area.

1. Fill abandoned utility structures with satisfactory soil materials according to backfill requirements in Section 312000 "Earth Moving."

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

7.01 SITE RESTORATION

A. Below-Grade Areas: Rough grade below-grade areas ready for further excavation or new construction.

B. 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."

C. 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.

8.01 REPAIRS

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

9.01 DISPOSAL OF DEMOLISHED MATERIALS

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. Do not burn demolished materials.

10.01 CLEANING

A. 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.

1. Clean roadways of debris caused by debris transport.

END OF SECTION

SECTION 03 0516
UNDERSLAB VAPOR BARRIER - STEGO

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Sheet vapor barrier under concrete slabs on grade.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Preparation of subgrade, granular fill, placement of concrete.

1.03 REFERENCE STANDARDS

A. ASTM E1643 - Standard Practice for Selection, Design, Installation and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs 2018a.

B. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs 2017.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit manufacturers' data on manufactured products.

C. Test Data: Submit report of tests showing compliance with specified requirements.

D. Samples: Submit samples of underslab vapor barrier to be used.

E. Manufacturer's Installation Instructions: Indicate installation procedures and interface required with adjacent construction.

PART 2 PRODUCTS

2.01 MATERIALS

A. Underslab Vapor Barrier:

1. Water Vapor Permeance: Not more than 0.010 perms, maximum.
2. Complying with ASTM E1745 Class A.
3. Thickness: 15 mils.
4. Basis of Design:
    a. Stego Industries LLC; Stego Wrap Vapor Barrier (15-mil): www.stegoindustries.com.
    b. Reef Industries, Inc.: www.reefindustries.com.
    c. W.R. Meadows, Inc.: www.wrmeadows.com.
    d. Substitutions: See Section 01 6000 - Product Requirements.

B. Accessory Products: Vapor barrier manufacturer's recommended tape, adhesive, mastic, etc., for sealing seams and penetrations in vapor barrier.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surface over which vapor barrier is to be installed is complete and ready before proceeding with installation of vapor barrier.

3.02 INSTALLATION

A. Install vapor barrier in accordance with manufacturer's instructions and ASTM E1643.
B. Install vapor barrier under interior slabs on grade; lap sheet over footings and seal to foundation walls.
C. Lap joints minimum 6 inches.
D. Seal joints, seams and penetrations watertight with manufacturer's recommended products and follow manufacturer's written instructions.
E. No penetration of vapor barrier is allowed except for reinforcing steel and permanent utilities.
F. Repair damaged vapor retarder before covering with other materials.

END OF SECTION 03 0516

SECTION 033000
CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:
   1. Footings.
   2. Stem walls.
   3. Slabs-on-grade.

1.03 DEFINITIONS

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

1.04 ACTION SUBMITTALS

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

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.
   2. Submit substantiating data for each concrete mix design contemplated for use to the Architect no less than four-weeks prior to first concrete placement. Data for each mix shall include the following:
      a. Mix identification number (unique for each mix submitted).
      b. Statement of intended mix use.
      c. Mixture proportions.
      d. Water/cementitious materials ratio.
      e. Wet and dry unit weight.
      f. Total air content.
      g. Design slump and allowable range after additions of all admixtures.
      h. Compressive strength tests.

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

1. Show all reinforcing, top and bottom profile of concrete element, supports below, including beams, columns and walls, grade beams, concrete walls, joists, etc. framing into element.
2. Provide one continuous elevation at 1/4" (1:48) scale for all walls in a continuous line. Show pockets and openings in walls, elevations of top walls, pilasters, sections through pilasters, and placing sequence of reinforcing for items with more than one reinforcing layer.
3. Show locations of approved construction joints, splices of reinforcing, type of splice used and splice location. Identify all ASTM A706 reinforcing locations.

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

E. Samples: For waterstops.

1.05 INFORMATIONAL SUBMITTALS

A. Material Certificates: For each of the following, signed by manufacturers:
   1. Cementitious materials.
   2. Admixtures.
   3. Form materials and form-release agents.
   4. Steel reinforcement and accessories.
   5. Curing compounds.
   6. Bonding agents.
   7. Repair materials.

B. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:
   1. Aggregates: Submit test reports indicating that aggregates are not potentially reactive based on the ASTM C295 or ASTM 1260 testing limits set forth in section 5.1 of “Guide Specification for Concrete Subject to Alkali-Silica Reactions” (2007 Portland Cement Association). Alternatively, submit ASTM C1567 test reports indicating that the combination of mix ingredients reduces the expansion due to Alkali aggregate reactivity such that the mix complies with section 5.2 of “Guide Specification for Concrete Subject to Alkali-Silica Reactions” (2007 Portland Cement Association). All tests for submitted reports shall have been performed within one year of the submittal date.

C. Minutes of preinstallation conference.

D. Placement Notification: Submit notification to Architect at least 24 hours in advance of placement.

E. Certification of chloride screen effectiveness for penetrating sealers.

F. Proposed location of saw cut joints not indicated on Drawings.
G. Curing compound data demonstrating specified moisture loss performance.
H. Evaporative retarder product and application data.

1.06 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, acceptable to authorities having jurisdiction, 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.
    3. Personnel inspecting concrete reinforcing steel have current certification as an ACI Concrete Construction Inspector or have experience in concrete construction acceptable to the Architect.
D. 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.
E. Formwork: Contractor shall be responsible for design and engineering of formwork. Design of formwork and preparation of formwork drawings shall be performed under supervision of a qualified engineer registered in the state of the project.
F. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
    1. ACI 301, "Specifications for Structural Concrete," Sections 1 through 5**.**
    2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
G. Preinstallation Conference: Conduct conference at Project site.
    1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:

a. Contractor's superintendent.
b. Ready-mix concrete manufacturer.
c. Concrete subcontractor.
d. Owner’s Testing/Inspection Agency.

2. Review as applicable to Project special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint-filler strips, semirigid joint fillers, forms and form removal limitations, shoring and reshoring procedures, vapor-retarder installation, anchor rod and anchorage device installation tolerances, steel reinforcement installation, floor and slab flatness and levelness measurement, concrete repair procedures, and concrete protection.
3. Minutes of the meeting shall be recorded by Contractor and distributed to all parties within five days. Provide one copy to Owner’s representative and Architect.

H. Record of Work: Maintain a record listing time and date of all structural concrete placement. Such record shall be kept until completion of Project and shall be available to Architect for examination at any time.

I. Pre-Placement Inspection: Formwork installation, reinforcing steel placement and installation of all items to be embedded or cast into concrete shall be verified by Contractor prior to placement.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage. Avoid damaging coatings on steel reinforcement if present.

B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

PART 2 PRODUCTS

2.01 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

1. Plywood, metal, or other approved panel materials.
2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
   a. High-density overlay, Class 1 or better.
   b. Medium-density overlay, Class 1 or better; mill-release agent treated and edge sealed.
   c. Structural 1, B-B or better; mill oiled and edge sealed.

d. B-B (Concrete Form), Class 1 or better; mill oiled and edge sealed.

B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

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

D. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

E. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

1. Furnish units that will leave no corrodible metal closer than 1 1/2" inch to the plane of exposed concrete surface.
2. Furnish ties that, when removed, will leave holes no larger than 1 inch in diameter in concrete surface.
3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.02 STEEL REINFORCEMENT

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

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

C. Low-Alloy-Steel Reinforcing Bars: ASTM A 706/A 706M, deformed, where welding of reinforcement or field bending is noted on Drawings.

D. Plain-Steel Wire: ASTM A 82/A 82M, as drawn.

E. Plain-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, plain, fabricated from as-drawn steel wire into flat sheets.

2.03 REINFORCEMENT ACCESSORIES

A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 6, plain-steel bars, cut true to length with ends square and free of burrs.

B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. 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:

1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.

C. Mechanical Connectors: Mechanical couplers shall develop in tension or compression, as required, at least 125% of bar yield strength. Connectors shall comply with ICC-ES acceptance criteria, ACI 133.

2.04 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, Type I/II, gray. Alternate cementitious materials when proposed to control alkali-silica reactions and tested as part of a representative concrete mix in accordance with ASTM C1567, may be used subject to approval. Supplement with the following:
      a. Fly Ash: ASTM C 618, Class F or C.

B. Normal-Weight Aggregates: ASTM C 33, Class 3S coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials. All coarse and fine aggregate shall be tested per ASTM C 295 or ASTM C 1293 in accordance with section 5.1 of “Guide Specification for Concrete Subject to Alkali-Silica Reactions” (2007 Portland Cement Association).
   1. Maximum Coarse-Aggregate Size: As indicated on Drawings.
   2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

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

2.05 ADMIXTURES

A. Air-Entraining Admixture: ASTM C 260.

B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will 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.
   7. Mid-Range Water Reducing Admixture: ASTM C 494/C 494M, Type A.

2.06 WATERSTOPS

A. Flexible Rubber Waterstops: CE CRD-C 513, with factory-installed metal eyelets**,** for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.
   1. Profile: Flat, dumbbell with center bulb
   2. Dimensions: 6 inches by 3/8 inch thick.

2.07 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      a. Axim Italcementi Group, Inc.; CATEXOL CimFilm.
      b. BASF Construction Chemicals - Building Systems; Confilm.
      c. ChemMasters; SprayFilm.
      d. Conspec by Dayton Superior; Aquafilm.
      e. Dayton Superior Corporation; Sure Film (J-74).
      f. Edoco by Dayton Superior; BurkeFilm.
      g. Euclid Chemical Company (The), an RPM company; Eucobar.
      h. Kaufman Products, Inc.; Vapor-Aid.
      i. Lambert Corporation; LAMBCO Skin.
      j. L&M Construction Chemicals, Inc.; E-CON.
      k. Meadows, W. R., Inc.; EVAPRE.
      l. Metalcrete Industries; Waterhold.
      m. Nox-Crete Products Group; MONOFILM.
      n. Sika Corporation; SikaFilm.
      o. SpecChem, LLC; Spec Film.
      p. Symons by Dayton Superior; Finishing Aid.
      q. TK Products, Division of Sierra Corporation; TK-2120 TRI-FILM.
      r. Unitex; PRO-FILM.
      s. Vexcon Chemicals, Inc.; Certi-Vex Envio Set.
B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. 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. Film must chemically break down in a four to six week period.

Provide data from independent laboratory indicating maximum moisture less than 0.30 kg/m^2 at 72 hours when tested in accordance with ASTM C 156.

F. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A. Shall have test data from an independent laboratory indicating a maximum moisture less than 0.30 kg/m^2 at 72 hours when tested in accordance with ASTM C 156.

2.08 RELATED MATERIALS

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

B. Bonding Agent: ASTM C 1059/C 1059M, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

2.09 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.

1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.
4. Compressive Strength: Not less than 4100 psiat 28 days when tested according to ASTM C 109/C 109M.

B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch and that can be filled in over a scarified surface to match adjacent floor elevations.

1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
4. Compressive Strength: Not less than 5000 psi at 28 days when tested according to ASTM C 109/C 109M.

2.10 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.

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

B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
   1. Fly Ash: 25 percent.

C. Limit water-soluble, chloride-ion content in hardened concrete to 0.06 for post-tensioned concrete, 0.15 for reinforced concrete exposed to chlorides in service, 0.30 for other reinforced concrete, and 1.00 for reinforced concrete that will be dry and protected from moisture in service, percent by weight of cement.

D. Admixtures: Use admixtures according to manufacturer's written instructions.
   1. Use water-reducing, high-range water-reducing, or plasticizing admixture in concrete, as required, for placement and workability.
   2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
   3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.

2.11 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Proportion structural normal-weight concrete mixture as noted on Drawings, unless aggregates are “potentially reactive” with alkalis based on the ASTM C 295 or ASTM C 1260 or ASTM C 1293 testing limits of Section 5.1 of “Guide Specification of Concrete Subject to Alkali-Silica Reactions” (2007 Portland Cement Association). When aggregates are “potentially reactive”, compliance with Section 5.2 of “Guide Specification for Concrete Subject to Alkali-Silica Reactions” (2007 Portland Cement Association) must be established through ASTM C 1567 testing for proposed alternate concrete mixture. Submit test reports in accordance with Part I of this Specification.

2.12 FABRICATING REINFORCEMENT

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

2.13 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M and ASTM C 1116/C 1116M, and furnish batch ticket information.

PART 3 EXECUTION

3.01 FORMWORK

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117. Concrete adjacent to elevator hoistway shall be installed to tolerances required by elevator manufacturer.
C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:
    1. Class A, 1/8 inch for smooth-formed finished surfaces.
    2. Class D, 1 inch for rough-formed finished surfaces.
    3. The permissible irregularity is a cumulative value due to all sources including layout, plumbness, member size, formwork offsets, joints, and member levelness. The permissible irregularity shall also apply between adjacent concrete surfaces on opposite sides of construction joint, expansion joint or shrinkage pour strip if present.
D. Construct forms tight enough to prevent loss of concrete mortar.
E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
    1. Install keyways, reglets, recesses, and the like, for easy removal.
    2. Do not use rust-stained steel form-facing material.
F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.
H. Chamfer exterior corners and edges of permanently exposed concrete.
I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

M. All formwork surfaces that support concrete exposed to view must be accepted by Architect prior to concrete placement.

3.02 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC 303 "Code of Standard Practice for Steel Buildings and Bridges."
      a. Tolerance of Embedded Items: Comply with ACI 117.
         1) Anchor Rods:
            (a) Plumbness: Within +/- 1/16 inch over anchor rod projection.
         2) Embedded Plates and Weldments:
            (a) Location: +/- 1 inch vertical, +/- 1 inch horizontal.
            (b) Plumb and Alignment: 1/4 inch in 12 inches (1:48).
   2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.

3.03 REMOVING AND REUSING FORMS

A. General: Formwork for sides of walls and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations and curing and protection operations need to be maintained.

B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.

C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.04 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
   1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would 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.
   1. Weld reinforcing bars according to AWS D1.4/D 1.4M, where indicated.
D. Size, length, number and placement of supports shall be sufficient as to maintain reinforcing position within specified tolerances during construction traffic and concrete placement.
E. On vertical formwork, use approved bar chairs or spacers as required to maintain concrete cover and bar position. Do not staple or use any other metallic fastener to secure bolsters, chairs, etc. to formwork for concrete surfaces exposed to exterior.
F. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
G. 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.

3.05 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, at locations indicated or as approved by Architect.
   1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. .
   2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
   3. Locate horizontal joints in walls at underside of slabs at the top of footings or floor slabs.
   4. Space vertical joints in walls as indicated. Locate joints beside pilasters integral with walls, near corners, and in concealed locations where possible.
C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:
   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 concrete develops random contraction cracks.
   2. All Other Interior Slabs-on-Grade: Unless noted otherwise on Drawings, locate construction joints on column centerlines. Locate control joints where shown on

Drawings. If not shown, provide control joints at column centerlines and at intervals not more than 10 feet each way.

D. 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. 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 Section 079200 "Joint Sealants," are indicated.
   2. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

3.06 WATERSTOPS

A. Flexible Waterstops: Install at locations shown in the drawings in construction joints and at other joints indicated to form a continuous diaphragm. Install in longest lengths practicable. Support and protect exposed waterstops during progress of the Work. Field fabricate joints in waterstops according to manufacturer's written instructions.

3.07 CONCRETE PLACEMENT

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

B. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.
   1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

C. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be 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 to not 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.
   3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete

embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

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

E. 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.

F. 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.

3.08 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
   1. Apply to concrete surfaces not exposed to public view.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and

patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces exposed to public view**.**

C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.09 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.

1. Apply float finish to surfaces to receive trowel finish.

C. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.

1. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
2. Finish surfaces to the following tolerances, according to ASTM E 1155, for a randomly trafficked floor surface:
    a. Specified overall values of flatness, F(F) 35; and of levelness, F(L) 25; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 17; for slabs-on-grade.

D. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces indicated or where ceramic or quarry tile is to be installed by either thickset or thin-set method. While concrete is still plastic, slightly scarify surface with a fine broom.

1. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.

E. 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 Architect before application.

3.10 MISCELLANEOUS CONCRETE ITEMS

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.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

3.11 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 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 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. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.

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

E. 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 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, 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. Moisture-retaining-cover shall

be inspected each day by Contractor. Any areas which do not show condensation on underside of cover or any slab areas which are not wet shall be immediately rewetted and cover replaced to prevent moisture loss.

a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project.

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.
   a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer.
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.

3.12 CONCRETE SURFACE REPAIRS

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

B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning and that are unacceptable to Architect. Allow Architect and Structural Engineer to observe concrete surfaces upon removal of forms and prior to repair of surface defects. Defects in structural concrete shall be brought to the attention of the Architect and Structural Engineer.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete. Limit cut depth to 3/4 inch. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template. Submit proposed repair to Architect for review prior to commencement of work.
   1. Repair finished surfaces containing defects that are unacceptable to Architect. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
   2. After concrete has cured at least 14 days, correct high areas by grinding.
   3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
   4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
   5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.

6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.
F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.13 FIELD QUALITY CONTROL

A. Testing and Inspection: As indicated on Drawings.

END OF SECTION 033000

SECTION 03 3511
CONCRETE FLOOR FINISHES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface treatments for concrete floors and slabs.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Finishing of concrete surface to tolerance; floating, troweling, and similar operations; curing.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with concrete floor placement and concrete floor curing.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's published data on each finishing product, including information on compatibility of different products and limitations.

C. Maintenance Data: Provide data on maintenance and renewal of applied finishes.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's sealed packaging, including application instructions.

1.06 FIELD CONDITIONS

A. Maintain light level equivalent to a minimum 200 W light source at 8 feet above the floor surface over each 20 foot square area of floor being finished.

B. Do not finish floors until interior heating system is operational.

C. Maintain ambient temperature of 50 degrees F minimum.

PART 2 PRODUCTS

2.01 CONCRETE FLOOR FINISH APPLICATIONS

A. Unless otherwise indicated, all concrete floors are to be finished using liquid densifier/hardener.

B. Liquid Densifier/Hardener:

C. Penetrating Clear Sealer:

D. High Gloss Clear Sealer:

E. Slip Resistant Coating: High gloss clear sealer with plastic aggregate.

2.02 DENSIFIERS AND HARDENERS

A. Liquid Densifier/Hardener: Penetrating chemical compound that reacts with concrete, filling the pores and dustproofing; for application to concrete after set.

2.03 COATINGS

A. High Gloss Clear Coating: Transparent, non-yellowing, water- or solvent-based coating.

1. Composition: Acrylic polymer-based.

B. Plastic Aggregate: Finely ground polymer for addition to coatings for slip resistance.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that floor surfaces are acceptable to receive the work of this section.

B. Verify that flaws in concrete have been patched and joints filled with methods and materials suitable for further finishes.

3.02 GENERAL

A. Apply materials in accordance with manufacturer's instructions.

3.03 COATING APPLICATION

A. Verify that surface is free of previous coatings, sealers, curing compounds, water repellents, laitance, efflorescence, fats, oils, grease, wax, soluble salts, residues from cleaning agents, and other impediments to adhesion.

B. Verify that water vapor emission from concrete and relative humidity in concrete are within limits established by coating manufacturer.

C. Protect adjacent non-coated areas from drips, overflow, and overspray; immediately remove excess material.

END OF SECTION 03 3511

SECTION 04 0511
MASONRY MORTARING AND GROUTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Mortar for masonry.
B. Grout for masonry.

1.02 RELATED REQUIREMENTS

A. Section 04 2000 - Unit Masonry: Installation of mortar and grout.
B. Section 04 2613 - Masonry Veneer: Installation of mortar.
C. Section 04 4313 - Stone Masonry Veneer: Installation of mortar.

1.03 REFERENCE STANDARDS

A. ASTM C5 - Standard Specification for Quicklime for Structural Purposes 2018.
B. ASTM C91/C91M - Standard Specification for Masonry Cement 2018.
C. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete 2018.
D. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar 2018.
E. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes 2018.
F. ASTM C270 - Standard Specification for Mortar for Unit Masonry 2019.
G. ASTM C404 - Standard Specification for Aggregates for Masonry Grout 2018.
H. ASTM C476 - Standard Specification for Grout for Masonry 2018.
I. ASTM C979/C979M - Standard Specification for Pigments for Integrally Colored Concrete 2016.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Include design mix and indicate whether the Proportion or Property specification of ASTM C270 is to be used. Also include required environmental conditions and admixture limitations.
C. Samples: Submit two samples of mortar, illustrating mortar color and color range.

1.05 QUALITY ASSURANCE

A. Comply with provisions of TMS 402/602, except where exceeded by requirements of Contract Documents.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Maintain packaged materials clean, dry, and protected against dampness, freezing, and foreign matter.

1.07 FIELD CONDITIONS

A. Cold and Hot Weather Requirements: Comply with requirements of TMS 402/602 or applicable building code, whichever is more stringent.

PART 2 PRODUCTS

2.01 MORTAR AND GROUT APPLICATIONS

A. Field-mix all mortar and grout.
B. Mortar Mix Designs: ASTM C270, Property Specification.
   1. Masonry below grade and in contact with earth: Type S.
   2. Exterior Masonry Veneer: Type N.
C. Grout Mix Designs:
   1. Bond Beams and Lintels: 3,000 psi strength at 28 days; 8-10 inches slump; provide premixed type in accordance with ASTM C 94/C 94M.

2.02 MATERIALS

A. Portland Cement: ASTM C150/C150M.
   1. Type: Type I - Normal; ASTM C150/C150M.
   2. Color: Standard gray.
B. Masonry Cement: ASTM C91/C91M.
   1. Type: Type N; ASTM C91/C91M.
   2. Colored Mortar: Premixed cement as required to match Architect's color sample.
   3. Manufacturers:
      a. Solomon Colors; Solomon Colors Concentrated A, H, and X Series: www.solomoncolors.com/#sle.
C. Hydrated Lime: ASTM C207, Type S.
D. Quicklime: ASTM C5, non-hydraulic type.
E. Mortar Aggregate: ASTM C144.
F. Grout Aggregate: ASTM C404.
G. Pigments for Colored Mortar: Pure, concentrated mineral pigments specifically intended for mixing into mortar and complying with ASTM C979/C979M.
   1. Color(s): As selected by Architect from manufacturer's full range.
H. Water: Clean and potable.

2.03 MORTAR MIXING

A. Thoroughly mix mortar ingredients using mechanical batch mixer, in accordance with ASTM C270 and in quantities needed for immediate use.
B. Maintain sand uniformly damp immediately before the mixing process.
C. Do not use anti-freeze compounds to lower the freezing point of mortar.
D. If water is lost by evaporation, re-temper only within two hours of mixing.

2.04 GROUT MIXING

A. Mix grout in accordance with ASTM C94/C94M.
B. Thoroughly mix grout ingredients in quantities needed for immediate use in accordance with ASTM C476 for fine and coarse grout.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install mortar and grout to requirements of section(s) in which masonry is specified.

B. Do not install grout in lifts greater than 16 inches without consolidating grout by rodding.

3.02 GROUTING

A. Low-Lift Grouting:
   1. Limit height of pours to 12 inches.
   2. Limit height of masonry to 16 inches above each pour.
   3. Pour grout only after vertical reinforcing is in place; place horizontal reinforcing as grout is poured. Prevent displacement of bars as grout is poured.
   4. Place grout for each pour continuously and consolidate immediately; do not interrupt pours for more than 1-1/2 hours.

B. High-Lift Grouting:
   1. Verify that horizontal and vertical reinforcement is in proper position and adequately secured before beginning pours.
   2. Place grout for spanning elements in single, continuous pour.

END OF SECTION 04 0511

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SECTION 04 2000
UNIT MASONRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Concrete block.
B. Mortar and grout.
C. Reinforcement and anchorage.
D. Flashings.
E. Lintels.
F. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 04 0100 - Maintenance of Masonry.
B. Section 04 0511 - Masonry Mortaring and Grouting.
C. Section 07 6200 - Sheet Metal Flashing and Trim: Through-wall masonry flashings.
D. Section 07 9200 - Joint Sealants: Sealing control and expansion joints.

1.03 REFERENCE STANDARDS

A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.
B. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement 2018.
C. ASTM A641/A641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire 2019.
D. ASTM A951/A951M - Standard Specification for Steel Wire for Masonry Joint Reinforcement 2016.
E. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete 2018a.
F. ASTM C90 - Standard Specification for Loadbearing Concrete Masonry Units 2016a.
G. ASTM C91/C91M - Standard Specification for Masonry Cement 2018.
H. ASTM C129 - Standard Specification for Nonloadbearing Concrete Masonry Units 2017.
I. ASTM C150/C150M - Standard Specification for Portland Cement 2018.
J. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes 2018.
K. ASTM C270 - Standard Specification for Mortar for Unit Masonry 2019.
L. ASTM C404 - Standard Specification for Aggregates for Masonry Grout 2018.
M. ASTM C476 - Standard Specification for Grout for Masonry 2018.
N. ASTM C1072 - Standard Test Method for Measurement of Masonry Flexural Bond Strength 2013, with Editorial Revision (2014).
O. ASTM C1148 - Standard Test Method for Measuring the Drying Shrinkage of Masonry Mortar 1992a (Reapproved 2014).

P. ASTM C1314 - Standard Test Method for Compressive Strength of Masonry Prisms 2018.
Q. ASTM E514/E514M - Standard Test Method for Water Penetration and Leakage Through Masonry 2014a.
R. BIA Technical Notes No. 7 - Water Penetration Resistance – Design and Detailing 2017.
S. BIA Technical Notes No. 13 - Ceramic Glazed Brick Exterior Walls 2017.
T. BIA Technical Notes No. 28B - Brick Veneer/Steel Stud Walls 2005.
U. BIA Technical Notes No. 46 - Maintenance of Brick Masonry 2017.
V. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures 2016.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide data for masonry units, fabricated wire reinforcement, mortar, and masonry accessories.
C. Samples: Submit four samples of split face block units to illustrate color, texture, and extremes of color range.
D. Manufacturer's Certificate: Certify that masonry units meet or exceed specified requirements.
E. Manufacturer's Certificate: Certify that water repellent admixture manufacturer has certified masonry unit manufacturer as an approved user of water repellent admixture in the manufacture of concrete block.

1.05 QUALITY ASSURANCE

A. Comply with provisions of TMS 402/602, except where exceeded by requirements of Contract Documents.
B. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section with minimum three years of documented experience.
C. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.06 MOCK-UP

A. Construct a masonry wall as a mock-up panel sized 8 feet long by 6 feet high; include mortar, accessories, structural backup, wall openings, and flashings (with lap joint, corner, and end dam) in mock-up.
B. Locate where directed.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

PART 2 PRODUCTS

2.01 CONCRETE MASONRY UNITS

A. Manufacturers:
   1. Basis of Design Manufacturer: Echelon, An Oldcastle Company. www.echelonmasonry.com

B. Concrete Block: Comply with referenced standards and as follows:
   1. Special Shapes: Provide non-standard blocks configured for corners, lintels, headers, control joint edges, and other detailed conditions.
   2. Load-Bearing Units: ASTM C90, normal weight.
      a. Hollow block, as indicated.
      b. Exposed Faces: Manufacturer's standard color and texture where indicated.
      c. Pattern: Standard or Split (as indicated on drawings for locations)
   3. Non-Loadbearing Units: ASTM C129.
      a. Hollow block, as indicated.
      b. Lightweight.
   4. Units with Integral Water Repellent: Concrete block units as specified in this section with polymeric liquid admixture added to concrete masonry units at the time of manufacture.
      a. Performance of Units with Integral Water Repellent:
         1) Water Permeance: When tested per ASTM E514/E514M and for a minimum of 72 hours.
            (a) No water visible on back of wall above flashing at the end of 24 hours.
            (b) No flow of water from flashing equal to or greater than 0.032 gallons per hour at the end of 24 hours.
            (c) No more than 25 percent of wall area above flashing visibly damp at end of test.
         2) Flexural Bond Strength: ASTM C1072; minimum 10 percent increase.
         3) Compressive Strength: ASTM C1314; maximum 5 percent decrease.
         4) Drying Shrinkage: ASTM C1148; maximum 5 percent increase in shrinkage.
      b. Use only in combination with mortar that also has integral water repellent admixture.
      c. Use water repellent admixtures for masonry units and mortar by a single manufacturer.
      d. Pattern: Standard or Split face (as indicated on drawings for locations).

2.02 MORTAR AND GROUT MATERIALS

A. Masonry Cement: ASTM C91/C91M, Type N.

1. Colored Mortar: Premixed cement as required to match Architect's color sample.

B. Portland Cement: ASTM C150/C150M, Type I; color as required to produce approved color sample.

C. Hydrated Lime: ASTM C207, Type S.

D. Grout Aggregate: ASTM C404.

E. Water: Clean and potable.

2.03 REINFORCEMENT AND ANCHORAGE

A. Manufacturers:

1. Blok-Lok Limited: www.blok-lok.com.
2. Hohmann & Barnard, Inc: www.h-b.com.
3. WIRE-BONDwww.wirebond.com.
4. Substitutions: See Section 01 6000 - Product Requirements.

B. Reinforcing Steel: ASTM A615/A615M, Grade 40 (40,000 psi), deformed billet bars; galvanized.

C. Single Wythe Joint Reinforcement: ASTM A951/A951M.

1. Type: Truss or ladder.
2. Material: ASTM A1064/A1064M steel wire, mill galvanized to ASTM A641/A641M Class 3.
3. Size: 0.1483 inch side rods with 0.1483 inch cross rods; width as required to provide not less than 5/8 inch of mortar coverage on each exposure.

D. Masonry Veneer Anchors: 2-piece anchors that permit differential movement between masonry veneer and structural backup, hot dip galvanized to ASTM A 153/A 153M, Class B.

1. Anchor plates: Not less than 0.075 inch thick, designed for fastening to structural backup through sheathing by two fasteners; provide design with legs that penetrate sheathing and insulation to provide positive anchorage.
2. Wire ties: Manufacturer's standard shape, 0.1875 inch thick.
3. Vertical adjustment: Not less than 3-1/2 inches.

2.04 FLASHINGS

A. Metal Flashing Materials: Stainless Steel, as specified in Section 07 6200.

B. Membrane Asphaltic Flashing Materials:

1. Rubberized Asphalt Flashing: Self-adhering polymer modified asphalt sheet; 40 mils (0.040 inch) minimum total thickness; 8 mil cross-laminated polyethylene bonded to adhesive rubberized asphalt, with a removable release liner.

C. Termination Bars: Stainless steel; compatible with membrane and adhesives.

D. Drip Edge: Stainless steel; angled drip with hemmed edge; compatible with membrane and adhesives.

E. Lap Sealants and Tapes: As recommended by flashing manufacturer; compatible with membrane and adhesives.

2.05 ACCESSORIES

A. Joint Filler: Closed cell polyvinyl chloride; oversized 50 percent to joint width; self expanding; in maximum lengths available.

B. Cavity Mortar Control: Semi-rigid polyethylene or polyester mesh panels, sized to thickness of wall cavity, and designed to prevent mortar droppings from clogging weeps and cavity vents and allow proper cavity drainage.
   1. Mortar Diverter: Semi-rigid mesh designed for installation at flashing locations.
      a. Manufacturers:
         1) Advanced Building Products, Inc: www.advancedbuildingproducts.com.
         2) Mortar Net Solutions: www.mortarnet.com.
         3) York Manufacturing, Inc: www.yorkmfg.com.
         4) Substitutions: See Section 01 6000 - Product Requirements.

C. Weeps:
   1. Color(s): As selected by Architect from manufacturer's full range.
   2. Manufacturers:
      a. Blok-Lok Limited: www.blok-lok.com.
      b. Hohmann & Barnard, Inc: www.h-b.com.
      c. WIRE-BOND: www.wirebond.com.
      d. Substitutions: See Section 01 6000 - Product Requirements.

D. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.

2.06 MORTAR AND GROUT MIXING

A. Mortar for Unit Masonry: ASTM C270, using the Proportion Specification.
   1. Masonry below grade and in contact with earth: Type S.
   2. Exterior, loadbearing masonry: Type N.
   3. Interior, non-loadbearing masonry: Type O.

B. Grout: ASTM C476; consistency required to fill completely volumes indicated for grouting; fine grout for spaces with smallest horizontal dimension of 2 inches or less; coarse grout for spaces with smallest horizontal dimension greater than 2 inches.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive masonry.

B. Verify that related items provided under other sections are properly sized and located.

C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

3.02 COLD AND HOT WEATHER REQUIREMENTS

A. Comply with requirements of TMS 402/602 or applicable building code, whichever is more stringent.

3.03 COURSING

A. Establish lines, levels, and coursing indicated. Protect from displacement.

B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.

C. Concrete Masonry Units:

1. Bond: Running, Stacked. Match existing or as noted on the architect's drawings
2. Coursing: One unit and one mortar joint to equal 8 inches.
3. Mortar Joints: Flush..

3.04 PLACING AND BONDING

A. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.

B. Lay hollow masonry units with face shell bedding on head and bed joints.

C. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.

D. Remove excess mortar and mortar smears as work progresses.

E. Interlock intersections and external corners.

F. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.

G. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.

H. Isolate top joint of masonry partitions from horizontal structural framing members and slabs or decks with compressible joint filler.

3.05 WEEPS/CAVITY VENTS

A. Install weeps in veneer walls at 24 inches on center horizontally on top of through-wall flashing above shelf angles and lintels and at bottom of walls.

3.06 REINFORCEMENT AND ANCHORAGE - GENERAL AND SINGLE WYTHE MASONRY

A. Unless otherwise indicated on drawings or specified under specific wall type, install horizontal joint reinforcement 16 inches on center.

B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.

C. Place continuous joint reinforcement in first and second joint below top of walls.

D. Lap joint reinforcement ends minimum 6 inches.

3.07 MASONRY FLASHINGS

A. Whether or not specifically indicated, install masonry flashing to divert water to exterior at all locations where downward flow of water will be interrupted.

1. Extend flashings full width at such interruptions and at least 6 inches, minimum, into adjacent masonry or turn up flashing ends at least 1 inch, minimum, to form watertight pan at non-masonry construction.
2. Remove or cover protrusions or sharp edges that could puncture flashings.
3. Seal lapped ends and penetrations of flashing before covering with mortar.

B. Extend laminated flashings to within 1/2 inch of exterior face of masonry and adhere to top of stainless steel angled drip with hemmed edge.

C. Lap end joints of flashings at least 6 inches, minimum, and seal watertight with flashing sealant/adhesive.

3.08 CONTROL AND EXPANSION JOINTS

A. Do not continue horizontal joint reinforcement through control or expansion joints.

B. Size control joints as indicated on drawings; if not indicated, 3/4 inch wide and deep.

3.09 TOLERANCES

A. Maximum Variation From Unit to Adjacent Unit: 1/16 inch.

B. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft and 1/2 inch in 20 ft or more.

C. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.

D. Maximum Variation from Level Coursing: 1/8 inch in 3 ft and 1/4 inch in 10 ft; 1/2 inch in 30 ft.

E. Maximum Variation of Mortar Joint Thickness: Head joint, minus 1/4 inch, plus 3/8 inch.

3.10 CUTTING AND FITTING

A. Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.11 CLEANING

A. Remove excess mortar and mortar droppings.

B. Clean soiled surfaces with cleaning solution.

C. Use non-metallic tools in cleaning operations.

3.12 PROTECTION

A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

END OF SECTION 04 2000

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SECTION 042010
REINFORCED UNIT MASONRY

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:

1. Concrete masonry units.
2. Mortar and grout.
3. Steel reinforcing bars.
4. Masonry joint reinforcement.
5. Miscellaneous masonry accessories.

B. Related Sections:

1. Section 042000 "Unit Masonry" for additional masonry requirements.

1.03 DEFINITIONS

A. CMU(s): Concrete masonry unit(s).

B. Reinforced Unit Masonry: Masonry containing reinforcing steel in grouted cells.

1.04 PERFORMANCE REQUIREMENTS

A. Provide reinforced unit masonry that develops indicated net-area compressive strengths at 28 days, as indicated on drawings.

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 Tables 1 and 2 in TMS 602/ACI 530.1/ASCE 6.

1.05 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Contractor will engage a qualified independent testing agency to perform preconstruction testing indicated below. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense. Materials tested shall be the same in every way to the materials used to construct this project and shall be from the same lots or batches used for constructing this project.

1. Concrete Masonry Unit Test: For each type of unit required, according to ASTM C 140 for compressive strength.
2. Grout Test (Compressive Strength): For each mix required, according to ASTM C 1019.

1.06 ACTION SUBMITTALS

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

1.07 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. Include data and calculations establishing average net-area compressive strength of units.
2. Cementitious materials. Include brand, type, and name of manufacturer.
3. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.

B. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
    1. Grout: Submit grout strength test data. Data shall be in conformance with the requirements for concrete mix designs per Division 3 section “Cast-in-place concrete”
        a. Include test reports, according to ASTM C 1019, for grout mixes required to comply with compressive strength requirement.
        b. For self consolidating grout, include test reports for slump flow and visual stability index (VSI) as determined by ASTM C1611

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 Tables 1 and 2 in TMS 602/ACI 530.1/ASCE 6.

1.08 QUALITY ASSURANCE

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.

C. Masonry Standard: Comply with TMS 602/ACI 530.1/ASCE 6 latest edition unless modified by requirements in the Contract Documents.

D. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination."

PART 2 PRODUCTS

2.01 CONCRETE MASONRY UNITS

A. CMUs: ASTM C 90.
    1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength as required to meet the specified prism strength, but in no case shall units be less than 1900 psi.
    2. Density Classification: Lightweight unless otherwise indicated.

2.02 MASONRY LINTELS

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

2.03 MORTAR AND GROUT MATERIALS

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

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

C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.

D. Aggregate for Mortar: ASTM C 144.

E. Aggregate for Grout: ASTM C 404.

F. Water: Potable.

G. Additives: None permitted, except as specified herein. Specifically do not lower freezing point of mortar or grout by use of calcium chloride or other antifreeze agents.

2.04 REINFORCEMENT

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

B. Masonry Joint Reinforcement, General: ASTM A 951/A 951M.

1. Interior Walls: Hot-dip galvanized, carbon steel.
2. Exterior Walls: Hot-dip galvanized, carbon steel.
3. Wire Size for Side Rods: As indicated on drawings
4. Wire Size for Cross Rods: 0.148-inchdiameter.
5. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches o.c.
6. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units.

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

2.05 MISCELLANEOUS ANCHORS

A. Anchor Bolts: Headed steel bolts complying with ASTM F1554 grade 36, or ASTM A307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153/A 153M, Class C; of dimensions indicated.

2.06 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. For reinforced masonry, use portland cement-lime mortar.

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 Reinforced Unit Masonry: Comply with ASTM C 270, Proportion 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 S.
2. For reinforced masonry, use Type S.
3. Mix cementitious materials and aggregates between 3 and 5 minutes in a mechanical batch mixer with a sufficient amount of water to produce a workable consistency. Unless acceptable, do not hand mix mortar. Maintain workability of mortar by remixing or retempering. Discard mortar which has begun to stiffen or is not used within 2-½ hours after initial mixing.

D. Grout for Reinforced 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 Table 7 in TMS 602/ACI 530.1/ASCE 6 for dimensions of grout spaces and pour height.
2. Grout shall attain a minimum compressive strength of 2000 psi at 28 days when tested in accordance with C1019.
3. Except for self-consolidating grout, mix and proportion grout in accordance with ASTM C 476, Table 1 or paragraph 4.2.2 for specified 28-day compressive strength indicated.
4. Provide grout with a slump of 8 to 11 inches for grout heights less than 5 feet 4 inches, or 10 to 11 inches for grout lift heights greater than 5 feet 4 inches as measured according to ASTM C 143/C 143M, unless self-consolidating grout is used.
5. Self consolidating grout, if used, shall comply with the material requirements of ASTM C476; have a slump flow of 24 to 30 in as determined by ASTM C1611/C1611M; and has a Visual Stability Index (VSI) less than or equal to 1 as determined in accordance with ASTM C1611/C1611M, Appendix X.1.
6. Proportioning of self-consolidating grout at the project site is not permitted. Do not add water at the project site except in accordance with the self-consolidating grout manufacturer’s recommendations.
7. Do not use admixtures unless acceptable. Field additional of admixtures is not permitted in self-consolidating grout.

PART 3 EXECUTION

3.01 LAYING MASONRY WALLS

A. Bond Pattern: 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.

B. 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.

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

3.02 MORTAR BEDDING AND JOINTING

A. Lay hollow CMUs as follows:

1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
2. With webs fully bedded in mortar in all courses of piers, columns, and pilasters.
3. With webs fully bedded in mortar each side of grouted cells.

3.03 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.

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.

3.04 CONTROL AND EXPANSION JOINTS

A. General: Install control joint materials in reinforced unit masonry as masonry progresses, as indicated on drawings.

3.05 LINTELS

A. Provide masonry lintels where shown and where openings of more than 24 inches for block-size units are shown without structural steel or other supporting lintels.

3.06 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, latest edition.

1. Support reinforcement to prevent displacement caused by construction loads or by placement of grout or mortar, beyond the allowable tolerances.
2. Completely embed reinforcing bars in grout.
3. Maintain clear distance between reinforcing bars and the interior of masonry unit or formed surface of at least 1/4 inch for fine grout and 1/2 inch for coarse grout, except where cross webs of hollow units are used as supports for horizontal reinforcement.
4. Place reinforcing bars maintaining the following minimum cover:
   a. Masonry face exposed to earth or weather: 2 inches for bars larger than No. 5 ; 1½ inches for No. 5 bars or smaller.
   b. Masonry not exposed to earth or weather: 1½ inches .
5. Maintain minimum clear distance between parallel bars of the nominal bar size or 1 inch , whichever is greater.
6. In columns and pilasters, maintain minimum clear distance between vertical bars of one and one-half times the nominal bar size or 1½ inches , whichever is greater.
7. Splice only where indicated on the Project Drawings, unless otherwise acceptable.
8. Unless accepted by the Architect/Engineer, do not bend reinforcement after it is embedded in grout or mortar.
9. Noncontact lap splices: Position bars spliced by noncontact lap splice no farther apart transversely than one-fifth the specified length of lap nor more than 8 inches
10. Joint reinforcement
    a. Place joint reinforcement so that longitudinal wires are embedded in mortar with a minimum cover of 1/2 inch when not exposed to weather or earth; or 5/8 inch when exposed to weather or earth.
    b. Provide minimum 6 inch lap splices for joint reinforcement.
    c. Ensure that all ends of longitudinal wires of joint reinforcement at laps are embedded in mortar or grout.
11. Placement Tolerances
    a. Place reinforcing bars in walls and flexural elements within a tolerance of 1/2 inch.
    b. Place vertical bars within:
       1) 2 inches of the required location along the length of the wall when the wall segment length exceeds 24 inches .

2) 1 inch of the required location along the length of the wall when the wall segment length does not exceed 24 inches

c. If it is necessary to move bars more than one bar diameter or a distance exceeding the tolerance stated above to avoid interference with other reinforcing steel, conduits, or embedded items, notify the Architect/Engineer for acceptance of the resulting arrangement of bars.

d. Foundation dowels that interfere with unit webs are permitted to be bent to a maximum of 1 inch horizontally for every 6 inches of vertical height.

C. Cleanouts: Provide cleanouts in the bottom course of masonry for each grout pour when the grout pour height exceeds 5 feet 4 inches .

1. Construct cleanouts so that the space to be grouted can be cleaned and inspected. In solid grouted masonry, space cleanouts horizontally a maximum of 32 inches on center.
2. Construct cleanouts with an opening of sufficient size to permit removal of debris. The minimum opening dimension shall be 3 inches .
3. After cleaning, close cleanouts with closures braced to resist grout pressure.

D. Grout Placement

1. Placing time: Place grout within 1-1/2 hours from introducing water in the mixture and prior to initial set.
   a. Discard site-mixed grout that does not meet the specified slump without adding water after initial mixing.
   b. For ready-mixed grout:
      1) Addition of water is permitted at the time of discharge to adjust slump.
      2) Discard ready-mixed grout that does not meet the specified slump without adding water, other than the water that was added at the time of discharge. The time limitation is waived as long as the ready-mixed grout meets the specified slump.
2. Confinement: Confine grout to the areas indicated on the Project Drawings. Use material to confine grout that permits bond between masonry units and mortar.
3. Grout pour height:
   a. Definition: The total height of masonry to be grouted prior to erection of additional masonry. A grout pour consists of one or more grout lifts.
   b. Do not exceed the maximum grout pour height given in TMS 602/ACI 530.1/ASCE 6, Table 7.
4. Grout lift height:
   a. Definition: An increment of grout height within a total grout pour. A grout pour consists of one or more grout lifts.
   b. For grout except self-consolidating grout:

1) Where the following conditions are met, place grout in lifts not exceeding 12 feet 8 inches .
   (a) The masonry has cured for at least 4 hours.
   (b) The grout slump is maintained between 10 and 11 inches .
   (c) No intermediate reinforced bond beams are placed between the top and the bottom of the pour height.
2) When there are intermediate bond beams within the grout pour, limit the grout lift height to the bottom of the lowest bond beam that is more than 5 feet 4 inches (1.63 m) above the bottom of the lift, but do not exceed a grout lift height of 12 feet 8 inches .
3) When the conditions above are not met, place grout in lifts not exceeding 5 feet 4 inches .

5. For self-consolidating grout:
   a. When placed in masonry that has cured for at least 4 hours, place in lifts not exceeding the grout pour height.
   b. When placed in masonry that has not cured for at least 4 hours, place in lifts not exceeding 5 feet 4 inches

E. Consolidation
1. Consolidate grout at the time of placement.
   a. Consolidate grout pours 12 inches or less in height by mechanical vibration or by puddling.
   b. Consolidate pours exceeding 12 inches in height by mechanical vibration and reconsolidate by mechanical vibration after initial water loss and settlement has occurred.
   c. Consolidation or reconsolidation is not required for self-consolidating grout.

F. Grout key: When grouting, form grout keys between grout pours. Form grout keys between grout lifts when the first lift is permitted to set prior to placement of the subsequent lift
1. Form a grout key by terminating the grout a minimum of 1½ inches below a mortar joint.
2. Do not form grout keys within beams.
3. At beams or lintels laid with closed bottom units, terminate the grout pour at the bottom of the beam or lintel without forming a grout key.

3.07 FIELD QUALITY CONTROL

A. As indicated on drawings

END OF SECTION 042010

SECTION 051200
STRUCTURAL STEEL FRAMING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:
   1. Structural steel.
   2. Grout.

B. Related Sections:
   1. Section 053100 "Steel Decking" for field installation of shear connectors through deck.
   2. Section 055000 "Metal Fabrications" for miscellaneous steel fabrications including steel lintels and shelf angles not attached to structural-steel frame and other metal items not defined as structural steel.
   3. Section 099113 "Exterior Painting" and Section 099123 "Interior Painting" and Section 099600 "High-Performance Coatings" for surface-preparation and priming requirements.

1.03 DEFINITIONS

A. Structural Steel: Elements of structural-steel frame, as classified by AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

B. Seismic-Load-Resisting System: Elements of structural-steel frame designated as "SLRS" or along grid lines designated as "SLRS" on Drawings, including cantilever columns and their connections.

C. Heavy Sections: Rolled and built-up sections as follows:
   1. Connection plates and column base plates thicker than 2 inches included in the Seismic-Load-Resisting System.

1.04 PERFORMANCE REQUIREMENTS

A. Connections: .
   1. Provide connections as shown or noted on Drawings. Design of connections not shown or noted shall be provided by Structural Engineer-of-Record upon request.
   2. Alternate connections may be submitted by the Contractor with prior approval of Structural Engineer-of-Record. Connections shall be designed for loads indicated on drawings or provided by Structural Engineer-of-Record. Loads indicated are developed using Load and Resistance Factor Design (LRFD) load combinations unless noted otherwise. One set of calculations for all alternate connections signed

and sealed by a qualified engineer shall be submitted with or in advance of applicable shop drawings.

B. Construction: Refer to the Drawings for description of lateral load resisting system.

1.05 ACTION SUBMITTALS

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

B. Shop and Erection Drawings: Show location, fabrication, and assembly of structural-steel components.

1. Location of each piece or detail within the structure.
2. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
3. Include embedment piece and setting drawings.
4. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
5. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical high-strength bolted connections.
6. Identify members and connections of the seismic-load-resisting system.
7. Drawings submitted in multiple packages shall contain individual submittals complete with all applicable erection drawings, details, and piece drawings.
8. Reproduction of Contract Documents is not permitted.
9. Provide schedule for submittal of shop and erection drawings.

C. Welding Procedure Specifications (WPSs) and Procedure Qualification Records (PQRs): Provide according to AWS D1.1/D1.1M, "Structural Welding Code - Steel," for each welded joint whether prequalified or qualified by testing.

D. Charpy V-Notch testing results for heavy sections and weld metal when required.

1.06 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer and fabricator.

B. Welding certificates.

C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

D. Mill test reports for structural steel, including chemical and physical properties.

E. Product Test Reports: For the following if present on project:

1. Bolts, nuts, and washers including mechanical properties and chemical analysis.
2. Direct-tension indicators.
3. Tension-control, high-strength bolt-nut-washer assemblies.
4. Shop primers.
5. Nonshrink grout.

1.07 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 as amended below:
    a. Section 3.2: Replace entire section with the following: “Requirements for structural steel including quantities, sizes, locations, arrangement, and details shall be shown or noted in the overall Contract Drawing package. Fabricator is responsible for incorporating all such information from structural, architectural, mechanical, and electrical drawings, as well as those of other disciplines.”
    b. Section 3.5: Remove all text after first sentence.
    c. Section 3.6: Replace entire section with the following: “When the fast-track project delivery system is selected, release of structural drawings shall constitute release for construction only if specifically noted as such on the drawing. Drawing indicated “preliminary” or “not for construction” shall not be used for detailing or construction except where the risk of any cost or delay associated with subsequent revisions to Contract Documents is accepted by the Owner, Contractor or Fabricator.”
    d. Section 4.4: Revise second sentence to read the following: “The shop and erection drawings shall be returned in accordance with the schedule defined in Division 1 of the project Specification. In the absence of such schedule, the Owner’s Designated Representative for Design shall return submittals within 14 calendar days of receipt from the Owner’s Designated Representative for Construction.”
2. AISC 341 and AISC 341s1..
3. AISC 360.
4. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

E. Preinstallation Conference: Conduct conference at Project site.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.

1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.
   1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
   2. Clean and relubricate bolts and nuts that become dry or rusty before use.
   3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F 1852 fasteners and for retesting fasteners after lubrication.

1.09 COORDINATION

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

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

PART 2 PRODUCTS

2.01 STRUCTURAL-STEEL MATERIALS

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than the following:
   1. W-Shapes: 60 percent.
   2. Channels, Angle-Shapes: 60 percent.
   3. All Other Steel Materials: 25 percent.

C. W-Shapes: ASTM A 992/A 992M unless indicated otherwise on Drawings.

D. Channels, Angle Shapes: ASTM A 36/A 36M unless indicated otherwise on Drawings.

E. Plate and Bar: ASTM A 36/A 36M unless indicated otherwise on Drawings..

F. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade C, structural tubing.

G. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade B.
   1. Weight Class: as indicated on Drawings.
   2. Finish: Black except where indicated to be galvanized.

H. Welding Electrodes: Comply with AWS requirements, 70 Series
   1. Conform to Charpy V-Notch test requirements of AISC 360.
   2. Conform to Charpy V-Notch test requirements of AISC 341 for components included in the Seismic-Load-Resisting System.

I. Heavy Sections:
   1. Conform to Charpy V-Notch test requirements of AISC 360.
   2. Conform to Charpy V-Notch test requirements of AISC 341 for components included in the Seismic-Load-Resisting System.

2.02 BOLTS, CONNECTORS, AND ANCHORS

A. Use Tension-Control, High-Strength Bolt-Nut-Washer Assemblies whenever possible unless indicated otherwise.

B. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade C, heavy-hex carbon-steel nuts; and ASTM F 436, Type 1, hardened carbon-steel washers; all with plain finish.

C. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, round head assemblies consisting of steel structural bolts with splined ends, heavy-hex carbon-steel nuts, and hardened carbon-steel washers.
   1. Finish: Plain.

D. Unheaded Anchor Rods: ASTM F 1554, Grade 55, weldable
   1. Configuration: Straight.
   2. Nuts: ASTM A 563 heavy-hex carbon steel.
   3. Plate Washers: ASTM A 36/A 36M carbon steel.
   4. Washers: ASTM F 436, Type 1, hardened carbon steel.
   5. Finish: Hot-dip zinc coating, ASTM A 153/A 153M, Class C

E. Headed Anchor Rods: ASTM F 1554, Grade 55, weldable, straight.
   1. Nuts: ASTM A 563 heavy-hex carbon steel.
   2. Plate Washers: ASTM A 36/A 36M carbon steel.
   3. Washers: ASTM F 436, Type 1, hardened carbon steel.
   4. Finish: Hot-dip zinc coating, ASTM A 153/A 153M, Class C.

F. Threaded Rods: ASTM A 36/A 36M .
   1. Nuts: ASTM A 563 heavy-hex carbon steel.
   2. Washers: ASTM A 36/A 36M carbon steel.
   3. Finish: Hot-dip zinc coating, ASTM A 153/A 153M, Class C

G. Deformed Anchor Studs (DAS) / Deformed Bar Anchors (DBA): Made from ASTM A 108 low carbon steel, cold worked and deformed per ASTM A 496. Minimum yield stress = 60 ksi (415 MPa); minimum tensile strength = 80 ksi (550 MPa).

H. Rebar: Rebar used for welding shall meet the requirements of ASTM A-706. Minimum bend diameters per ACI 318.

I. Expansion Anchors, Screw Anchors, and Adhesive Anchors: Size and Manufacturer as indicated on Drawings. Complete assemblies with required rods, nuts, washers, and adhesive system as applicable. Installed in accordance with Manfacturer's installation instructions. Current ICC approval and published ICC Research Report required.

1. Finish for use in exposed or potentially wet environments and for attachment of exterior cladding materials: Galvanized in conformance with ASTM A 153 or stainless steel, Series 300.

2.03 PRIMER

A. Primer: Comply with Section 099113 "Exterior Painting," Section 099123 "Interior Painting," and Section 099600 "High-Performance Coatings."

B. Galvanizing Repair Paint: MPI#18, MPI#19, or SSPC-Paint 20.

2.04 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time. Minimum compressive strength = 6000 psi. Required where grout is exposed to view or weathering.

2.05 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC 360.

1. Identify high-strength structural steel according to ASTM A 6/A 6M and maintain markings until structural steel has been erected.
2. Mark and match-mark materials for field assembly.
3. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations, if applicable.

B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.

1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.

C. Bolt Holes: Cut, drill, mechanically thermal cut, or punch standard bolt holes perpendicular to metal surfaces. Do not enlarge bolt holes by burning.

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

E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 2, "Hand Tool Cleaning or SSPC-SP 3, "Power Tool Cleaning."

F. Deformed Anchor Studs / Deformed Bar Anchors Prepare steel surfaces as recommended by manufacturer of anchors. Use automatic end welding of anchors according to AWS D1.1/D1.1M and manufacturer's written instructions.

G. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel framing members.

1. Cut, drill, thermal cut, or punch holes perpendicular to steel surfaces.
2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.

H. Splices: Splicing of members to obtain required lengths is not permitted without prior approval of structural Engineer-of-Record unless indicated on the Drawings.

I. Substitutions: Where exact sizes and weights indicated on Drawings are not readily available, secure approval of alternate sizes from Structural Engineer-of Record in time to prevent project delay.

2.06 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: As indicated on Drawings.

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

2.07 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.
3. Surfaces to be high-strength bolted with slip-critical connections.
4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
5. Galvanized surfaces.
6. Surfaces not otherwise indicated to be painted that are not exposed to view or weather in the final condition.

B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Unless more stringent requirements are required by the primer or coating manufacturer instructions, prepare surfaces according to either of the following specifications and standards:

1. SSPC-SP 2, "Hand Tool Cleaning."
2. SSPC-SP 3, "Power Tool Cleaning."

2.08 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/A 123M.

1. Fill vent and drain holes in closed sections (HSS or Pipe) that will be exposed in the finished Work unless they will function as weep holes, by plugging with zinc solder and filing off smooth.
2. Galvanize lintels and shelf angles located in exterior walls.

2.09 SOURCE QUALITY CONTROL

A. Testing and Inspection: As indicated on Drawings.

PART 3 EXECUTION

3.01 EXAMINATION

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

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

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

3.02 PREPARATION

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

1. Coordinate installation of non-structural steel items that load the temporarily supported steel frame such that temporary supports are adequate to resist all imposed loads.

3.03 ERECTION

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

B. Base Bearing and Leveling Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.

1. Set plates for structural members on wedges, shims, or setting nuts as required.
2. Weld plate washers to top of baseplate where indicated on Drawings.
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. Clean and moisten surfaces to receive grout. Immediately remove any remaining free water. 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's "Code of Standard Practice for Steel Buildings and Bridges."

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

1. Level and plumb individual members of structure.

2. Make allowances for difference between temperature at time of erection and mean temperature of 70° F when structure is completed and in service.

E. Splice members only where indicated.
1. Fasten splices in compression after bearing surface have been brought into contact. Close all gaps greater than 1/16” by driving non-tapered mild steel shims full depth of bearing surface along full length of gap.

F. Do not use thermal cutting during erection unless approved by Structural Engineer-of-Record. Finish thermally cut sections within smoothness limits in AWS D1.1/D1.1M.

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

3.04 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: -As indicated on Drawings.

B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
1. 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 where indicated on Drawings, back gouge, and grind steel smooth.
3. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.

3.05 FIELD QUALITY CONTROL

A. Testing and Inspection: As indicated on Drawings.

3.06 REPAIRS AND PROTECTION

A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780.

B. Touchup Painting: Cleaning and touchup painting are specified in Section 099113 "Exterior Painting" Section 099123 "Interior Painting."

END OF SECTION 051200

SECTION 053100
STEEL DECKING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:
   1. Roof deck.

B. Related Requirements:
   1. Section 051200 “Structural Steel Framing” for shop- and field-welded shear connectors.
   2. Section 099113 “Exterior Painting” for repair painting of primed deck and finish painting of deck.

1.03 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.

1.04 INFORMATIONAL SUBMITTALS

A. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that each of the following complies with requirements:
   1. Power-actuated mechanical fasteners.

1.05 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.3, “Structural Welding Code – Sheet Steel.”

1.06 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.

PART 2 PRODUCTS

2.01 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."

B. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

2.02 ROOF DECK

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

1. ASC Profiles, Inc.; a Blue Scope Steel company.
2. Canam United States; Canam Group Inc.
3. CMC Joist & Deck.
4. Consolidated Systems, Inc.; Metal Dek Group.
5. Cordeck.
6. DACS, Inc.
7. Epic Metals Corporation.
8. Marlyn Steel Decks, Inc.
9. New Millennium Building Systems, LLC.
10. Nucor Corp.; Vulcraft Group.
11. Roof Deck, Inc.
12. Valley Joist; Subsidiary of EBSCO Industries, Inc.
13. Verco Manufacturing Co.
14. Wheeling Corrugating Company; Div. of Wheeling-Pittsburgh Steel Corporation.

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. Galvanized and Shop-Primed Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), grade, thickness and profile as indicated, zinc coating; cleaned, pretreated, and primed with manufacturer's standard baked-on, rust-inhibitive primer. Use at exterior locations indicated to be painted and exposed to view.
   a. Color: Manufacturer's standard.
2. Span Condition: As indicated.
3. Side Laps: Overlapped.

2.03 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. 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.
E. Weld Washers: Uncoated steel sheet, shaped to fit deck rib, 0.0747 inch thick, with factory-punched hole of 3/8-inch minimum diameter.
F. Galvanizing Repair Paint: ASTM A 780
G. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.
B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 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. Obtain prior written approval from Structural Engineer-of-Record before installing shoring.
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.
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.
    1. Refer to Drawings for opening sizes requiring reinforcement and typical reinforcement options.
    2. Miscellaneous openings not shown on the Drawings such as those required for vents, risers, conduits, etc. shall be cut and reinforced if necessary, by the trade requiring the opening.
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 with prior written approval of Structural Engineer-of-Record. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

3.03 ROOF-DECK INSTALLATION

A. Fasten roof-deck panels as indicated on drawings. Provide weld washer at each location where uncoated deck of thickness 0.028 inches or less is being fastened to supporting members by welding.

B. End Bearing: Install deck ends over supporting frame with a minimum end bearing length as indicated, with end joints as follows:

1. End Joints: Lapped as indicated. .

C. Miscellaneous Roof-Deck Accessories: Install 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.

3.04 FIELD QUALITY CONTROL

A. Testing and Inspection: As indicated on Drawings.

3.05 PROTECTION

A. Galvanizing Repairs: Where deck is exposed to weather or moisture, prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. 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."

C. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

1. Do not use deck units for storage or as a working platform until permanently secured in position.
2. Contractor shall assure that completed deck is not damaged by use as a runaway, storage of materials or subsequent work.
3. Contractor shall assure that construction loads are not allowed which exceed the safe carrying capacity of the deck.

END OF SECTION 053100

SECTION 05 5213
PIPE AND TUBE RAILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wall mounted handrails.

B. Floor mounted railings

1.02 RELATED REQUIREMENTS

A. Section 04 2000 - Unit Masonry: Placement of anchors in masonry.

B. Section 09 9113 - Exterior Painting: Paint finish.

1.03 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design 2010.

B. AISC 201 - AISC Certification Program for Structural Steel Fabricators, Standard for Steel Building Structures 2006.

C. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless 2020.

D. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer 2004.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, anchorage, size and type of fasteners, and accessories.

1.05 QUALITY ASSURANCE

A. Structural Designer Qualifications: Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located, or personnel under direct supervision of such an engineer.

B. Welder Qualifications: Show certification of welders employed on the Work, verifying AWS qualification within the previous 12 months.

C. Fabricator Qualifications:

1. A qualified steel fabricator that is certified by the American Institute for Steel Construction (AISC) under AISC 201.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Handrails and Railings

B. Stage Protection Railings

2.02 RAILINGS - GENERAL REQUIREMENTS

A. Design, fabricate, and test railing assemblies in accordance with the most stringent requirements of applicable local code.

B. Allow for expansion and contraction of members and building movement without damage to connections or members.
C. Dimensions: See drawings for configurations and heights.
   1. Top Rails and Wall Rails: 1-1/2 inches diameter, round.
D. Provide anchors and other components as required to attach to structure, made of same materials as railing components unless otherwise indicated; where exposed fasteners are unavoidable provide flush countersunk fasteners.
   1. For anchorage to masonry, provide brackets to be embedded in masonry, for bolting anchors.
   2. Posts: Provide adjustable flanged brackets.
E. Provide welding fittings to join lengths, seal open ends, and conceal exposed mounting bolts and nuts, including but not limited to elbows, T-shapes, splice connectors, flanges, escutcheons, and wall brackets.

2.03 STEEL RAILING SYSTEM

A. Steel Pipe: ASTM A53/A53M Grade B Schedule 80, black finish.
B. Welding Fittings: Factory- or shop-welded from matching pipe or tube; seams continuously welded; joints and seams ground smooth.
C. Exposed Fasteners: No exposed bolts or screws.
D. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

2.04 FABRICATION

A. Accurately form components to suit specific project conditions and for proper connection to building structure.
B. Fit and shop assemble components in largest practical sizes for delivery to site.
C. Fabricate components with joints tightly fitted and secured. Provide spigots and sleeves to accommodate site assembly and installation.
D. Welded Joints:
   1. Exterior Components: Continuously seal joined pieces by continuous welds. Drill condensate drainage holes at bottom of members at locations that will not encourage water intrusion.
   2. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

A. Clean and strip primed steel items to bare metal where site welding is required.

B. Supply items required to be cast into concrete or embedded in masonry with setting templates, for installation as work of other sections.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.
B. Install components plumb and level, accurately fitted, free from distortion or defects, with tight joints.
C. Install railings in compliance with ADA Standards for accessible design at applicable locations.
D. Anchor railings securely to structure.
E. Field weld anchors as indicated on shop drawings. Touch-up welds with primer. Grind welds smooth.
F. Conceal anchor bolts and screws whenever possible. Where not concealed, use flush countersunk fastenings.

3.04 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per floor level, non-cumulative.
B. Maximum Offset From True Alignment: 1/4 inch.
C. Maximum Out-of-Position: 1/4 inch.

END OF SECTION 05 5213

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SECTION 061000

ROUGH CARPENTRY

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following:

1. Framing with dimension lumber.
2. Framing with timber.
3. Framing with engineered wood products.
4. Metal fabrications used to support wood members including bearing plates, anchor bolts, and weldments.
5. Rough hardware, including but not limited to metal framing anchors, columns caps and bases, hangers, straps, bolts, screws, and nails.

B. Related Sections include the following:

1. Division 06 Section "Sheathing."
2. Division 06 Section "Shop-Fabricated Wood Trusses."
3. Division 06 Section “Wood Decking”

1.03 DEFINITIONS

A. Exposed Framing: Framing not concealed by other construction.

B. Dimension Lumber: Lumber of 2 inches nominal or greater but less than 5 inches nominal in least dimension.

C. Timber: Lumber of 5 inches nominal or greater in least dimension.

D. Lumber grading agencies, and the abbreviations used to reference them, include the following:

1. NeLMA: Northeastern Lumber Manufacturers' Association.
2. NLGA: National Lumber Grades Authority.
3. RIS: Redwood Inspection Service.
4. SPIB: The Southern Pine Inspection Bureau.
5. WCLIB: West Coast Lumber Inspection Bureau.
6. WWPA: Western Wood Products Association.

1.04 SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with re-

quirements. Indicate type of preservative used and net amount of preservative retained.

B. Fastener Patterns: Full-size templates for fasteners in exposed framing.

C. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.

D. Research/Evaluation Reports: For the following, showing compliance with building code in effect for Project:

1. Wood-preservative-treated wood.
2. Engineered wood products.
3. Power-driven fasteners.
4. Powder-actuated fasteners.
5. Expansion anchors.
6. Metal framing anchors.

E. Shop Drawings: Submit shop drawings for all metal framing connectors and weldments showing dimensions, material type and thickness, hole sizes and locations and fastener sizes and lengths, weld sizes and lengths, and finishes. Submit manufacturer's catalog information and installation instructions for all metal framing connections.

F. Layout Drawings: Submit layout drawings for all hold-down anchor bolts and sill plate anchor bolts embedded in concrete or masonry. Indicate anchor bolts, lengths and dimensions from edge of foundation wall or grid. Describe means and methods used to ensure hold-down anchor bolts are correctly located, to ensure anchor bolts will not be moved during concreting, and to ensure anchor bolts locations in hardened concrete are within specified tolerance in plan and in plumbness.

G. Submit Manufacturer's data and/or certification verifying:

1. Plywood and OSB conformance to the product standards listed herein.
2. Fabricated lumber conformance to design properties noted on the drawings.

H. Nails: Submit 2 samples of each nail proposed to be used on the project. Include sample of nails for mechanical connectors. Attach to each nail sample a written description including manufacturer, ASTM reference, designation, type, diameter, length, and finish. Submit sizes and types of all pneumatically or mechanically driven nails proposed for use, along with code approved report showing equivalent allowable loads to specified nails. Submit metal framing connector manufacturer's requirements for using pneumatically or mechanically driven nails or their products.

I. Certification: Submit certification that all beams and stringers used in cantilevers or continuous spans are graded to provide the full allowable stresses over the entire member length

J. Wood Moisture Content: Submit test results of wood moisture content for all dimension lumber, all pressure preservative treated lumber, and all timbers. Lumber shall be tested at time of installation.

1.05 QUALITY ASSURANCE

A. Source Limitations for Engineered Wood Products: Obtain each type of engineered wood product through one source from a single manufacturer.

B. Wood Framing: Comply with requirements of the IBC version noted on the drawings and National Design Specification for Wood Construction, latest edition, as published by the American Forest and Paper Association.

C. Structural capacities for structural composite lumber shall be established and monitored in accordance with ASTM D5456.

D. Joist hangers and other metal connectors shall comply with ASTM D1761.

E. Preinstallation Conference: Contractor shall hold a preinstallation conference prior to erecting wood framing.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

PART 2 PRODUCTS

2.01 WOOD PRODUCTS, GENERAL

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

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece or omit grade stamp and provide certificates of grade compliance issued by grading agency.
3. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
4. Provide dressed lumber, S4S, unless otherwise indicated.

B. Engineered Wood Products: Provide engineered wood products acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that show compliance with building code in effect for Project.

1. Allowable Design Stresses: Provide engineered wood products with allowable design stresses, as published by manufacturer, that meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data

or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

2.02 WOOD-PRESERVATIVE-TREATED LUMBER

A. Preservative Treatment by Pressure Process: AWPA C2, except that lumber that is not in contact with the ground and is continuously protected from liquid water may be treated according to AWPA C31 with inorganic boron (SBX).
   1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
   2. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
   1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece or omit marking and provide certificates of treatment compliance issued by inspection agency.

D. Application: Unless naturally durable wood recognized by the building code is specified, Treat items indicated on Drawings, and the following:
   1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
   2. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
   3. Wood sheathing and framing members that rest on exterior foundation walls and are less than 8” from exposed earth.
   4. Wood posts or columns supported on a concrete slab or footing in direct contact with earth unless the post/column is supported by a metal pedestal projecting at least 1” above the slab/footing and at least 6” above exposed earth.

2.03 DIMENSION LUMBER FRAMING

A. Maximum Moisture Content: 19 percent for members 4x and smaller

B. Species and grade as noted on the drawings.

2.04 TIMBER FRAMING

A. Provide timber framing complying with the following requirements, according to grading rules of grading agency indicated:
   1. Species, Grade, and Design Stresses: As noted on the drawings.

2. Additional Restriction: Free of heart centers.

2.05 ENGINEERED WOOD PRODUCTS

A. Laminated-Veneer Lumber: Structural composite lumber made from wood veneers with grain primarily parallel to member lengths, evaluated and monitored according to ASTM D 5456 and manufactured with an exterior-type adhesive complying with ASTM D 2559 and containing no urea formaldehyde. Required design values are noted on the drawings.

B. Parallel-Strand Lumber: Structural composite lumber made from wood strand elements with grain primarily parallel to member lengths, evaluated and monitored according to ASTM D 5456 and manufactured with an exterior-type adhesive complying with ASTM D 2559 and containing no urea formaldehyde. Required design values are noted on the drawings.

2.06 MISCELLANEOUS LUMBER

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

1. Blocking.
2. Nailers.

2.07 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.

1. Where rough carpentry is pressure-preservative treated, provide fasteners of 300 series stainless steel and use stainless steel fasteners in stainless steel hardware. Where rough carpentry is exposed or in area of high relative humidity provide fasteners with hot-dip galvanized zinc coating complying with ASTM A153, Class D. All other fasteners shall be electro-galvanized meeting ASTM A641 “Regular Coating”. Fasteners include all accessories such as washers and nuts.

B. Nails: Nails shall be “Engineered Construction Nails” in accordance with ASTM F1667. Use common wire nail lengths and diameters noted. Threaded, hardened steel nails may be substituted for common size nails of corresponding size. Use ring shank or screw shank nails for attachment of plywood and OSB.

1. Pneumatically or mechanically driven nails shall be subject to a jobsite testing to qualify equipment and personnel. Test shall demonstrate that nailing is achieved without over driving of nails and with proper spacing and edge distance. If jobsite testing is acceptable to the Architect, and if shown to be equivalent to box wire nail allowable loads in accordance with CABO report number NER-272 or equivalent code approval report, machine nails may be substituted for hand driven nails. Use of machine nails is subject to written approval of the Architect.

C. Power-Driven Fasteners: NES NER-272.

D. Wood Screws: ASME B18.6.1. Wood Screws: Cut or rolled thread wood screws meeting the requirements of ANSI/ASME Standard B19.6.1. Provide corrosion resistant coating equivalent to hot dip galvanizing]].

E. Lag Bolts: ASTM A307 hex head. Hot dip galvanized with hot dip galvanized washers.

F. Bolts and Anchor Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex heads and nuts except anchor bolts shall have heavy hex heads where indicated, and flat washers. Hot-dip galvanized nuts and washers.

G. Washers: Provide hot-dip galvanized steel washers under all bolt and lag bolt heads and nuts bearing against wood. Use hot-dip galvanized mallable iron washers when washer is exposed to view. Surface area of washer to be minimum of 16 times the shank area of the receiving bolt or lag screw. Thickness not less than 1/10 of the washer diameter or length of longest side. Use beveled washers where the bolt to member alignment is not perpendicular. Use plate washers under steel washer at sill and sole plates, hot-dip galvanize.

H. Steel Plates, Straps, and Weldments: Size as indicated. Where welded, provide minimum of 3/16” fillet welds all sides and full length of contact surfaces unless noted. Use E70 welding electrodes. If exposed and within reach of public, grind all exposed edges and corners to 1/8” radius and remove all sharp edges. Prime with shop paint. Use ASTM A36 material, Hot-dip galvanized after fabrication.

I. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.

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

2.08 METAL FRAMING ANCHORS

A. Basis-of-Design Products: Subject to compliance with requirements, provide products indicated on Drawings.

B. Allowable Design Loads: Provide products with allowable design loads, as published by manufacturer, that meet or exceed those of products of manufacturers listed. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency. Provide with maximum number nails, bolts, and/or screws allowed for each connector according to Manufacturer. Provide nails, bolts, screws of size, length, and finish specified by the Manufacturer. Gun nails shall not be used for

connector nailing without prior written approval. Connector fastener requirements shall be tamped or labeled directly on the connector.

C. Galvanized Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 coating designation.
   1. Use for interior locations where stainless steel is not indicated.

D. Stainless-Steel Sheet: ASTM A 666, Type 316.
   1. Use for exterior locations and for connectors in contact with pressure preservative treated wood. Fasteners shall also be stainless steel.

E. Joist Hangers: U-shaped joist hangers with 2-inch- long seat and 1-1/4-inch- wide nailing flanges at least 85 percent of joist depth.

F. Top Flange Hangers: U-shaped joist hangers, full depth of joist, formed from metal strap with tabs bent to extend over and be fastened to supporting member.

G. Bridging: Rigid, V-section, nailless type, 0.050 inch thick, length to suit joist size and spacing.

H. Post Bases: Adjustable-socket type for bolting in place with standoff plate to raise post 1 inch above base and with 2-inch- minimum side cover.

I. Joist Ties: Flat straps, with holes for fasteners, for tying joists together over supports.

J. Rafter Tie-Downs (Hurricane or Seismic Ties): Bent strap tie for fastening rafters or roof trusses to wall studs below, 2-1/4 inches wide by 0.062 inch thick. Tie fits over top of rafter or truss and fastens to both sides of rafter or truss, face of top plates, and side of stud below unless noted otherwise.

PART 3 EXECUTION

3.01 INSTALLATION, GENERAL

A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking, and similar supports to comply with requirements for attaching other construction. All wood columns and posts shall be framed to have full end bearing. [If unseasoned, beams, stringers, posts, or timbers are used, Contractor shall retighten all bolts and shim all gaps between members one year after initial installation. Frame members for passage of pipes and ducts to avoid cutting structural members. Do not cut, notch, or bore framing members for passage of pipes or conduits without prior written acceptance of Architect.

B. Fit members together accurately without trimming cutting or other unauthorized modification. Members shall be accurately assembled to lines and elevations indicated on approved shop drawings and Contract Documents. The various members forming parts of a complete frame or structure, after being assembled, shall be aligned and adjusted accurately before being fastened. Clean bearing surfaces which will be in permanent contact before members are assembled. No drifting or cutting to enlarge unfair holes

will be allowed. Provide temporary supports, bracing and anchorage as required to hold members in place until permanently secured.

C. Framing Standard: Comply with AF&PA's "Details for Conventional Wood Frame Construction," unless otherwise indicated.

D. Framing with Engineered Wood Products: Install engineered wood products to comply with manufacturer's written instructions.

E. Metal Framing Anchors: Install metal framing to comply with manufacturer's written instructions.

F. Do not splice structural members between supports.

G. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.

1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches o.c.

H. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

I. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

1. Use inorganic boron for items that are continuously protected from liquid water.
2. Use copper naphthenate for items not continuously protected from liquid water.

J. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated.

K. Fasteners

1. Use common wire nails, unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood; do not countersink nail heads, unless otherwise indicated. Where splitting is likely to occur, prebore nail holes 1/2 size of nail diameter and use threaded, hardened steel nails. Nail heads shall be installed flush with sheathing. Do not overdrive. Provide 3/8” minimum edge distance to all sheathing edges.
2. Wood Screws: Prebore holes before installing. Hole diameter and installation shall satisfy the NDS. It is acceptable lubricate screw with soap before installing.
3. Bolts (Including Anchor Bolts and Hold-down Bolts): Bolt holes shall be 1/32” minimum and 1/16” maximum larger than the bolt diameter. Carefully center bolt hole between side plates and main members. Provide steel washers between

wood and bolt heads and/or nuts. Countersink heads flush only where indicated. Bolted connections shall be snugly tightened, but not to the extent of crushing wood under washers. Damage threads to prevent nuts from loosening.

4. Lag Screws: Provide steel washer between wood and screw head. Provide lead holes for the screw portion as follows:
   a.

Lag Screw Nominal Diameter	Lead Hole Diameter
1/2 in. dia.	5/16 in. dia.
3/4 in. dia.	1/2 in. dia.
1 in. dia	3/4 in. dia.

   b. Clearance hole for the shank shall have a diameter equal to the unthreaded portion of the screw shank and shall have the same depth of penetration as the length of the unthreaded shank. It is acceptable to lubricate screw with soap before installing.

L. For exposed work, arrange fasteners in straight rows parallel with edges of members, with fasteners evenly spaced, and with adjacent rows staggered.
   1. Comply with approved fastener patterns where applicable. Before fastening, mark fastener locations, using a template made of sheet metal, plastic, or cardboard.

3.02 CEILING JOIST AND RAFTER FRAMING INSTALLATION

A. Ceiling Joists: Install ceiling joists with crown edge up and complying with requirements specified above for floor joists. Face nail to ends of parallel rafters.
   1. Where ceiling joists are at right angles to rafters, provide additional short joists parallel to rafters from wall plate to first joist; nail to ends of rafters and to top plate and nail to first joist or anchor with framing anchors or metal straps. Provide 1-by-8-inch nominal- size or 2-by-4-inch nominal- size stringers spaced 48 inches o.c. crosswise over main ceiling joists.

B. Rafters: Notch to fit exterior wall plates and use metal framing anchors. Double rafters to form headers and trimmers at openings in roof framing, if any, and support with metal hangers. Where rafters abut at ridge, place directly opposite each other and nail to ridge member or use metal ridge hangers.
   1. At valleys, provide double-valley rafters of size indicated or, if not indicated, of same thickness as regular rafters and 2 inches deeper. Bevel ends of jack rafters for full bearing against valley rafters.
   2. At hips, provide hip rafter of size indicated or, if not indicated, of same thickness as regular rafters and 2 inches deeper. Bevel ends of jack rafters for full bearing against hip rafter.

C. Provide collar beams (ties) as indicated or, if not indicated, provide 1-by-6-inch nominal-size boards between every third pair of rafters, but not more than 48 inches o.c. Locate

below ridge member, at third point of rafter span. Cut ends to fit roof slope and nail to rafters.

D. Provide special framing as indicated for eaves, overhangs, dormers, and similar conditions, if any.

3.03 TIMBER FRAMING INSTALLATION

A. Install timber with crown edge up and provide not less than 4 inches of bearing on supports. Provide continuous members, unless otherwise indicated; tie together over supports as indicated if not continuous.

B. Where beams or girders are framed into pockets of exterior concrete or masonry walls, provide 1/2-inch air space at sides and ends of wood members.

C. Install wood posts using metal anchors indicated.

D. Treat ends of timber beams and posts exposed to weather by dipping in water-repellent preservative for 15 minutes.

3.04 WOOD INSTALLATION TOLERANCES

A. Roof Framing:

1. Location in plan +/- 1/4” for joists and metal plate connected wood trusses not at a building edge, +/- 1/8” for joists, metal plate connected wood trusses, rimboard, blocking, etc. at building edges.
2. Levelness: +/- 1/4” in 10’ and no more than 1/8” between adjacent floor members

B. Exposed Columns:

1. Plan location: +/- 1/8”
2. Plumbness: +/- 1/4” in 10, ½” total over height of column
3. Elevation: =/- 1/4" of specified elevation

3.05 FIELD QUALITY CONTROL

A. The completed work shall be inspected by the Owner’s inspection/testing agency prior to covering the work. The following inspections are required:

1. Prior to the start of the work, review the Contractor’s quality control procedures. Review the scope and frequency of inspections.
2. Review Fabricator’s quality control procedures for all fabricated lumber, connectors, and weldments prior to fabrication for the project. This includes all products in the section as well as Wood Decking and Press-Plate Wod Trusses.]
3. Inspect all lumber for conformance of the Contract Documents. Check moisture content of all pressure preservative treated lumbar and all members 5x and larger and of 10% of other members.]
4. Inspect all members for size, placement, and connection details. Inspect blocking, bridging, and bracing. Verify proper connection hardware, proper size, length,

and finish of connector fasteners and their installation. Inspect for specified bearing. Inspect from Contract Documents and approved submittals.

5. Inspect and test all welds in fabricate steel pieces. Inspect 100% visual and 10% magnetic particle. Full penetration welds shall be ultrasonically inspected.
6. Diaphragms
    a. Inspect thickness and grade of wood structural panels, blocking, and all other metal connectors, minimum size of panels, and the edge and field nailing of the wood structural panel to the framing for conformance to the approved submittals and Construction Documents.
7. Metal Plate Connected Wood Trusses:
    a. Inspect size and location of metal plates, bolts, or other connection devices, conformance to approved submittals and the Construction Documents. Verify that nails, bolts, hold-down anchors and all other metal connectors or other devices are tight and otherwise properly installed. Verify that permanent web bracing, including x-bracing, has been installed.
8. Fabricated Lumber:
    a. Inspect grade, nailing, end bearing, end attachment, size, spacing, bridging, and stamp listing code approval for conformance to approved submittals and the Construction Documents
9. Anchor Bolts:
    a. Verify that anchor bolts have been placed, have proper plate washers, are correctly tightened, and are located within tolerance.

END OF SECTION 061000

SECTION 061326
HEAVY TIMBER TRUSS CONSTRUCTION

GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:

1. Trusses using timbers**.**

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for dimension lumber items associated with heavy timber framing.

1.03 DEFINITIONS

A. Timbers: Lumber of 5 inches nominal or greater in least dimension.

B. Inspection agencies, and the abbreviations used to reference them, include the following:

1. NeLMA: Northeastern Lumber Manufacturers' Association.
2. NHLA: National Hardwood Lumber Association.
3. NLGA: National Lumber Grades Authority.
4. SPIB: Southern Pine Inspection Bureau (The).
5. WCLIB: West Coast Lumber Inspection Bureau.
6. WWPA: Western Wood Products Association.

1.04 ACTION SUBMITTALS

A. Product Data: For preservative-treated wood products and timber connectors.

1. For preservative-treated wood products. Include chemical treatment manufacturer's written instructions for handling, storing, installing, and finishing treated material.
2. For timber connectors. Include installation instructions.

B. Shop Drawings: For heavy timber trusses. Show layout, dimensions of each member, and details of connections.

C. Delegated-Design Submittal: For heavy timber trusses, including connections, indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.05 INFORMATIONAL SUBMITTALS

A. Material Certificates:

1. For timbers specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by ALSC's Board of Review.
2. For preservative-treated wood products. Indicate type of preservative used and net amount of preservative retained. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

B. Certificates of Inspection: Issued by lumber-grading agency for exposed timber not marked with grade stamp.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Schedule delivery of materials to avoid extended on-site storage and to avoid delaying the Work.

B. Store materials under cover and protected from weather and contact with damp or wet surfaces. Provide for air circulation within and around stacks and under temporary coverings.

PART 2 PRODUCTS

2.01 TIMBER

A. Comply with DOC PS 20 and with grading rules of lumber-grading agencies certified by ALSC's Board of Review as applicable.

1. Factory mark each item of timber with grade stamp of grading agency.
2. For exposed timber indicated to receive a stained or natural finish, apply grade stamps to surfaces that are not exposed to view, or omit grade stamps and provide certificates of grade compliance issued by grading agency.

B. Timber Species and Grade: As indicated on drawings.

C. Moisture Content: Provide timber with 19 percent maximum moisture content at time of dressing.

D. Dressing: Provide dressed timber (S4S) unless otherwise indicated.

2.02 PRESERVATIVE TREATMENT

A. Pressure treat materials with waterborne preservative according to AWPA U1; Use Category UC2 for interior construction not in contact with the ground, Use Category UC3b for exterior construction not in contact with the ground.

B. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.

1. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not contain colorants, bleed through, or otherwise adversely affect finishes.

C. Use process that includes water-repellent treatment.

D. Use process that does not include water repellents or other substances that might interfere with application of indicated finishes.
E. Retain first paragraph below if kiln-dried wood is required.
F. After treatment, redry materials to 19 percent maximum moisture content.
G. Mark treated materials with treatment quality mark of an inspection agency approved by ALSC's Board of Review.
    1. For exposed items indicated to receive a stained or natural finish, mark each piece on surface that is not exposed or omit marking and provide certificates of treatment compliance issued by inspection agency.
H. Application: Treat all heavy timber framing unless otherwise indicated.

2.03 TIMBER CONNECTORS

A. Materials: Unless otherwise indicated, fabricate from the following materials:
    1. Structural-steel shapes, plates, and flat bars complying with ASTM A36/A36M.
    2. Round steel bars complying with ASTM A575, Grade M 1020.
    3. Hot-rolled steel sheet complying with ASTM A1011/A1011M, Structural Steel, Type SS, Grade 33.
B. Hot-dip galvanize steel assemblies and fasteners after fabrication to comply with ASTM A123/A123M or ASTM A153/A153M.

2.04 MISCELLANEOUS MATERIALS

A. End Sealer: Manufacturer's standard, transparent, colorless wood sealer that is effective in retarding the transmission of moisture at cross-grain cuts and is compatible with indicated finish.
B. Penetrating Sealer: Manufacturer's standard, transparent, penetrating wood sealer that is compatible with indicated finish.

2.05 FABRICATION

A. Shop fabricate members by cutting and restoring exposed surfaces to match specified surfacing. Finish exposed surfaces to remove planing or surfacing marks, and to provide a finish equivalent to that produced by machine sanding with No. 120 grit sandpaper.
B. Predrill for fasteners and assembly of units.
C. Where preservative-treated members are indicated, fabricate (cut, drill, surface, and sand) before treatment to greatest extent possible. Where fabrication must be done after treatment, apply a field-treatment preservative to comply with AWPA M4.
    1. Use inorganic boron (SBX) treatment for members not in contact with the ground and continuously protected from liquid water.
    2. Use copper naphthenate treatment for members in contact with the ground or not continuously protected from liquid water.
D. Coat crosscuts with end sealer.

E. Seal Coat: After fabricating and surfacing each unit, apply a saturation coat of penetrating sealer on surfaces of each unit except for treated wood where the treatment included a water repellent.

PART 3 EXECUTION

3.01 INSTALLATION

A. General: Erect heavy timber trusses true and plumb. Provide temporary bracing to maintain lines and levels until permanent supporting members are in place.
   1. Handle and temporarily support heavy timber framing to prevent surface damage, compression, and other effects that might interfere with indicated finish.

B. Framing Built into Masonry: Provide 1/2-inch clearance at tops, sides, and ends of members built into masonry, and bevel cut ends 3 inches; do not embed more than 4 inches unless otherwise indicated.

C. Cutting: Avoid extra cutting after fabrication. Where field fitting is unavoidable, comply with requirements for shop fabrication.

D. Fitting: Fit members by cutting and restoring exposed surfaces to match specified surfacing.
   1. Predrill for fasteners using timber connectors as templates.
   2. Finish exposed surfaces to remove planing or surfacing marks, and to provide a finish equivalent to that produced by machine sanding with No. 120 grit sandpaper.
   3. Coat crosscuts with end sealer.
   4. Where preservative-treated members must be cut during erection, apply a field-treatment preservative to comply with AWPA M4.
      a. Use inorganic boron (SBX) treatment for members not in contact with the ground and continuously protected from liquid water.
      b. Use copper naphthenate treatment for members in contact with the ground or not continuously protected from liquid water.

E. Install timber connectors as indicated.
   1. Unless otherwise indicated, install bolts with same orientation within each connection and in similar connections.
   2. Install bolts with orientation as indicated or, if not indicated, as directed by Architect.

3.02 ADJUSTING

A. Repair damaged surfaces and finishes after completing erection. Replace damaged heavy timber framing if repairs are not approved by Architect.

END OF SECTION 061300

SECTION 061600
SHEATHING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following:
   1. Roof sheathing.

B. Related Sections include the following:
   1. Division 06 Section "Rough Carpentry"

1.03 SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
   1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Indicate type of preservative used and net amount of preservative retained.
   2. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
   3. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

B. Research/Evaluation Reports: For the following, showing compliance with building code in effect for Project:
   1. Preservative-treated plywood.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Stack plywood and other panels flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

PART 2 PRODUCTS

2.01 WOOD PANEL PRODUCTS, GENERAL

A. Plywood: Conform to product standard PS-1-latest edition and APA Plywood Design specifications PDS latest edition. Provide exposure 1 except where surface or edge of plywood will be exposed to weather, then use exterior grade.

B. Oriented Strand Board: Conform to product standard PS2 and APA design specification PRP108. Provide Exposure 1 rated panels. Do not use oriented strand board where surface or edge of panel will be exposed to weather.

C. Thickness: As needed to comply with requirements specified, but not less than thickness indicated.

D. Factory mark panels to indicate compliance with applicable standard.

2.02 PRESERVATIVE-TREATED PLYWOOD

A. Preservative Treatment by Pressure Process: AWPA C9.

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.

B. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.

C. Application: Treat items indicated on Drawing and plywood in contact with masonry or concrete.

D. ROOF SHEATHING

E. Plywood Roof Sheathing: Exposure 1 sheathing. Use exterior grade where exposed to weather.

1. Span Rating: Not less than 40/20
2. Nominal Thickness: Not less than 19/32 inch.

F. Oriented-Strand-Board Roof Sheathing: Exposure 1 sheathing. Do not use where exposed to weather.

1. Span Rating: Not less than 40/20.
2. Nominal Thickness: Not less than 19/32 inch.

2.03 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.

1. For roof sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.

B. See Division 6 Section “Rough Carpentry” for additional fastener requirements.

PART 3 EXECUTION

3.01 INSTALLATION, GENERAL

A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction, unless otherwise indicated.

C. Securely attach to substrate by fastening as indicated, complying with the following:

1. NES NER-272 for power-driven fasteners.
2. Table 2304.9.1, "Fastening Schedule," in ICC's "International Building Code."

D. Use common wire nails, unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections. Install fasteners without splitting wood.

E. Coordinate roof sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

F. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

G. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.02 WOOD STRUCTURAL PANEL INSTALLATION

A. General: Comply with applicable recommendations in APA Form No. E30S, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.

B. Fastening Methods: Fasten panels as indicated below:

1. Roof Sheathing:
    a. Refer to drawings for fastener size and spacing requirements.
    b. Nail to wood framing.
    c. Space panels 1/8 inch apart at edges and ends.

3.03 FIELD QUALITY CONTROL

A. Refer to Division 06 Section “Rough Carpentry” for inspection requirements of Structural Sheathing.

END OF SECTION 061600

SECTION 061753
SHOP-FABRICATED WOOD TRUSSES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:
   1. Wood roof trusses.

B. Related Requirements:
   1. Section 061326 – Heavy Timber Trusses

1.03 DEFINITIONS

A. Metal-Plate-Connected Wood Trusses: Planar structural units consisting of metal-plate-connected members fabricated from dimension lumber and cut and assembled before delivery to Project site.

1.04 ACTION SUBMITTALS

A. Product Data: For metal-plate connectors, metal truss accessories, and fasteners.
   1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification from treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
   2. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to truss fabricator.

B. Shop Drawings: Show fabrication and installation details for trusses.
   1. Show location, pitch, span, camber, configuration, and spacing for each type of truss required.
   2. Indicate sizes, stress grades, and species of lumber.
   3. Indicate locations, sizes, and materials for permanent bracing required to prevent buckling of individual truss members due to design loads.
   4. Indicate type, size, material, finish, design values, orientation, and location of metal connector plates.
   5. Show splice details and bearing details.

C. Delegated-Design Submittal: For metal-plate-connected wood trusses indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data: For metal connector-plate manufacturer and fabricator.

B. Material Certificates: For dimension lumber specified to comply with minimum specific gravity. Indicate species and grade selected for each use and specific gravity.

C. Product Certificates: For metal-plate-connected wood trusses, signed by officer of truss-fabricating firm.

D. Evaluation Reports: For the following, from ICC-ES:

1. Wood-preservative-treated lumber.
2. Metal-plate connectors.
3. Metal truss accessories.

1.06 QUALITY ASSURANCE

A. Metal Connector-Plate Manufacturer Qualifications: A manufacturer that is a member of TPI and that complies with quality-control procedures in TPI 1 for manufacture of connector plates.

1. Manufacturer's responsibilities include providing professional engineering services needed to assume engineering responsibility.
2. Engineering Responsibility: Preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.

B. Fabricator Qualifications: Shop that participates in a recognized quality-assurance program, complies with quality-control procedures in TPI 1, and involves third-party inspection by an independent testing and inspecting agency acceptable to Architect and authorities having jurisdiction.

C. 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.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Handle and store trusses to comply with recommendations in SBCA BCSI, "Building Component Safety Information: Guide to Good Practice for Handling, Installing, Restraining, & Bracing Metal Plate Connected Wood Trusses."

1. Store trusses flat, off of ground, and adequately supported to prevent lateral bending.
2. Protect trusses from weather by covering with waterproof sheeting, securely anchored.
3. Provide for air circulation around stacks and under coverings.

B. Inspect trusses showing discoloration, corrosion, or other evidence of deterioration. Discard and replace trusses that are damaged or defective.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design metal-plate-connected wood trusses.

B. Structural Performance: Metal-plate-connected wood trusses shall be capable of withstanding design loads within limits and under conditions indicated. Comply with requirements in TPI 1 unless more stringent requirements are specified below.

1. Design Loads: As indicated.
2. Maximum Deflection under Design Loads: As indicated in the drawings.

C. Comply with applicable requirements and recommendations of TPI 1, TPI DSB, and SBCA BCSI.

D. Wood Structural Design Standard: Comply with applicable requirements in AF&PA's "National Design Specifications for Wood Construction" and its "Supplement."

2.02 DIMENSION LUMBER

A. Lumber: DOC PS 20 and applicable rules of any rules-writing agency certified by the American Lumber Standard Committee (ALSC) Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. For exposed lumber indicated to receive a stained or natural finish, omit grade stamp and provide certificates of grade compliance issued by grading agency.
3. Provide dressed lumber, S4S.
4. Provide dry lumber with **19** percent maximum moisture content at time of dressing.

B. Minimum Chord Size for Roof Trusses: 2 by 4 inches nominal for both top and bottom chords.

C. Minimum Specific Gravity for Top Chords: 0.50.

D. Permanent Bracing: Provide wood bracing that complies with requirements for miscellaneous lumber in Section 061000 "Rough Carpentry."

2.03 WOOD-PRESERVATIVE-TREATED LUMBER

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with the ground, Use Category UC3b for exterior construction not in contact with the ground.

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
2. For exposed trusses indicated to receive a stained or natural finish, use chemical formulations that do not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

D. Application: Treat all trusses unless otherwise indicated.

2.04 METAL CONNECTOR PLATES

A. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to the following:

1. Alpine Engineered Products, Inc.; a division of ITW Building Components Group, Inc.
2. Cherokee Metal Products, Inc.; Masengill Machinery Company; Masengill Machinery Company.
3. CompuTrus, Inc;
4. Eagle Metal Products;
5. Jager Building Systems, Inc.;
6. MiTek Industries, Inc.;
7. Robbins Engineering, Inc;
8. Truswal Systems Corporation;

B. Fabricate connector plates to comply with TPI 1.

C. Hot-Dip Galvanized-Steel Sheet: ASTM A653/A653M; Structural Steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G60 coating designation; and not less than 0.036 inch thick.

1. Use for interior locations unless otherwise indicated.

D. Hot-Dip Heavy-Galvanized-Steel Sheet: ASTM A653/A653M; Structural Steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G185 coating designation; and not less than 0.036 inch thick.

1. Use for wood-preservative-treated lumber and where indicated.

2.05 FASTENERS

A. Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

1. Provide fasteners for use with metal framing anchors that comply with written recommendations of metal framing manufacturer.
2. Where trusses are exposed to weather, in ground contact, made from pressure-preservative treated wood, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M.

B. Nails, Brads, and Staples: ASTM F1667.

2.06 METAL FRAMING ANCHORS AND ACCESSORIES

A. Allowable design loads, as published by manufacturer, shall comply with or exceed those **of** products of manufacturers listed. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency. Framing anchors shall be punched for fasteners adequate to withstand same loads as framing anchors.

B. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A653/A653M, G60 coating designation.
   1. Use for interior locations unless otherwise indicated.

C. Hot-Dip Heavy-Galvanized-Steel Sheet: ASTM A653/A653M; Structural Steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G185 coating designation; and not less than 0.036 inch thick.
   1. Use for wood-preservative-treated lumber and where indicated.

D. Truss Tie-Downs: Bent strap tie for fastening roof trusses to wall studs below, 1-1/2 inches wide by 0.050 inch thick.

E. Roof Truss Bracing/Spacers: U-shaped channels, 1-1/2 inches wide by 1 inch deep by 0.040 inch thick, made to fit between two adjacent trusses and accurately space them apart, and with tabs having metal teeth for fastening to trusses.

2.07 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: SSPC-Paint 20, with dry film containing a minimum of 92 percent zinc dust by weight.

2.08 FABRICATION

A. Cut truss members to accurate lengths, angles, and sizes to produce close-fitting joints.

B. Fabricate metal connector plates to sizes, configurations, thicknesses, and anchorage details required to withstand design loads for types of joint designs indicated.

C. Assemble truss members in design configuration indicated; use jigs or other means to ensure uniformity and accuracy of assembly, with joints closely fitted to comply with tolerances in TPI 1. Position members to produce design camber indicated.
   1. Fabricate wood trusses within manufacturing tolerances in TPI 1.

D. Connect truss members by metal connector plates located and securely embedded simultaneously in both sides of wood members by air or hydraulic press.

2.09 SOURCE QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform special inspections.
   1. Provide special inspector with access to fabricator's documentation of detailed fabrication and quality-control procedures that provide a basis for inspection control of the workmanship and the fabricator's ability to conform to approved construction documents and referenced standards.

2. Provide special inspector with access to places where wood trusses are being fabricated to perform inspections.

B. Correct deficiencies in Work that special inspections indicate do not comply with the Contract Documents.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install wood trusses only after supporting construction is in place and is braced and secured.

B. If trusses are delivered to Project site in more than one piece, assemble trusses before installing.

C. Hoist trusses in place by lifting equipment suited to sizes and types of trusses required, exercising care not to damage truss members or joints by out-of-plane bending or other causes.

D. Install and brace trusses according to TPI recommendations and as indicated.

E. Install trusses plumb, square, and true to line and securely fasten to supporting construction.

F. Space trusses as indicated; adjust and align trusses in location before permanently fastening.

G. Anchor trusses securely at bearing points; use metal truss tie-downs or floor truss hangers as applicable. Install fasteners through each fastener hole in metal framing anchors according to manufacturer's fastening schedules and written instructions.

H. Securely connect each truss ply required for forming built-up girder trusses.

1. Anchor trusses to girder trusses as indicated.

I. Install and fasten permanent bracing during truss erection and before construction loads are applied. Anchor ends of permanent bracing where terminating at walls or beams.

1. Install bracing to comply with Section 061000 "Rough Carpentry."

J. Install wood trusses within installation tolerances in TPI 1.

K. Do not alter trusses in field. Do not cut, drill, notch, or remove truss members.

L. Replace wood trusses that are damaged or do not comply with requirements.

1. Damaged trusses may be repaired according to truss repair details signed and sealed by the qualified professional engineer responsible for truss design, when approved by Architect.

3.02 REPAIRS AND 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. Retain first paragraph below instead of paragraph above if boron-treated wood is not used, but borate treatment of wood that has become wet is used to help prevent mold and mildew. Delete if site-applied boron treatment is specified in Section 313116 "Termite Control."

C. Protect wood trusses from weather. If, despite protection, wood trusses become wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

D. Repair damaged galvanized coatings on exposed surfaces according to ASTM A780/A780M and manufacturer's written instructions.

3.03 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform special inspections to verify that temporary installation restraint/bracing and the permanent individual truss member restraint/bracing are installed in accordance with the approved truss submittal package.

END OF SECTION 061753

SECTION 06 2000
FINISH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Finish carpentry items.

1.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.
B. Section 06 1000 - Rough Carpentry: Support framing, grounds, and concealed blocking.
C. Section 09 9123 - Interior Painting: Painting of finish carpentry items.
D. Section 09 9300 - Staining and Transparent Finishing: Staining and transparent finishing of finish carpentry items.

1.03 REFERENCE STANDARDS

A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards 2014, with Errata (2018).
B. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards 2021, with Errata.
C. NEMA LD 3 - High-Pressure Decorative Laminates 2005.
D. PS 1 - Structural Plywood 2009 (Revised 2019).

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with plumbing rough-in, electrical rough-in, installation of associated and adjacent components, and [_____].
B. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.
B. Product Data:
   1. Provide data on fire retardant treatment materials and application instructions.
C. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
   1. Scale of Drawings: 1-1/2 inch to 1 foot, minimum.
   2. Provide the information required by AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS).

1.06 QUALITY ASSURANCE

A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store finish carpentry items under cover, elevated above grade, and in a dry, well-ventilated area not exposed to heat or sunlight.

B. Protect from moisture damage.
C. Handle materials and products to prevent damage to edges, ends, or surfaces.

PART 2 PRODUCTS

2.01 FINISH CARPENTRY ITEMS

A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.

2.02 WOOD-BASED COMPONENTS

A. Provide sustainably harvested wood, certified or labeled as specified in Section 01 6000 - Product Requirements.

2.03 SHEET MATERIALS

A. Softwood Plywood, Not Exposed to View: Any face species, medium density fiberboard core; PS 1 Grade B-B, glue type as recommended for application.

2.04 PLASTIC LAMINATE MATERIALS

A. Plastic Laminate: NEMA LD 3; color as selected by Architect; textured, low gloss finish.
   1. Products:
   2. Basis of Design Product: (PL-1, PL-2) Wilsonart; www.wilsonart.com
      a. Substitutions: See Section 01 6000 - Product Requirements.
B. Laminate Adhesive: Type recommended by laminate manufacturer to suit application; not containing formaldehyde or other volatile organic compounds.

2.05 FASTENINGS

A. Adhesive for Purposes Other Than Laminate Installation: Suitable for the purpose; not containing formaldehyde or other volatile organic compounds.
B. Concealed Joint Fasteners: Threaded steel.

2.06 ACCESSORIES

A. Adhesive: Type recommended by fabricator to suit application.
B. Lumber for Shimming and Blocking: Softwood lumber of Southern Pine species.
C. Plastic Edge Trim: Extruded flat shaped; smooth finish; self locking serrated tongue; of width to match component thickness; [_____] color.
D. Wood Filler: Solvent base, tinted to match surface finish color.

2.07 FABRICATION

A. Shop assemble work for delivery to site, permitting passage through building openings.
B. Cap exposed plastic laminate finish edges with plastic trim.
C. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.
D. Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arises. Locate counter butt joints minimum 2 feet from sink cut-outs.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify adequacy of backing and support framing.

B. Verify mechanical, electrical, and building items affecting work of this section are placed and ready to receive this work.

3.02 INSTALLATION

A. Install custom fabrications in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade indicated.

B. Set and secure materials and components in place, plumb and level.

C. Carefully scribe work abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim to conceal larger gaps.

3.03 TOLERANCES

A. Maximum Variation from True Position: 1/16 inch.

B. Maximum Offset from True Alignment with Abutting Materials: 1/32 inch.

END OF SECTION 06 2000

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SECTION 07 2100
THERMAL INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Batt insulation and vapor retarder in exterior wall, ceiling, and roof construction.
B. Batt insulation for filling perimeter window and door shim spaces and crevices in exterior wall and roof.

1.02 REFERENCE STANDARDS

A. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing 2017.
B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2018b.
C. ASTM E136 - Standard Test Method for Behavior of Materials in a Vertical Tube Furnace At 750 Degrees C 2016a.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.

1.04 FIELD CONDITIONS

A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

PART 2 PRODUCTS

2.01 APPLICATIONS

A. Insulation in Metal Framed Walls: Batt insulation with integral vapor retarder.
B. Insulation Above Lay-In Acoustical Ceilings: Batt insulation with no vapor retarder.

2.02 BATT INSULATION MATERIALS

A. Where batt insulation is indicated, either glass fiber or mineral fiber batt insulation may be used, at Contractor's option.
B. Glass Fiber Batt Insulation: Flexible preformed batt or blanket, complying with ASTM C665; friction fit.
    1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.
    2. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.
    3. Combustibility: Non-combustible, when tested in accordance with ASTM E136.
    4. Thermal Resistance: See drawings for R-value, min R-13.
    5. Facing: Aluminum foil, flame spread 25 rated; one side.
    6. Manufacturers:
        a. CertainTeed Corporation: www.certainteed.com.
        b. Johns Manville: www.jm.com.

c. Owens Corning Corporation: www.ocbuildingspec.com.
d. Substitutions: See Section 01 6000 - Product Requirements.

C. Mineral Fiber Batt Insulation: Flexible or semi-rigid preformed batt or blanket, complying with ASTM C665; friction fit; unfaced flame spread index of 0 (zero) when tested in accordance with ASTM E84.
1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.
2. Smoke Developed Index: 0 (zero), when tested in accordance with ASTM E84.
3. Thermal Resistance: See drawings for R-value.
4. Manufacturers:
a. Johns Manville: www.jm.com.
b. Knauf Insulation: www.knaufinsulation.com.
c. ROCKWOOL (ROXUL, Inc): www.rockwool.com.
d. Thermafiber, Inc: www.thermafiber.com.
e. Substitutions: See Section 01 6000 - Product Requirements.

2.03 ACCESSORIES

A. Adhesive: Type recommended by insulation manufacturer for application.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation.
B. Verify substrate surfaces are flat, free of honeycomb, fins, irregularities, or materials or substances that may impede adhesive bond.

3.02 BATT INSTALLATION

A. Install insulation in accordance with manufacturer's instructions.
B. Install in exterior wall spaces without gaps or voids. Do not compress insulation.
C. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.
D. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation.

3.03 PROTECTION

A. Do not permit installed insulation to be damaged prior to its concealment.

END OF SECTION 07 2100

SECTION 07 4113
METAL ROOF PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Architectural roofing system of preformed aluminum panels.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Roof sheathing.

1.03 REFERENCE STANDARDS

A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2017a.

B. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2014.

C. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric) 2014.

D. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection 2019.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Storage and handling requirements and recommendations.
   2. Installation methods.

C. Shop Drawings: Include layouts of roof panels, details of edge and penetration conditions, spacing and type of connections, flashings, underlayments, and special conditions.
   1. Show work to be field-fabricated or field-assembled.

D. Verification Samples: For each roofing system specified, submit samples of minimum size 12 inches square, representing actual roofing metal, thickness, profile, color, and texture.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store roofing panels on project site as recommended by manufacturer to minimize damage to panels prior to installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

2.02 ARCHITECTURAL METAL ROOF PANELS

A. Architectural Metal Roofing: Provide complete engineered system complying with specified requirements and capable of remaining weathertight while withstanding anticipated movement of substrate and thermally induced movement of roofing system.

B. Metal Panels: Factory-formed panels with factory-applied finish.

1. Aluminum Panels:
    a. Alloy and Temper: Aluminum complying with ASTM B209 (ASTM B209M); temper as required for forming.
    b. Thickness: Minimum 20 gage (0.032 inch).
2. Profile: Standing seam, with minimum 1.0 inch seam height; concealed fastener system for field seaming with special tool.
3. Texture: Smooth.
4. Length: As indicated on drawings.
5. Width: Maximum panel coverage of 24 inches.

2.03 ATTACHMENT SYSTEM

A. Concealed System: Provide manufacturer's standard stainless steel or nylon-coated aluminum concealed anchor clips designed for specific roofing system and engineered to meet performance requirements, including anticipated thermal movement.

2.04 FABRICATION

A. Panels: Provide factory or field fabricated panels with applied finish and accessory items, using manufacturer's standard processes as required to achieve specified appearance and performance requirements.

2.05 FINISHES

A. Fluoropolymer Coil Coating System: Manufacturer's standard multi-coat aluminum coil coating system complying with AAMA 2605, including at least 70 percent polyvinylidene fluoride (PVDF) resin, and at least 80 percent of coil coated aluminum surfaces having minimum total dry film thickness (DFT) of 0.9 mil, 0.0009 inch; color and gloss as selected from manufacturer’s standards.

2.06 ACCESSORIES

A. Miscellaneous Sheet Metal Items: Provide flashings, gutters, downspouts, trim, moldings, closure strips, preformed crickets, caps, and equipment curbs of the same material, thickness, and finish as used for the roofing panels. Items completely concealed after installation may optionally be made of stainless steel.

B. Rib and Ridge Closures: Provide prefabricated, close-fitting components of steel with corrosion resistant finish or combination steel and closed-cell foam.

C. Sealants:
   1. Exposed Sealant: Elastomeric; silicone, polyurethane, or silyl-terminated polyether/polyurethane.
   2. Concealed Sealant: Non-curing butyl sealant or tape sealant.

D. Underlayment: Synthetic non-asphaltic sheet, intended by manufacturer for mechanically fastened roofing underlayment without sealed seams.
   1. Self Sealability: Passing nail sealability test specified in ASTM D1970/D1970M.
   2. Low Temperature Flexibility: Passing test specified in ASTM D1970/D1970M.
   3. Fasteners: As specified by manufacturer and building code qualification report or approval.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation of preformed metal roof panels until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Broom clean wood sheathing prior to installation of roofing system.

B. Coordinate roofing work with provisions for roof drainage, flashing, trim, penetrations, and other adjoining work to assure that the completed roof will be free of leaks.

C. Separate dissimilar metals by applying a bituminous coating, self-adhering rubberized asphalt sheet, or other permanent method approved by roof panel manufacturer.

D. Where metal will be in contact with wood or other absorbent material subject to wetting, seal joints with sealing compound and apply one coat of heavy-bodied bituminous paint.

3.03 INSTALLATION

A. Overall: Install roofing system in accordance with approved shop drawings and panel manufacturer's instructions and recommendations, as applicable to specific project conditions. Anchor all components of roofing system securely in place while allowing for thermal and structural movement.
   1. Install roofing system with concealed clips and fasteners, except as otherwise recommended by manufacturer for specific circumstances.
   2. Minimize field cutting of panels. Where field cutting is absolutely required, use methods that will not distort panel profiles. Use of torches for field cutting is absolutely prohibited.

B. Accessories: Install all components required for a complete roofing assembly, including flashings, gutters, downspouts, trim, moldings, closure strips, preformed crickets, caps, equipment curbs, rib closures, ridge closures, and similar roof accessory items.

C. Install roofing felt and building paper slip sheet on roof deck before installing preformed metal roof panels. Secure by methods acceptable to roof panel manufacturer, minimizing use of metal fasteners. Apply from eaves to ridge in shingle fashion, overlapping horizontal joints a minimum of 2 inches and side and end laps a minimum of 3 inches. Offset seams in building paper and seams in roofing felt.

D. Roof Panels: Install panels in strict accordance with manufacturer's instructions, minimizing transverse joints except at junction with penetrations.

1. Provide sealant tape or other approved joint sealer at lapped panel joints.
2. Install sealant or sealant tape, as recommended by panel manufacturer, at end laps and side joints.

3.04 CLEANING

A. Clean exposed sheet metal work at completion of installation. Remove grease and oil films, excess joint sealer, handling marks, and debris from installation, leaving the work clean and unmarked, free from dents, creases, waves, scratch marks, or other damage to the finish.

3.05 PROTECTION

A. Do not permit storage of materials or roof traffic on installed roof panels. Provide temporary walkways or planks as necessary to avoid damage to completed work. Protect roofing until completion of project.

B. Touch-up, repair, or replace damaged roof panels or accessories before Date of Substantial Completion.

END OF SECTION 07 4113

SECTION 07 6200
SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fabricated sheet metal items, including flashings, counterflashings, gutters, and downspouts.
B. Sealants for joints within sheet metal fabrications.

1.02 REFERENCE STANDARDS

A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum 2014 (2015 Errata).
B. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2017a.
C. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2015.
D. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2014.
E. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric) 2014.
F. ASTM C920 - Standard Specification for Elastomeric Joint Sealants 2018.
G. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free 2007 (Reapproved 2018).
H. SMACNA (ASMM) - Architectural Sheet Metal Manual 2012.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.

1.04 QUALITY ASSURANCE

A. Perform work in accordance with SMACNA (ASMM) requirements and standard details, except as otherwise indicated.
B. Fabricator and Installer Qualifications: Company specializing in sheet metal work with 5 years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

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

PART 2 PRODUCTS

2.01 SHEET MATERIALS

A. Aluminum: ASTM B209 (ASTM B209M); 20 gage, (0.032 inch) thick; anodized finish of color as selected.
   1. Clear Anodized Finish: AAMA 611 AA-M12C22A41 Class I clear anodic coating not less than 0.7 mils thick.

B. Pre-Finished Aluminum: ASTM B209 (ASTM B209M); 20 gage, (0.032 inch) thick; plain finish shop pre-coated with fluoropolymer coating.
   1. Fluoropolymer Coating: High Performance Organic Finish, AAMA 2604; multiple coat, thermally cured fluoropolymer finish system.
   2. Color: As selected by Architect from manufacturer's full colors.

C. Stainless Steel: ASTM A666, Type 304 alloy, soft temper, 28 gage, (0.0156 inch) thick; smooth No. 4 - Brushed finish.

2.02 FABRICATION

A. Form sections true to shape, accurate in size, square, and free from distortion or defects.

B. Form pieces in longest possible lengths.

C. Hem exposed edges on underside 1/2 inch; miter and seam corners.

D. Form material with flat lock seams, except where otherwise indicated; at moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.

E. Fabricate corners from one piece with minimum 18 inch long legs; seam for rigidity, seal with sealant.

F. Fabricate flashings to allow toe to extend 2 inches over roofing gravel. Return and brake edges.

2.03 ACCESSORIES

A. Fasteners: Stainless steel, with soft neoprene washers.

B. Primer: Zinc chromate type.

C. Concealed Sealants: Non-curing butyl sealant.

D. Exposed Sealants: ASTM C920; elastomeric sealant, with minimum movement capability as recommended by manufacturer for substrates to be sealed; color to match adjacent material.

E. Plastic Cement: ASTM D4586/D4586M, Type I.

PART 3 EXECUTION

3.01 PREPARATION

A. Install starter and edge strips, and cleats before starting installation.

B. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil.

3.02 INSTALLATION

A. Secure flashings in place using concealed fasteners.
B. Apply plastic cement compound between metal flashings and felt flashings.
C. Fit flashings tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.
D. Seal metal joints watertight.

END OF SECTION 07 6200

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SECTION 07 9200
JOINT SEALANTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nonsag gunnable joint sealants.
B. Self-leveling pourable joint sealants.
C. Joint backings and accessories.
D. Owner-provided field quality control.

1.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions: Additional requirements for sealants and primers.
B. Section 07 8400 - Firestopping: Firestopping sealants.
C. Section 09 2116 - Gypsum Board Assemblies: Sealing acoustical and sound-rated walls and ceilings.
D. Section 09 3000 - Tiling: Sealant between tile and plumbing fixtures and at junctions with other materials and changes in plane.

1.03 REFERENCE STANDARDS

A. ASTM C661 - Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer 2015.
B. ASTM C794 - Standard Test Method for Adhesion-In-Peel of Elastomeric Joint Sealants 2018.
C. ASTM C834 - Standard Specification for Latex Sealants 2017.
D. ASTM C920 - Standard Specification for Elastomeric Joint Sealants 2018.
E. ASTM C1087 - Standard Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems 2016.
F. ASTM C1193 - Standard Guide for Use of Joint Sealants 2016.
G. ASTM C1248 - Standard Test Method for Staining of Porous Substrate by Joint Sealants 2008 (Reapproved 2012).
H. ASTM C1330 - Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants 2018.
I. ASTM C1521 - Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints 2013.
J. SCAQMD 1168 - Adhesive and Sealant Applications 1989 (Amended 2017).

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data for Sealants: Submit manufacturer's technical data sheets for each product to be used, that includes the following.

1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.
2. List of backing materials approved for use with the specific product.
3. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
4. Substrates the product should not be used on.
5. Substrates for which use of primer is required.
6. Substrates for which laboratory adhesion and/or compatibility testing is required.

C. Color Cards for Selection: Where sealant color is not specified, submit manufacturer's color cards showing standard colors available for selection.

D. Preconstruction Laboratory Test Reports: Submit at least four weeks prior to start of installation.

E. Preinstallation Field Adhesion Test Plan: Submit at least two weeks prior to start of installation.

F. Field Quality Control Plan: Submit at least two weeks prior to start of installation.

G. Preinstallation Field Adhesion Test Reports: Submit filled out Preinstallation Field Adhesion Test Reports log within 10 days after completion of tests; include bagged test samples and photographic records.

H. Field Quality Control Log: Submit filled out log for each length or instance of sealant installed, within 10 days after completion of inspections/tests; include bagged test samples and photographic records, if any.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

B. Installer Qualifications: Company specializing in performing the work of this section and with at least three years of documented experience.

C. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

D. Preconstruction Laboratory Testing: Arrange for sealant manufacturer(s) to test each combination of sealant, substrate, backing, and accessories.

1. Adhesion Testing: In accordance with ASTM C794.
2. Compatibility Testing: In accordance with ASTM C1087.
3. Allow sufficient time for testing to avoid delaying the work.
4. Deliver to manufacturer sufficient samples for testing.
5. Report manufacturer's recommended corrective measures, if any, including primers or techniques not indicated in product data submittals.

6. Testing is not required if sealant manufacturer provides data showing previous testing, not older than 24 months, that shows satisfactory adhesion, lack of staining, and compatibility.

E. Preinstallation Field Adhesion Test Plan: Include destructive field adhesion testing of one sample of each combination of sealant type and substrate, except interior acrylic latex sealants, and include the following for each tested sample.
   1. Identification of testing agency.
   2. Preinstallation Field Adhesion Test Log Form: Include the following data fields, with known information filled out.
      a. Test date.
      b. Location on project.
      c. Sealant used.
      d. Stated movement capability of sealant.
      e. Test method used.
      f. Date of installation of field sample to be tested.
      g. Date of test.
      h. Copy of test method documents.
      i. Age of sealant upon date of testing.
      j. Test results, modeled after the sample form in the test method document.
      k. Indicate use of photographic record of test.

F. Owner will employ an independent testing agency to perform the field quality control inspection and testing as referenced in PART 3 of this section and as follows, to prepare and submit the field quality control plan and log, and to provide recommendations of remedies in the case of failure.
   1. Contractor shall cooperate with testing agency and repair failures discovered and destructive test location damage.

G. Field Quality Control Plan:
   1. Field Quality Control Log Form: Show same data fields as on Preinstallation Field Adhesion Test Log, with known information filled out and lines for multiple tests per sealant/substrate combinations; include visual inspection and specified field testing; allow for possibility that more tests than minimum specified may be necessary.

H. Field Adhesion Test Procedures:
   1. Allow sealants to fully cure as recommended by manufacturer before testing.
   2. Have a copy of the test method document available during tests.
   3. Record the type of failure that occurred, other information required by test method, and the information required on the Field Quality Control Log.

4. When performing destructive tests, also inspect the opened joint for proper installation characteristics recommended by manufacturer, and report any deficiencies.
5. Deliver the samples removed during destructive tests in separate sealed plastic bags, identified with project, location, test date, and test results, to Owner.
6. If any combination of sealant type and substrate does not show evidence of minimum adhesion or shows cohesion failure before minimum adhesion, report results to Architect.

I. Destructive Field Adhesion Test: Test for adhesion in accordance with ASTM C1521, using Destructive Tail Procedure.
1. Sample: At least 18 inch long.
2. Minimum Elongation Without Adhesive Failure: Consider the tail at rest, not under any elongation stress; multiply the stated movement capability of the sealant in percent by two; then multiply 1 inch by that percentage; if adhesion failure occurs before the "1 inch mark" is that distance from the substrate, the test has failed.
3. If either adhesive or cohesive failure occurs prior to minimum elongation, take necessary measures to correct conditions and re-test; record each modification to products or installation procedures.

1.06 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
B. Correct defective work within a five year period after Date of Substantial Completion.
C. Warranty: Include coverage for installed sealants and accessories that fail to achieve watertight seal , exhibit loss of adhesion or cohesion, or do not cure.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Non-Sag Sealants: Permits application in joints on vertical surfaces without sagging or slumping.
1. Dow Chemical Company: consumer.dow.com/en-us/industry/ind-building-construction.html.
2. Master Builders Solutions by BASF: www.master-builders-solutions.basf.us/en-us.
3. Momentive Performance Materials, Inc (formerly GE Silicones): www.momentive.com.
4. Pecora Corporation: www.pecora.com.
5. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com.
6. Substitutions: See Section 01 6000 - Product Requirements.

B. Self-Leveling Sealants: Pourable or self-leveling sealant that has sufficient flow to form a smooth, level surface when applied in a horizontal joint.
   1. Master Builders Solutions by BASF: www.master-builders-solutions.basf.us/en-us.
   2. Pecora Corporation: www.pecora.com.
   3. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com.
   4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 JOINT SEALANT APPLICATIONS

A. Scope:
   1. Exterior Joints: Seal open joints, whether or not the joint is indicated on drawings, unless specifically indicated not to be sealed. Exterior joints to be sealed include, but are not limited to, the following items.
      a. Wall expansion and control joints.
      b. Joints between door, window, and other frames and adjacent construction.
      c. Joints between different exposed materials.
      d. Openings below ledge angles in masonry.
      e. Other joints indicated below.
   2. Interior Joints: Do not seal interior joints unless specifically indicated to be sealed. Interior joints to be sealed include, but are not limited to, the following items.
      a. Joints between door, window, and other frames and adjacent construction.
      b. Other joints indicated below.
   3. Do not seal the following types of joints.
      a. Intentional weepholes in masonry.
      b. Joints indicated to be treated with manufactured expansion joint cover or some other type of sealing device.
      c. Joints where sealant is specified to be provided by manufacturer of product to be sealed.
      d. Joints where installation of sealant is specified in another section.
      e. Joints between suspended panel ceilings/grid and walls.

B. Interior Wet Areas: Bathrooms, restrooms, and kitchens; fixtures in wet areas include plumbing fixtures, countertops, and cabinets. Use mildew-resistant silicone sealant, unless otherwise indicated.

C. Joints between exterior sheathing panels: Use multi-part, non-sag polyurethane sealant, unless otherwise indicated.

D. Exterior joints in masonry, including expansion/control joints: Use low modulus silicone sealant, unless otherwise indicated.

E. Exterior and interior joints at perimeter of windows/storefront: Medium modulus silicone sealant, unless otherwise indicated.
F. Joints at perimeter of hollow metal framing: Medium modulus silicone sealant, unless otherwise indicated.
G. Exterior joints between wall finish and conduit & pipe penetrations, base plates of light fixtures, signage supports and other items applied to exterior wall surface: Medium modulus silicone sealant, unless otherwise indicated.
H. Interior concealed bedding joints and thresholds: Acrylic sealant, unless otherwise indicated.
I. Exterior and interior horizontal traffic-bearing joints, excluding tile floor joints: Two-part polyurethane sealant, unless otherwise indicated.
J. Tile expansion and control joint sealant: Refer to Tiling section.
K. Firestopped joints: Firestop sealant as specified in Firestopping section.

2.03 JOINT SEALANTS - GENERAL

A. Sealants and Primers: Provide products having lower volatile organic compound (VOC) content than indicated in SCAQMD 1168.

2.04 NONSAG JOINT SEALANTS

A. Non-Staining Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.
   1. Movement Capability: Plus and minus 50 percent, minimum.
   2. Non-Staining To Porous Stone: Non-staining to light-colored natural stone when tested in accordance with ASTM C1248.
   3. Dirt Pick-Up: Reduced dirt pick-up compared to other silicone sealants.
   4. Hardness Range: 15 to 40, Shore A, when tested in accordance with ASTM C661.
   5. Color: To be selected by Architect from manufacturer's standard range.
   6. Manufacturers:
      a. Dow Chemical Company; DOWSIL 756 SMS Building Sealant: consumer.dow.com/en-us/industry/ind-building-construction.html; Medium modulus silicone sealant for use at natural stone.
      b. Dow Chemical Company; DOWSIL 790 Silicone Building Sealant: consumer.dow.com/en-us/industry/ind-building-construction.html; Low modulus silicone sealant.
      c. Dow Chemical Company; DOWSIL 795 Silicone Building Sealant: consumer.dow.com/en-us/industry/ind-building-construction.html; Medium modulus silicone sealant.
      d. Pecora Corporation; Pecora 890 NST (Non-Staining Technology): www.pecora.com; Low modulus silicone sealant.

e. Pecora Corporation; Pecora 895 NST (Non-Staining Technology): www.pecora.com; Medium modulus silicone sealant.
f. Tremco Commercial Sealants & Waterproofing; Spectrem 1: www.tremcosealants.com; Low modulus silicone sealant.
g. Tremco Commercial Sealants & Waterproofing; Spectrem 2: www.tremcosealants.com; Medium modulus silicone sealant.
h. Tremco Commercial Sealants & Waterproofing; Spectrem 3: www.tremcosealants.com; Medium modulus silicone sealant for use at natural stone.
i. Substitutions: See Section 01 6000 - Product Requirements.

B. Mildew-Resistant Silicone Sealant: ASTM C920, Grade NS, Uses M and A; single component, mildew resistant; not expected to withstand continuous water immersion or traffic.
1. Color: To be selected by Architect from manufacturer's standard range.
2. Manufacturers:
a. Dow Chemical Company; DOWSIL 786 Silicone Sealant: consumer.dow.com/en-us/industry/ind-building-construction.html.
b. Momentive Performance Materials, Inc.; GE Construction Sealants; GE SCS1700 Sanitary: www.siliconefor building.com.
c. Pecora Corporation; Pecora 898 NST (Non-Staining Technology): www.pecora.com.
d. Substitutions: See Section 01 6000 - Product Requirements.

C. Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; multi-component; not expected to withstand continuous water immersion or traffic.
1. Movement Capability: Plus and minus [____] percent, minimum.
2. Hardness Range: 20 to 35, Shore A, when tested in accordance with ASTM C661.
3. Color: To be selected by Architect from manufacturer's standard range.
4. Service Temperature Range: Minus 40 to 180 degrees F.
5. Manufacturers:
a. Master Builders Solutions by BASF; MasterSeal NP-2: www.master-builders-solutions.basf.us/en-us.
b. Pecora Corporation; DynaTrol II: www.pecora.com.
c. Tremco Commercial Sealants & Waterproofing; Dymeric 240 FC: www.tremcosealants.com.
d. Substitutions: See Section 01 6000 - Product Requirements.

D. Acrylic Emulsion Latex: Water-based; ASTM C834, single component, non-staining, non-bleeding, non-sagging; paintable; not intended for exterior use.
1. Color: To be selected by Architect from manufacturer's standard range.

2. Grade: ASTM C834; Grade Minus 18 Degrees C (0 Degrees F).
3. Manufacturers:
    a. Master Builders Solutions by BASF; MasterSeal NP 520: www.master-builders-solutions.basf.us/en-us.
    b. Pecora Corporation; AC-20 +Silicone: www.pecora.com.
    c. Pecora Corporation; AVW-920: www.pecora.com.
    d. Tremco Commercial Sealants & Waterproofing; Tremflex 834: www.tremcosealants.com.
    e. Substitutions: See Section 01 6000 - Product Requirements.

2.05 SELF-LEVELING SEALANTS

A. Self-Leveling Polyurethane Sealant for Horizontal Expansion Joints: ASTM C920, Grade P, Uses T, M and O; multi-component; explicitly approved by manufacturer for horizontal expansion joints.
    1. Movement Capability: Plus and minus 25 percent, minimum.
    2. Hardness Range: 30 to 35, Shore A, when tested in accordance with ASTM C661.
    3. Color: To be selected by Architect from manufacturer's standard range.
    4. Manufacturers:
        a. Master Builders Solutions by BASF; MasterSeal SL2: www.master-builders-solutions.basf.us/en-us.
        b. Pecora Corporation; Urexpan NR-200: www.pecora.com.
        c. Tremco Commercial Sealants & Waterproofing; THC-901: www.tremcosealants.com.
        d. Substitutions: See Section 01 6000 - Product Requirements.

2.06 ACCESSORIES

A. Backer Rod: Cylindrical cellular foam rod with surface that sealant will not adhere to, compatible with specific sealant used, and recommended by backing and sealant manufacturers for specific application.
    1. Type for Joints Not Subject to Pedestrian or Vehicular Traffic: ASTM C1330; Type O - Open Cell Polyurethane.
    2. Type for Joints Subject to Pedestrian or Vehicular Traffic: ASTM C1330; Type B - Bi-Cellular Polyethylene.
    3. Open Cell: 40 to 50 percent larger in diameter than joint width.
    4. Closed Cell and Bi-Cellular: 25 to 33 percent larger in diameter than joint width.
B. Backing Tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.
C. Masking Tape: Self-adhesive, nonabsorbent, non-staining, removable without adhesive residue, and compatible with surfaces adjacent to joints and sealants.

D. Joint Cleaner: Non-corrosive and non-staining type, type recommended by sealant manufacturer; compatible with joint forming materials.
E. Primers: Type recommended by sealant manufacturer to suit application; non-staining.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that joints are ready to receive work.
B. Verify that backing materials are compatible with sealants.
C. Verify that backer rods are of the correct size.
D. Preinstallation Adhesion Testing: Install a sample for each test location indicated in the test plan.
    1. Test each sample as specified in PART 1 under QUALITY ASSURANCE article.
    2. Notify Architect of date and time that tests will be performed, at least seven days in advance.
    3. Record each test on Preinstallation Adhesion Test Log as indicated.
    4. If any sample fails, review products and installation procedures, consult manufacturer, or take whatever other measures are necessary to ensure adhesion; re-test in a different location; if unable to obtain satisfactory adhesion, report to Architect.
    5. After completion of tests, remove remaining sample material and prepare joint for new sealant installation.

3.02 PREPARATION

A. Remove loose materials and foreign matter that could impair adhesion of sealant.
B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.
C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.
D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.

3.03 INSTALLATION

A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.
B. Perform installation in accordance with ASTM C1193.
C. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer.
D. Install bond breaker backing tape where backer rod cannot be used.
E. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.

F. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.

G. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.

3.04 FIELD QUALITY CONTROL

A. Owner will employ an independent testing agency to perform field quality control inspection and testing as specified in PART 1 under QUALITY ASSURANCE article.

B. Remove and replace failed portions of sealants using same materials and procedures as indicated for original installation.

END OF SECTION 07 9200

SECTION 08 1113
HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Non-fire-rated hollow metal doors and frames.
B. Hollow metal frames for wood doors.

1.02 RELATED REQUIREMENTS

A. Section 08 7100 - Door Hardware.

1.03 ABBREVIATIONS AND ACRONYMS

A. ANSI: American National Standards Institute.
B. NFPA: National Fire Protection Association.
C. SDI: Steel Door Institute.
D. UL: Underwriters Laboratories.

1.04 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design 2010.
B. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors 2011.
C. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames 2003 (R2009).
D. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100) 2017.
E. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames 2011.
F. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2019a.
G. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable 2018.
H. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength 2018a.
I. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2018b.
J. BHMA A156.115 - American National Standard for Hardware Preparation in Steel Doors and Steel Frames 2016.
K. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.
L. NAAMM HMMA 830 - Hardware Selection for Hollow Metal Doors and Frames 2002.
M. NAAMM HMMA 831 - Hardware Locations for Hollow Metal Doors and Frames 2011.

N. NAAMM HMMA 840 - Guide Specifications for Installation and Storage of Hollow Metal Doors and Frames 2007.
O. NAAMM HMMA 861 - Guide Specifications for Commercial Hollow Metal Doors and Frames 2014.
P. SDI 117 - Manufacturing Tolerances for Standard Steel Doors and Frames 2013.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes.
C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and any indicated finish requirements.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Provide hollow metal doors and frames from SDI Certified manufacturer: www.steeldoor.org/sdicertified.php.
B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.
C. Maintain at project site copies of reference standards relating to installation of products specified.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Comply with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion and adverse effects on factory applied painted finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Hollow Metal Doors and Frames:
    1. Ceco Door, an Assa Abloy Group company: www.assaabloydss.com.
    2. Mesker, dormakaba Group: www.meskeropeningsgroup.com.
    3. Steelcraft, an Allegion brand: www.allegion.com.
    4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PERFORMANCE REQUIREMENTS

A. Requirements for Hollow Metal Doors and Frames:
    1. Steel Sheet: Comply with one or more of the following requirements; galvannealed steel complying with ASTM A653/A653M, cold-rolled steel complying with ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel complying with ASTM A1011/A1011M, commercial steel (CS) Type B, for each.
    2. Accessibility: Comply with ICC A117.1 and ADA Standards.

3. Exterior Door Top Closures: Flush end closure channel, with top and door faces aligned.
4. Door Edge Profile: Manufacturers standard for application indicated.
5. Typical Door Face Sheets: Flush.
6. Glazed Lights: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings. Style: Manufacturers standard.
7. Hardware Preparations, Selections and Locations: Comply with NAAMM HMMA 830 and NAAMM HMMA 831 or BHMA A156.115 and ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
8. Zinc Coating for Typical Interior and/or Exterior Locations: Provide metal components zinc-coated (galvanized) and/or zinc-iron alloy-coated (galvannealed) by the hot-dip process in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness, unless noted otherwise for specific hollow metal doors and frames.
    a. Based on SDI Standards: Provide at least A40/ZF120 (galvannealed) when necessary, coating not required for typical interior door applications, and at least A60/ZF180 (galvannealed) for corrosive locations.

B. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

2.03 HOLLOW METAL DOORS

A. Exterior Doors: Thermally insulated.
1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
    a. Level 3 - Extra Heavy-duty.
    b. Physical Performance Level A, 1,000,000 cycles; in accordance with ANSI/SDI A250.4.
    c. Model 1 - Full Flush.
    d. Door Face Metal Thickness: 16 gage, 0.053 inch, minimum.
    e. Zinc Coating: A60/ZF180 galvannealed coating; ASTM A653/A653M.
2. Door Core Material: Polyisocyanurate, 2 lbs/cu ft minimum density.
    a. Foam Plastic Insulation: Manufacturer's standard board insulation with maximum flame spread index (FSI) of 75, and maximum smoke developed index (SDI) of 450 in accordance with ASTM E84, and completely enclosed within interior of door.
3. Door Thermal Resistance: R-Value of 9.9, minimum, for installed thickness of polyisocyanurate.

4. Door Thickness: 1-3/4 inch, nominal.
5. Weatherstripping: Refer to Section 08 7100.
6. Door Finish: Factory primed and field finished.

B. Interior Doors, Non-Fire-Rated:
1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
a. Level 2 - Heavy-duty.
b. Physical Performance Level B, 500,000 cycles; in accordance with ANSI/SDI A250.4.
c. Model 1 - Full Flush.
d. Door Face Metal Thickness: 18 gage, 0.042 inch, minimum.
2. Door Core Material: Manufacturers standard core material/construction and in compliance with requirements.
3. Door Thickness: 1-3/4 inch, nominal.
4. Door Finish: Factory primed and field finished.

2.04 HOLLOW METAL FRAMES

A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.
B. Interior Door Frames, Non-Fire Rated: Full profile/continuously welded type.
1. Frame Metal Thickness: 16 gage, 0.053 inch, minimum.
2. Frame Finish: Factory primed and field finished.
C. Frames for Wood Doors: Comply with frame requirements in accordance with corresponding door.
D. Frames in Masonry Walls: Size to suit masonry coursing with head member 4 inch high to fill opening without cutting masonry units.
E. Frames Wider than 48 inches: Reinforce with steel channel fitted tightly into frame head, flush with top.

2.05 FINISHES

A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.
B. Bituminous Coating: Asphalt emulsion or other high-build, water-resistant, resilient coating.

2.06 ACCESSORIES

A. Glazing: As specified in Section 08 8000, factory installed.
B. Removable Stops: Formed sheet steel, shape as indicated on drawings, mitered or butted corners; prepared for countersink style tamper proof screws.
C. Grout for Frames: Portland cement grout with maximum 4 inch slump for hand troweling; thinner pumpable grout is prohibited.

D. Silencers: Resilient rubber, fitted into drilled hole; provide three on strike side of single door, three on center mullion of pairs, and two on head of pairs without center mullions.

E. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

C. Verify that finished walls are in plane to ensure proper door alignment.

3.02 PREPARATION

3.03 INSTALLATION

A. Install doors and frames in accordance with manufacturer's instructions and related requirements of specified door and frame standards or custom guidelines indicated.

B. Coordinate frame anchor placement with wall construction.

C. Install door hardware as specified in Section 08 7100.

1. Comply with recommended practice for hardware placement of doors and frames in accordance with ANSI/SDI A250.6 or NAAMM HMMA 861.

D. Comply with glazing installation requirements of Section 08 8000.

E. Coordinate installation of electrical connections to electrical hardware items.

F. Touch up damaged factory finishes.

3.04 TOLERANCES

A. Clearances Between Door and Frame: Comply with related requirements of specified frame standards or custom guidelines indicated in accordance with SDI 117 or NAAMM HMMA 861.

B. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

3.05 ADJUSTING

A. Adjust for smooth and balanced door movement.

END OF SECTION 08 1113

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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 055000 "Metal Fabrications" for miscellaneous steel supports, door-opening framing, corner guards, and bollards.
2. Section 111200 "Parking Control Equipment" for parking control equipment interlocked to overhead coiling doors.

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.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.
3. Include description of automatic-closing device and testing and resetting instructions.

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.
5. Show locations of controls, locking devices**,** detectors or replaceable fusible links, and other accessories.
6. Include diagrams for power, signal, and control wiring.

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 with sensor edge.
3. Guides.
4. Brackets.
5. Hood.
6. Locking device(s).
7. Include similar Samples of accessories involving color selection.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1. Fire-Rated Door Inspector: Submit documentation of compliance with NFPA 80, section 5.2.3.1.
2. Submit copy of DHI Fire and Egress Door Assembly Inspector (FDAI) certificate.

B. Oversize Construction Certification: For door assemblies required to be fire-rated and that exceed size limitations of labeled assemblies.

C. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Special warranty.

B. Maintenance Data: For overhead coiling doors to include in maintenance manuals.

C. 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. 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 from single source from single manufacturer.

1. Obtain operators and controls from overhead coiling-door manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Accessibility Standard: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design".

B. Structural Performance, Exterior Doors: Capable of withstanding the following design wind loads:

1. Design Wind Load: Uniform pressure (velocity pressure) of 20 lbf/sq. ft., acting inward and outward.
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.
4. Operability under Wind Load: Design overhead coiling doors to remain operable under design wind load, acting inward and outward.

C. Windborne-Debris Impact Resistance: Provide overhead coiling doors that pass ASTM E1886 missile-impact and cyclic-pressure tests according to ASTM E1996 for Wind Zone 1 for basic protection.

D. Seismic Performance: Overhead coiling doors shall withstand the effects of earthquake motions determined according to ASCE/SEI 7**.**

1. Component Importance Factor: 1.5.

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. ACME Rolling Doors.
b. Cornell.
c. Lawrence Roll-Up Doors, Inc.
d. Overhead Door Corporation.
e. Raynor.
f. Southwestern Rolling Steel Door Co.

B. Operation Cycles: Door components and operators capable of operating for not less than 50,000. 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.

1. Include tamperproof cycle counter.

C. Air Infiltration: Maximum rate of 0.4 cfm/sq. ft. at 15 and 25 mph when tested according to ASTM E283 or DASMA 105.

D. STC Rating: 24.

E. Curtain R-Value: 8.0 deg F x h x sq. ft./Btu.

F. Door Curtain Material: Galvanized steel.

G. Door Curtain Slats: Flat profile slats of 3-1/4-inch center-to-center height.

1. Insulated-Slat Interior Facing: Metal.
2. Gasket Seal. Manufacturer's standard continuous gaskets between slats.

H. Bottom Bar: Two angles, each not less than 1-1/2 by 1-1/2 by 1/8 inch thick; fabricated from aluminum extrusions with mill finish.

I. Curtain Jamb Guides: Galvanized steel with exposed finish matching curtain slats.

J. Hood: Galvanized steel.

1. Shape: Round.
2. Mounting: Face of wall.

K. Locking Devices: Equip door with locking device assembly.

L. Electric Door Operator:

1. Usage Classification: Standard duty, up to 25 cycles per hour and up to 90 cycles per day.
2. Operator Location: Wall.
3. Safety: Listed according to UL 325 by a qualified testing agency for commercial or industrial use**;** moving parts of operator enclosed or guarded if exposed and mounted at 8 feet or lower.
4. Motor Exposure: Interior.
5. Motor Electrical Characteristics:

a. Horsepower: 3/4 hp.
b. Voltage: 208-V ac, single phase, 60 Hz.

6. Emergency Manual Operation: Chain type.
7. Obstruction-Detection Device: Automatic pneumatic sensor edge on bottom bar.

    a. Sensor Edge Bulb Color: Black.

8. Control Station(s): Interior mounted.

M. Door Finish:

1. Baked-Enamel or Powder-Coated Finish: Color as selected by Architect from manufacturer's full range.
2. Factory Prime Finish: Manufacturer's standard color.
3. Interior Curtain-Slat Facing: Finish as selected by Architect from manufacturer's full range.

2.4 MATERIALS, GENERAL

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.5 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. Steel Door Curtain Slats: Zinc-coated (galvanized), cold-rolled structural-steel sheet; complying with ASTM A653/A653M, with G90 zinc coating; nominal sheet thickness (coated) of 0.028 inch; 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 steel thickness of 0.010 inch.

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.

2.6 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. Galvanized Steel: Nominal 0.028-inch-thick, hot-dip galvanized-steel sheet with G90 zinc coating, complying with ASTM A653/A653M.

B. Removable Metal Soffit: Formed or extruded from same metal and with same finish as curtain if hood is mounted above ceiling unless otherwise indicated.

2.7 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.

B. Chain Lock Keeper: Suitable for padlock.

C. Safety Interlock Switch: Equip power-operated doors with safety interlock switch to disengage power supply when door is locked.

2.8 COUNTERBALANCE MECHANISM

A. 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.

B. Torsion Rod for Counterbalance Shaft: Fabricate of manufacturer's standard cold-rolled steel, sized to hold fixed spring ends and carry torsional load.

C. Brackets: Manufacturer's standard mounting brackets of either cast iron or cold-rolled steel plate.

2.9 MANUAL DOOR OPERATORS

A. General: Equip door with manual door operator by door manufacturer.

B. 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.

2.10 ELECTRIC DOOR OPERATORS

A. General: Electric door operator assembly of size and capacity recommended and provided by door manufacturer for door and operation-cycles requirement specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, control stations, control devices, integral gearing for locking door, and accessories required for proper operation.

1. Comply with NFPA 70.
2. Control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6, with NFPA 70 Class 2 control circuit, maximum 24-V ac or dc.

B. Usage Classification: Electric operator and components capable of operating for not less than number of cycles per hour indicated for each door.

C. Door Operator Location(s): Operator location indicated for each door.

1. Wall Mounted: Operator is mounted to the inside front wall on the left or right side of door and connected to door drive shaft with drive chain and sprockets. Side room is required for this type of mounting. Wall-mounted operator can also be mounted above or below shaft; if above shaft, headroom is required.

D. Motors: Reversible-type motor with controller (disconnect switch) for motor exposure indicated for each door assembly.

1. Electrical Characteristics: Minimum as indicated for each door assembly. If not indicated, large enough to start, accelerate, and operate door in either direction from any position, at a speed not less than 8 in./sec. and not more than 12 in./sec., without exceeding nameplate ratings or service factor.
2. Operating Controls, Controllers, Disconnect Switches, Wiring Devices, and Wiring: Manufacturer's standard unless otherwise indicated.
3. Coordinate wiring requirements and electrical characteristics of motors and other electrical devices with building electrical system and each location where installed.

E. Limit Switches: Equip each motorized door with adjustable switches interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.

F. Obstruction-Detection Devices: External entrapment protection consisting of indicated automatic safety sensor capable of protecting full width of door opening.

1. Pneumatic Sensor Edge: Automatic safety sensor edge, located within astragal or weather stripping mounted to bottom bar. Contact with sensor activates device.

G. Control Station: Three-button control station in fixed location with momentary-contact push-button controls labeled "Open" and "Stop" and sustained- or constant-pressure push-button control labeled "Close."

1. Interior-Mounted Units: Full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 enclosure.

H. Emergency Manual Operation: Equip each electrically powered door with capability for emergency manual operation. Design manual mechanism so required force for door operation does not exceed 25 lbf.

I. Emergency Operation Disconnect Device: Equip operator with hand-operated disconnect mechanism for automatically engaging manual operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount mechanism so it is accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.

J. Motor Removal: Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency manual operation.

2.11 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.

2.12 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.

2.13 STEEL AND GALVANIZED-STEEL FINISHES

A. Factory Prime Finish: Manufacturer's standard primer, compatible with field-applied finish. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.

B. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.

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.

C. Accessibility: Install overhead coiling doors, switches, and controls along accessible routes in compliance with the accessibility standard.

D. Power-Operated Doors: Install according to UL 325.

3.3 FIELD QUALITY CONTROL

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

B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Test door release, closing, and alarm operations when activated by smoke detector or building's fire-alarm system. Test manual operation of closed door. Reset door-closing mechanism after successful test.

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 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. After electrical circuitry has been energized, operate doors to confirm proper motor rotation and door performance.
3. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

3.5 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.

C. Adjust seals to provide tight fit around entire perimeter.

3.6 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include three months' full maintenance by skilled employees of coiling-door Installer. Include monthly 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.
2. Include 24-hour-per-day, seven-day-per-week, emergency callback service.

3.7 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 08 5113
ALUMINUM WINDOWS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Extruded aluminum windows with fixed sash, operating sash, and infill panels.
B. Factory glazing.
C. Operating hardware.

1.02 RELATED REQUIREMENTS

A. Section 05 5000 - Metal Fabrications: Steel lintels.
B. Section 06 1000 - Rough Carpentry: Wood perimeter shims.
C. Section 07 2500 - Weather Barriers: Sealing frame to water-resistive barrier installed on adjacent construction.
D. Section 07 9200 - Joint Sealants: Sealing joints between window frames and adjacent construction.

1.03 REFERENCE STANDARDS

A. AAMA/WDMA/CSA 101/I.S.2/A440 - North American Fenestration Standard/Specification for Windows, Doors, and Skylights 2017.
B. AAMA CW-10 - Care and Handling of Architectural Aluminum from Shop to Site 2015.
C. AAMA 609 & 610 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum (Combined Document) 2015.
D. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2021a.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.
B. Product Data: Include component dimensions, information on glass and glazing, internal drainage details, and descriptions of hardware and accessories.
C. Shop Drawings: Indicate opening dimensions, elevations of different types, framed opening tolerances, anchorage locations, [_____], and installation requirements.
D. Samples:
    1. Framing: Two samples, 12 by 12 inch in size illustrating typical corner construction, accessories, and finishes.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of AAMA CW-10.

B. Protect finished surfaces with wrapping paper or strippable coating during installation. Do not use adhesive papers or sprayed coatings that bond to substrate when exposed to sunlight or weather.

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Aluminum Windows Manufacturers:
   1. Arcadia, Inc: www.arcadiainc.com/#sle.
   2. Boyd Aluminum: www.boydaluminum.com/#sle.
   3. ES Windows; ES-P250: www.eswindows.com/#sle.
   4. Manko Window Systems, Inc: www.mankowindows.com/#sle.

2.02 ALUMINUM WINDOWS

A. Aluminum Windows: Extruded aluminum frame and sash, factory fabricated, factory finished, with operating hardware, related flashings, and anchorage and attachment devices.
   1. Frame Depth: 2-1/4 inch.
   2. Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors; fasteners and attachments concealed from view; reinforced as required for operating hardware and imposed loads.
   3. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.
   4. Movement: Accommodate movement between window and perimeter framing and deflection of lintel, without damage to components or deterioration of seals.
   5. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.

PART 3 EXECUTION

3.01 PRIME WINDOW INSTALLATION

A. Install windows in accordance with manufacturer's instructions.

B. Attach window frame and shims to perimeter opening to accommodate construction tolerances and other irregularities.

C. Align window plumb and level, free of warp or twist. Maintain dimensional tolerances and alignment with adjacent work.

D. Install sill and sill end angles.

E. Provide thermal isolation where components penetrate or disrupt building insulation. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

3.02 TOLERANCES

A. Maximum Variation from Level or Plumb: 1/16 inches every 3 ft non-cumulative or 1/8 inches per 10 ft, whichever is less.

3.03 ADJUSTING

A. Adjust hardware for smooth operation and secure weathertight closure.

3.04 CLEANING

A. Remove protective material from factory finished aluminum surfaces.

END OF SECTION 08 5113

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SECTION 087100 - DOOR HARDWARE

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 commercial door hardware for the following:

1. Swinging doors.
2. Sliding doors.
3. Other doors to the extent indicated.

B. Door hardware includes, but is not necessarily limited to, the following:

1. Mechanical door hardware.
2. Electromechanical door hardware.
3. Cylinders specified for doors in other sections.

C. Related Sections:

1. Division 08 Section “Hollow Metal Doors and Frames”.
2. Division 08 Section “Aluminum-Framed Entrances and Storefronts”.

D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.

1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
2. ICC/IBC - International Building Code.
3. NFPA 70 - National Electrical Code.
4. NFPA 80 - Fire Doors and Windows.
5. NFPA 101 - Life Safety Code.
6. NFPA 105 - Installation of Smoke Door Assemblies.
7. State Building Codes, Local Amendments.

E. Standards: All hardware specified herein shall comply with the following industry standards as applicable. Any undated reference to a standard shall be interpreted as referring to the latest edition of that standard:

1. ANSI/BHMA Certified Product Standards - A156 Series.

2. UL10C - Positive Pressure Fire Tests of Door Assemblies.
3. ANSI/UL 294 - Access Control System Units.
4. UL 305 - Panic Hardware.
5. ANSI/UL 437- Key Locks.

1.3 SUBMITTALS

A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.

B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."

2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.

3. Content: Include the following information:

a. Type, style, function, size, label, hand, and finish of each door hardware item.
b. Manufacturer of each item.
c. Fastenings and other pertinent information.
d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
e. Explanation of abbreviations, symbols, and codes contained in schedule.
f. Mounting locations for door hardware.
g. Door and frame sizes and materials.
h. Warranty information for each product.

4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.

C. Shop Drawings: Details of electrified access control hardware indicating the following:

1. Wiring Diagrams: Upon receipt of approved schedules, submit detailed system wiring diagrams for power, signaling, monitoring, communication, and control of the access control system electrified hardware. Differentiate between manufacturer-installed and field-installed wiring. Include the following:

a. Elevation diagram of each unique access controlled opening showing location and interconnection of major system components with respect to their placement in the respective door openings.
b. Complete (risers, point-to-point) access control system block wiring diagrams.
c. Wiring instructions for each electronic component scheduled herein.

2. Electrical Coordination: Coordinate with related sections the voltages and wiring details required at electrically controlled and operated hardware openings.

D. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.

E. Informational Submittals:

1. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.

F. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Procedures.

1.4 QUALITY ASSURANCE

A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.

B. Certified Products: Where specified, products must maintain a current listing in the Builders Hardware Manufacturers Association (BHMA) Certified Products Directory (CPD).

C. Installer Qualifications: A minimum 3 years documented experience installing both standard and electrified door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

D. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.

E. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.

1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.

2. Provide electromechanical door hardware from the same manufacturer as mechanical door hardware, unless otherwise indicated.

F. Each unit to bear third party permanent label demonstrating compliance with the referenced standards.

G. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:

1. Function of building, purpose of each area and degree of security required.
2. Plans for existing and future key system expansion.
3. Requirements for key control storage and software.
4. Installation of permanent keys, cylinder cores and software.
5. Address and requirements for delivery of keys.

H. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.

1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
3. Review sequence of operation narratives for each unique access controlled opening.
4. Review and finalize construction schedule and verify availability of materials.
5. Review the required inspecting, testing, commissioning, and demonstration procedures

I. At completion of installation, provide written documentation that components were applied to manufacturer's instructions and recommendations and according to approved schedule.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.

B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.

C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.6 COORDINATION

A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.

B. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.7 WARRANTY

A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:

1. Structural failures including excessive deflection, cracking, or breakage.
2. Faulty operation of the hardware.
3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
4. Electrical component defects and failures within the systems operation.

C. Standard Warranty Period: One year from date of Substantial Completion, unless otherwise indicated.

D. Special Warranty Periods:
1. Five years for exit hardware.
2. Ten years for manual overhead door closer bodies.
3. Five years for motorized electric latch retraction exit devices.
4. Two years for electromechanical door hardware, unless noted otherwise.

1.8 MAINTENANCE SERVICE

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

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.

B. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:

1. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.

C. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

2.2 HANGING DEVICES

A. Hinges: ANSI/BHMA A156.1 butt hinges with number of hinge knuckles and other options as specified in the Door Hardware Sets.

1. Quantity: Provide the following hinge quantity:

a. Two Hinges: For doors with heights up to 60 inches.
b. Three Hinges: For doors with heights 61 to 90 inches.
c. Four Hinges: For doors with heights 91 to 120 inches.
d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.

2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:

a. Widths up to 3’0”: 4-1/2” standard or heavy weight as specified.
b. Sizes from 3’1” to 4’0”: 5” standard or heavy weight as specified.

3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:

a. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
b. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.

4. Hinge Options: Comply with the following:

a. Non-removable Pins: With the exception of electric through wire hinges, provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the all out-swinging lockable doors.

5. Manufacturers:

a. McKinney (MK) - TA/T4A Series, 5 knuckle.

B. Continuous Geared Hinges: ANSI/BHMA A156.26 Grade 1-600 continuous geared hinge. with minimum 0.120-inch thick extruded 6063-T6 aluminum alloy hinge leaves and a minimum overall width of 4 inches. Hinges are non-handed, reversible and fabricated to template screw locations. Factory trim hinges to suit door height and prepare for electrical cut-outs.

1. Manufacturers:

a. Pemko (PE).

2.3 POWER TRANSFER DEVICES

A. Electrified Quick Connect Transfer Hinges: Provide electrified transfer hinges with Molex™ standardized plug connectors and sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets with a 1-year warranty. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.

1. Manufacturers:

a. McKinney (MK) - QC (# wires) Option.

B. Electric Door Wire Harnesses: Provide electric/data transfer wiring harnesses with standardized plug connectors to accommodate up to twelve (12) wires. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Provide sufficient number and type of concealed wires to accommodate electric function of specified hardware. Provide a connector for through-door electronic locking devices and from hinge to junction box above the opening. Wire nut connections are not acceptable. Determine the length required for each electrified hardware component for the door type, size and construction, minimum of two per electrified opening.

1. Provide one each of the following tools as part of the base bid contract:

a. McKinney (MK) - Electrical Connecting Kit: QC-R001.
b. McKinney (MK) - Connector Hand Tool: QC-R003.

2. Manufacturers:

    a. McKinney (MK) - QC-C Series.

2.4 DOOR OPERATING TRIM

A. Flush Bolts and Surface Bolts: Provide products conforming to ANSI/BHMA A156.3 and A156.16, Grade 1.

1. Flush bolts to be furnished with top rod of sufficient length to allow bolt retraction device location approximately six feet from the floor.
2. Furnish dust proof strikes for bottom bolts.
3. Surface bolts to be minimum 8” in length and U.L. listed for labeled fire doors and U.L. listed for windstorm components where applicable.
4. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.

5. Manufacturers:

    a. Rockwood (RO).

B. Door Push Plates and Pulls: ANSI/BHMA A156.6 door pushes and pull units of type and design specified in the Hardware Sets. Coordinate and provide proper width and height as required where conflicting hardware dictates.

1. Push/Pull Plates: Minimum .050 inch thick, size as indicated in hardware sets, with beveled edges, secured with exposed screws unless otherwise indicated.
2. Door Pull and Push Bar Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door unless otherwise indicated.
3. Offset Pull Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door and offset of 90 degrees unless otherwise indicated.
4. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets.

5. Manufacturers:

    a. Rockwood (RO).

2.5 CYLINDERS AND KEYING

A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.

B. Source Limitations: Obtain each type of keyed cylinder and keys from the same source manufacturer as locksets and exit devices, unless otherwise indicated.

1. Manufacturers:

a. Yale Commercial (YA).

C. Cylinder Types: Original manufacturer cylinders able to supply the following cylinder formats and types:

1. Threaded mortise cylinders with rings and cams to suit hardware application.
2. Rim cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
3. Bored or cylindrical lock cylinders with tailpieces as required to suit locks.
4. Tubular deadlocks and other auxiliary locks.
5. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
6. Keyway: Manufacturer’s Standard.

D. Keying System: Each type of lock and cylinders to be factory keyed.

1. Supplier shall conduct a "Keying Conference" to define and document keying system instructions and requirements.
2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.
3. New System: Key locks to a new key system as directed by the Owner.

E. Key Quantity: Provide the following minimum number of keys:

1. Change Keys per Cylinder: Three (3).
2. Master Keys (per Master Key Level/Group): Five (5).
3. Construction Keys (where required): Ten (10).
4. Construction Control Keys (where required): Two (2).
5. Permanent Control Keys (where required): Two (2).

F. Construction Keying: Provide construction master keyed cylinders.

G. Key Registration List (Bitting List):

1. Provide keying transcript list to Owner's representative in the proper format for importing into key control software.
2. Provide transcript list in writing or electronic file as directed by the Owner.

2.6 MECHANICAL LOCKS AND LATCHING DEVICES

A. Cylindrical Locksets, Grade 1 (Commercial Duty): ANSI/BHMA A156.2, Series 4000, Operational Grade 1 Certified Products Directory (CPD) listed.

1. Locks are to be non-handed and fully field reversible.

2. Manufacturers:

a. Yale Commercial(YA) 4700LN Series.

2.7 ELECTROMECHANICAL LOCKING DEVICES

A. Electromechanical Cylindrical Locksets, Grade 1 (Heavy Duty): Subject to same compliance standards and requirements as mechanical cylindrical locksets, electrified locksets to be of type and design as specified below.

1. Electrified Lock Options: Where indicated in the Hardware Sets, provide electrified options including: outside door lock/unlock trim control and request-to-exit signaling. Unless otherwise indicated, provide electrified locksets standard as fail secure.

2. Manufacturers:

a. Yale Commercial(YA) - 5400LN Series.

2.8 AUXILIARY LOCKS

A. Narrow Case Deadlocks and Deadlatches: ANSI/BHMA 156.13 Series 1000 Grade 1 narrow case deadlocks and deadlatches for swinging or sliding door applications. All functions shall be manufactured in a single sized case formed from 12 gauge minimum, corrosion resistant steel (option for fully stainless steel case and components). Provide minimum 2 7/8" throw laminated stainless steel bolt. Bottom rail deadlocks to have 3/8” diameter bolts.

1. Manufacturers:

a. Adams Rite Manufacturing (AD) - MS1850S / MS1950 Series.

2.9 LOCK AND LATCH STRIKES

A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:

1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.
4. Double-lipped strikes: For locks at double acting doors. Furnish with retractable stop for rescue hardware applications.

B. Standards: Comply with the following:

1. Strikes for Mortise Locks and Latches: BHMA A156.13.
2. Strikes for Bored Locks and Latches: BHMA A156.2.
3. Strikes for Auxiliary Deadlocks: BHMA A156.36.
4. Dustproof Strikes: BHMA A156.16.

2.10 CONVENTIONAL EXIT DEVICES

A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:

1. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305. Provide proper fasteners as required by manufacturer including sex nuts and bolts at openings specified in the Hardware Sets.

2. Where exit devices are required on fire rated doors, provide devices complying with NFPA 80 and with UL labeling indicating "Fire Exit Hardware". Provide devices with the proper fasteners for installation as tested and listed by UL. Consult manufacturer’s catalog and template book for specific requirements.

3. Except on fire rated doors, provide exit devices with hex key dogging device to hold the pushbar and latch in a retracted position. Provide optional keyed cylinder dogging on devices where specified in Hardware Sets.

4. Devices must fit flat against the door face with no gap that permits unauthorized dogging of the push bar. The addition of filler strips is required in any case where the door light extends behind the device as in a full glass configuration.

5. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer's heavy duty escutcheon trim with threaded studs for thru-bolts.

   a. Lock Trim Design: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets.
   b. Where function of exit device requires a cylinder, provide a cylinder (Rim or Mortise) as specified in Hardware Sets.

6. Vertical Rod Exit Devices: Where surface or concealed vertical rod exit devices are used at interior openings, provide as less bottom rod (LBR) unless otherwise indicated. Provide dust proof strikes where thermal pins are required to project into the floor.

7. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2” wide stiles.

8. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.

9. Rail Sizing: Provide exit device rails factory sized for proper door width application.

10. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.

B. Conventional Push Rail Exit Devices (Commercial Duty): ANSI/BHMA A156.3, Grade 1 Certified Products Directory (CPD) listed panic and fire exit hardware devices furnished in the functions specified in the Hardware Sets. Fabricate latchbolts from cast stainless steel, Pullman type, incorporating a deadlocking feature.

1. Manufacturers:

a. Yale Commercial(YA) - 6000 Series.

C. Electromechanical Push Rail Exit Devices (Commercial Duty): ANSI/BHMA A156.3, Grade 1 Certified Products Directory (CPD) listed panic and fire exit hardware devices subject to same compliance standards and requirements as mechanical exit devices. Electrified exit devices to be of type and design as specified below and in the hardware sets.

1. Where conventional power supplies are not sufficient, include any specific controllers required to provide the proper inrush current.

2. Manufacturers:

a. Yale (YA) - 6000 Series.

2.11 DOOR CLOSERS

A. All door closers specified herein shall meet or exceed the following criteria:

1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers.

2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.

3. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the Americans with Disabilities Act, provide units complying with ANSI ICC/A117.1.

4. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.

5. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.

6. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.

B. Door Closers, Surface Mounted (Cam Action): ANSI/BHMA 156.4, Grade 1 Certified Products Directory (CPD) listed surface mounted, high efficiency door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be of the cam and roller design, one piece cast aluminum silicon alloy body with adjustable backcheck and independently controlled valves for closing sweep and latch speed.

1. Manufacturers:

a. Norton Rixson (NO) - 2800ST Series.

C. Door Closers, Surface Mounted (Commercial Duty): ANSI/BHMA 156.4, Grade 1 Certified Products Directory (CPD) listed surface mounted, institutional grade door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck, closing sweep, and latch speed control valves. Provide non-handed units standard.

1. Manufacturers:

a. Yale Commercial(YA) - 3500 Series.

2.12 ARCHITECTURAL TRIM

A. Door Protective Trim

1. General: Door protective trim units to be of type and design as specified below or in the Hardware Sets.

2. Size: Fabricate protection plates (kick, armor, or mop) not more than 2" less than door width (LDW) on stop side of single doors and 1” LDW on stop side of pairs of doors, and not more than 1" less than door width on pull side. Coordinate and provide proper width and height as required where conflicting hardware dictates. Height to be as specified in the Hardware Sets.

3. Where plates are applied to fire rated doors with the top of the plate more than 16” above the bottom of the door, provide plates complying with NFPA 80. Consult manufacturer’s catalog and template book for specific requirements for size and applications.

4. Protection Plates: ANSI/BHMA A156.6 protection plates (kick, armor, or mop), fabricated from the following:

a. Stainless Steel: 300 grade, 050-inch thick.

5. Options and fasteners: Provide manufacturer's designated fastener type as specified in the Hardware Sets. Provide countersunk screw holes.

6. Manufacturers:

a. Rockwood (RO).

2.13 DOOR STOPS AND HOLDERS

A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.

B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.

1. Manufacturers:

a. Rockwood (RO).

C. Overhead Door Stops and Holders: ANSI/BHMA A156.8, Grade 1 Certified Products Directory (CPD) listed overhead stops and holders to be surface or concealed types as indicated in Hardware Sets. Track, slide, arm and jamb bracket to be constructed of extruded bronze and shock absorber spring of heavy tempered steel. Provide non-handed design with mounting brackets as required for proper operation and function.

1. Manufacturers:

a. Norton Rixson (RF).

2.14 ARCHITECTURAL SEALS

A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.

B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.

1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.

C. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.

1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and NPFA 252, Standard Methods of Fire Tests of Door Assemblies.

D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.

E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.

F. Manufacturers:

1. Pemko (PE).

2.15 FABRICATION

A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.16 FINISHES

A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.

B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware

C. 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 scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.2 PREPARATION

A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.

B. Wood Doors: Comply with ANSI/DHI A115-W series.

3.3 INSTALLATION

A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.

1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.

B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:

1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
2. DHI TDH-007-20: Installation Guide for Doors and Hardware.
3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.

C. Retrofitting: Install door hardware to comply with manufacturer's published templates and 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 specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.

D. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."

E. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.4 FIELD QUALITY CONTROL

A. Field Inspection (Punch Report): Reference Division 01 Sections “Closeout Procedures”. Produce project punch report for each installed door opening indicating compliance with approved submittals and verification hardware is properly installed, operating and adjusted. Include list of items to be completed and corrected, indicating the reasons or deficiencies causing the Work to be incomplete or rejected.

1. Organization of List: Include separate Door Opening and Deficiencies and Corrective Action Lists organized by Mark, Opening Remarks and Comments, and related Opening Images and Video Recordings.

3.5 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.

3.6 CLEANING AND PROTECTION

A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.

B. Clean adjacent surfaces soiled by door hardware installation.

C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

3.7 DEMONSTRATION

A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

3.8 DOOR HARDWARE SETS

A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.

1. Quantities listed are for each pair of doors, or for each single door.

2. The supplier is responsible for handing and sizing all products.

3. Where multiple options for a piece of hardware are given in a single line item, the supplier shall provide the appropriate application for the opening.

B. Manufacturer’s Abbreviations:

1. MK - McKinney
2. PE - Pemko
3. RO - Rockwood
4. YA - Yale
5. AD - Adams Rite
6. RF - Rixson
7. NO - Norton
8. SU - Securitron

Hardware Sets

Set: 1.0

Doors: B106.1, B110.1

2	Continuous Hinge	CFM__SLF-HD1 - DOOR HEIGHT		PE
2	Flush Bolt (Manual)	555/557 (TO SUIT)	US26D	RO
1	Mortise Deadlock	MS1850S	628	AD
1	Mortise Cylinder	2153	626	YA
1	Thumbturn	4066	130	AD
2	Push Pull	RM251 Mtg-Type 1XHD	US32D	RO
2	Conc Overhead Stop	6-X36	630	RF
2	Surface Closer	TJ3301	689	YA
1	Threshold	272A MSES25SS		PE
2	Sweep	315CN		PE
1	Status Indicator	4089		AD

Notes:
• Perimeter/meeting stile seals by frame/door supplier.
• Door to remain unlocked during occupancy.

Set: 2.0

Doors: B115

3	Hinge (heavy weight)	T4A3386	US32D	MK
1	Electric Hinge (heavy weight)	T4A3386-QC12	US32D	MK ⚡
1	Rim Exit Device, Nightlatch	6100ED B P AU627F	630	YA ⚡
1	Surface Closer	3331	689	YA
1	Kick Plate	K1050 10" CSK	US32D	RO
1	Threshold	272A MSES25SS		PE
1	Gasketing (Head/Jambs)	S773BL		PE
1	Sweep	315CN		PE
1	Frame Harness	QC-C1500P		MK ⚡
1	Door Harness	QC-CXXX- LENGTH TO SUIT		MK ⚡
1	Card Reader	BY SECURITY SUPPLIER		
1	Door Position Switch	BY SECURITY SUPPLIER		SU ⚡
1	Controller	BY SECURITY SUPPLIER		⚡
1	Wiring Diagram	Elevation and Point to Point as Specified		

Notes:
• Electronic Operation: Valid card or key retracts latchbolt. Request to exit shows authorized egress. Free egress at all times. In case of power loss, door remains locked and latched.

Set: 3.0

Doors: B105, B109, D102

7	Hinge (heavy weight)	T4A3786	US26D	MK	
1	Electric Hinge (heavy weight)	T4A3786-QC12	US26D	MK	⚡
2	Flush Bolt (Manual)	555/557 (TO SUIT)	US26D	RO	
1	Fail Secure Lock	AU 5491LN REX	626	YA	⚡
1	Surf Overhead Stop	9-X36	630	RF	
1	Surface Closer	3331	689	YA	
2	Kick Plate	K1050 10" CSK	US32D	RO	
1	Threshold	272A MSES25SS		PE	
1	Gasketing (Head/Jambs)	S773BL		PE	
2	Sweep	315CN		PE	
1	Astragal (Overlapping)	357SP		PE	
1	Astragal (Meeting Edge)	S771C		PE	
1	Frame Harness	QC-C1500P		MK	⚡
1	Door Harness	QC-CXXX- LENGTH TO SUIT		MK	⚡
1	Card Reader	BY SECURITY SUPPLIER			
2	Door Position Switch	BY SECURITY SUPPLIER		SU	⚡
1	Power Supply	BY SECURITY SUPPLIER			⚡
1	Wiring Diagram	Elevation and Point to Point as Specified			

Notes:
• Electronic Operation: Valid card unlocks outside lever or key retracts latchbolt. Request to exit shows authorized egress. Free egress at all times. In case of power loss, door remains locked and latched.

Set: 4.0

Doors: C104, C105

7	Hinge (heavy weight)	T4A3786	US26D	MK	
1	Electric Hinge (heavy weight)	T4A3786-QC12	US26D	MK	⚡
2	Flush Bolt (Manual)	555/557 (TO SUIT)	US26D	RO	
1	Fail Secure Lock	AU 5491LN REX	626	YA	⚡
1	Surf Overhead Stop	9-X36	630	RF	
1	Surface Closer	2800ST	689	NO	

2	Kick Plate	K1050 10" CSK	US32D	RO
1	Threshold	272A MSES25SS		PE
1	Gasketing (Head/Jambs)	S773BL		PE
2	Sweep	315CN		PE
1	Astragal (Overlapping)	357SP		PE
1	Astragal (Meeting Edge)	S771C		PE
1	Frame Harness	QC-C1500P		MK
1	Door Harness	QC-CXXX- LENGTH TO SUIT		MK
1	Card Reader	BY SECURITY SUPPLIER		
2	Door Position Switch	BY SECURITY SUPPLIER		SU
1	Power Supply	BY SECURITY SUPPLIER		
1	Wiring Diagram	Elevation and Point to Point as Specified		

Notes:
• Install overhead stop pull side mounted.
• Electronic Operation: Valid card unlocks outside lever or key retracts latchbolt. Request to exit shows authorized egress. Free egress at all times. In case of power loss, door remains locked and latched.

Set: 5.0

Doors: A108, A111

3	Hinge (heavy weight)	T4A3386	US32D	MK
1	Electric Hinge (heavy weight)	T4A3386-QC12	US32D	MK
1	Fail Secure Lock	AU 5491LN REX	626	YA
1	Surface Closer	3331	689	YA
1	Kick Plate	K1050 10" CSK	US32D	RO
1	Threshold	272A MSES25SS		PE
1	Gasketing (Head/Jambs)	S773BL		PE
1	Sweep	315CN		PE
1	Frame Harness	QC-C1500P		MK
1	Door Harness	QC-CXXX- LENGTH TO SUIT		MK
1	Card Reader	BY SECURITY SUPPLIER		
1	Door Position Switch	BY SECURITY SUPPLIER		SU
1	Power Supply	BY SECURITY SUPPLIER		
1	Wiring Diagram	Elevation and Point to Point as Specified		

Notes:
• Electronic Operation: Valid card unlocks outside lever or key retracts latchbolt. Request to exit shows

authorized egress. Free egress at all times. In case of power loss, door remains locked and latched. Lock included with door position switch, request to exit, and end of line resistors to detect tampering.

Set: 6.0

Doors: A109, A110, C102, C103, EX.1

3	Hinge (heavy weight)	T4A3386	US32D	MK
1	Electric Hinge (heavy weight)	T4A3386-QC12	US32D	MK
1	Fail Secure Lock	AU 5491LN REX	626	YA
1	Surface Closer	2800ST	689	NO
1	Kick Plate	K1050 10" CSK	US32D	RO
1	Threshold	272A MSES25SS		PE
1	Gasketing (Head/Jambs)	S773BL		PE
1	Sweep	315CN		PE
1	Frame Harness	QC-C1500P		MK
1	Door Harness	QC-CXXX- LENGTH TO SUIT		MK
1	Card Reader	BY SECURITY SUPPLIER		
1	Power Supply	BY SECURITY SUPPLIER		
1	Wiring Diagram	Elevation and Point to Point as Specified		

Notes:
• Electronic Operation: Valid card unlocks outside lever or key retracts latchbolt. Request to exit shows authorized egress. Free egress at all times. In case of power loss, door remains locked and latched. Lock included with door position switch, request to exit, and end of line resistors to detect tampering.

Set: 7.0

Doors: EX.2

6	Hinge (heavy weight)	T4A3386	US32D	MK
2	Flush Bolt (Manual)	555/557 (TO SUIT)	US26D	RO
1	Storeroom Lock	AU 4705LN	626	YA
1	Surf Overhead Stop	9-X36	630	RF
1	Surface Closer	3331	689	YA
2	Kick Plate	K1050 10" CSK	US32D	RO
1	Threshold	272A MSES25SS		PE
1	Gasketing (Head/Jambs)	S773BL		PE
2	Sweep	315CN		PE
1	Astragal (Overlapping)	357SP		PE
1	Astragal (Meeting Edge)	S771C		PE

2	Door Position Switch	BY SECURITY SUPPLIER		SU

Set: 8.0

Doors: B114

4	Hinge (heavy weight)	T4A3386	US32D	MK
1	Storeroom Lock	AU 4705LN	626	YA
1	Surface Closer	2800ST	689	NO
1	Kick Plate	K1050 10" CSK	US32D	RO
1	Threshold	272A MSES25SS		PE
1	Gasketing (Head/Jambs)	S773BL		PE
1	Sweep	315CN		PE

Set: 9.0

Doors: B103

4	Hinge (heavy weight)	T4A3386	US32D	MK
1	Entry Lock	AU 4704LN	626	YA
1	Surface Closer	2800ST	689	NO
1	Kick Plate	K1050 10" CSK	US32D	RO
1	Threshold	272A MSES25SS		PE
1	Gasketing (Head/Jambs)	S773BL		PE
1	Sweep	315CN		PE

Set: 10.0

Doors: B106, B110

4	Hinge (heavy weight)	T4A3386	US32D	MK
1	Classroom Lock	AU 4708LN	626	YA
1	Surface Closer	3331	689	YA
1	Kick Plate	K1050 10" CSK	US32D	RO
1	Threshold	272A MSES25SS		PE
1	Gasketing (Head/Jambs)	S773BL		PE
1	Sweep	315CN		PE

Set: 11.0

Doors: B107, B111

4	Hinge (heavy weight)	T4A3386	US32D	MK
1	Deadbolt	D162	626	YA

1	Door Pull	RM3300-13 Mtg-Type 1	US32D	RO
1	Push Plate	70C	US32D	RO
1	Surface Closer	3331	689	YA
1	Kick Plate	K1050 10" CSK	US32D	RO
1	Door Stop	403/441CU (TO SUIT)	US26D	RO
1	Threshold	272A MSES25SS		PE
1	Gasketing (Head/Jambs)	S773BL		PE
1	Sweep	315CN		PE

Set: 12.0

Doors: B108, B112

4	Hinge (heavy weight)	T4A3386	US32D	MK
1	Deadbolt	D162	626	YA
1	Door Pull	RM3300-13 Mtg-Type 1	US32D	RO
1	Push Plate	70C	US32D	RO
1	Surface Closer	2800ST	689	NO
1	Kick Plate	K1050 10" CSK	US32D	RO
1	Mop Plate	K1050 4" CSK	US32D	RO
1	Door Stop	403/441CU (TO SUIT)	US26D	RO
1	Threshold	272A MSES25SS		PE
1	Gasketing (Head/Jambs)	S773BL		PE
1	Sweep	315CN		PE

Set: 13.0

Doors: A102, A105, A107

2	Hinge (heavy weight)	T4A3786	US26D	MK
1	Electric Hinge (heavy weight)	T4A3786-QC12	US26D	MK
1	Fail Secure Lock	AU 5491LN REX	626	YA
1	Surface Closer	R / PR3301 (TO SUIT)	689	YA
1	Kick Plate	K1050 10" CSK	US32D	RO
1	Door Stop	403/441CU (TO SUIT)	US26D	RO
3	Silencer	608/609 (TO SUIT)		RO
1	Frame Harness	QC-C1500P		MK
1	Door Harness	QC-CXXX- LENGTH TO SUIT		MK
1	Card Reader	BY SECURITY SUPPLIER		
1	Door Position Switch	BY SECURITY SUPPLIER		SU
1	Power Supply	BY SECURITY SUPPLIER		

1 Wiring Diagram	Elevation and Point to Point as Specified	

Notes:
• Electronic Operation: Valid card unlocks outside lever or key retracts latchbolt. Request to exit shows authorized egress. Free egress at all times. In case of power loss, door remains unlocked and latched. Lock included with door position switch and request to exit.

Set: 14.0

Doors: A104

3 Hinge	TA2714	US26D	MK
1 Storeroom Lock	AU 4705LN	626	YA
1 Surface Closer	R / PR3301 (TO SUIT)	689	YA
1 Kick Plate	K1050 10" CSK	US32D	RO
1 Door Stop	403/441CU (TO SUIT)	US26D	RO
3 Silencer	608/609 (TO SUIT)		RO

Set: 15.0

Doors: C106

3 Hinge	TA2714	US26D	MK
1 Storeroom Lock	AU 4705LN	626	YA
1 Surface Closer	3321	689	YA
1 Kick Plate	K1050 10" CSK	US32D	RO
3 Silencer	608/609 (TO SUIT)		RO

Set: 16.0

Doors: A103, A106, B104

3 Hinge	TA2714	US26D	MK
1 Privacy Lock	AU 4702LN	626	YA
1 Kick Plate	K1050 10" CSK	US32D	RO
1 Mop Plate	K1050 4" CSK	US32D	RO
1 Door Stop	403/441CU (TO SUIT)	US26D	RO
3 Silencer	608/609 (TO SUIT)		RO
1 Coat Hook	RM802	US32D	RO

Set: 17.0

Doors: A108.1, A111.1

0 All Hardware	BY DOOR SUPPLIER

END OF SECTION 087100

SECTION 09 0561

COMMON WORK RESULTS FOR FLOORING PREPARATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This section applies to floors identified in Contract Documents that are receiving the following types of floor coverings:
   1. Resilient tile and sheet.
   2. Carpet tile.
   3. Thin-set ceramic tile and stone tile.
B. Preparation of new concrete floor slabs for installation of floor coverings.
C. Testing of concrete floor slabs for moisture and alkalinity (pH).
D. Remediation of concrete floor slabs due to unsatisfactory moisture or alkalinity (pH) conditions.
   1. Contractor shall perform all specified remediation of concrete floor slabs. If such remediation is indicated by testing agency's report and is due to a condition not under Contractor's control or could not have been predicted by examination prior to entering into the contract, a contract modification will be issued.
E. Patching compound.
F. Remedial floor coatings.

1.02 REFERENCE STANDARDS

A. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or (50-mm) Cube Specimens) 2016a.
B. ASTM C472 - Standard Test Methods for Physical Testing of Gypsum, Gypsum Plasters and Gypsum Concrete 1999 (Reapproved 2014).
C. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride 2016a.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordinate scheduling of cleaning and testing, so that preliminary cleaning has been completed for at least 24 hours prior to testing.

1.04 SUBMITTALS

A. Floor Covering and Adhesive Manufacturers' Product Literature: For each specific combination of substrate, floor covering, and adhesive to be used; showing:
   1. Moisture and alkalinity (pH) limits and test methods.
   2. Manufacturer's required bond/compatibility test procedure.
B. Remedial Materials Product Data: Manufacturer's published data on each product to be used for remediation.

1. Manufacturer's statement of compatibility with types of flooring applied over remedial product.
2. Test reports indicating compliance with specified performance requirements, performed by nationally recognized independent testing agency.
3. Manufacturer's installation instructions.

C. Testing Agency's Report:
1. Description of areas tested; include floor plans and photographs if helpful.
2. Summary of conditions encountered.
3. Moisture and alkalinity (pH) test reports.
4. Copies of specified test methods.
5. Recommendations for remediation of unsatisfactory surfaces.
6. Product data for recommended remedial coating.
7. Submit report directly to Owner.
8. Submit report not more than two business days after conclusion of testing.

D. Adhesive Bond and Compatibility Test Report.

1.05 QUALITY ASSURANCE

A. Moisture and alkalinity (pH) testing will be performed by an independent testing agency employed and paid by Owner.

B. Testing Agency Qualifications: Independent testing agency experienced in the types of testing specified.
1. Submit evidence of experience consisting of at least 3 test reports of the type required, with project Owner's project contact information.

C. Contractor's Responsibility Relating to Independent Agency Testing:
1. Provide access for and cooperate with testing agency.
2. Confirm date of start of testing at least 10 days prior to actual start.
3. Allow at least 4 business days on site for testing agency activities.
4. Achieve and maintain specified ambient conditions.
5. Notify Owner when specified ambient conditions have been achieved and when testing will start.

D. Remedial Coating Installer Qualifications: Company specializing in performing work of the type specified in this section, trained by or employed by coating manufacturer, and able to provide at least 3 project references showing at least 3 years' experience installing moisture emission coatings.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, handle, and protect products in accordance with manufacturer’s instructions and recommendations.

B. Deliver materials in manufacturer’s packaging; include installation instructions.

C. Keep materials from freezing.

1.07 FIELD CONDITIONS

A. Maintain ambient temperature in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 65 degrees F or more than 85 degrees F.

B. Maintain relative humidity in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 40 percent and not more than 60 percent.

PART 2 PRODUCTS

2.01 MATERIALS

A. Patching Compound: Floor covering manufacturer's recommended product, suitable for conditions, and compatible with adhesive and floor covering. In the absence of any recommendation from flooring manufacturer, provide a product with the following characteristics:

1. Cementitious moisture-, mildew-, and alkali-resistant compound, compatible with floor, floor covering, and floor covering adhesive, and capable of being feathered to nothing at edges.
2. Latex or polyvinyl acetate additions are permitted; gypsum content is prohibited.
3. Compressive Strength: 3000 psi, minimum, after 28 days, when tested in accordance with ASTM C109/C109M or ASTM C472, whichever is appropriate.

B. Alternate Flooring Adhesive: Floor covering manufacturer's recommended product, suitable for the moisture and pH conditions present; low-VOC. In the absence of any recommendation from flooring manufacturer, provide a product recommended by adhesive manufacturer as suitable for substrate and floor covering and for conditions present.

C. Remedial Floor Coating: Single- or multi-layer coating or coating/overlay combination intended by its manufacturer to resist water vapor transmission to degree sufficient to meet flooring manufacturer's emission limits, resistant to the level of alkalinity (pH) found, and suitable for adhesion of flooring without further treatment.

1. Thickness: As required for application and in accordance with manufacturer's installation instructions.
2. Use product recommended by testing agency.

PART 3 EXECUTION

3.01 CONCRETE SLAB PREPARATION

A. Follow recommendations of testing agency.

B. Perform following operations in the order indicated:

1. Preliminary cleaning.

2. Moisture vapor emission tests; 3 tests in the first 1000 square feet and one test in each additional 1000 square feet, unless otherwise indicated or required by flooring manufacturer.
3. Internal relative humidity tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
4. Alkalinity (pH) tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
5. Specified remediation, if required.
6. Patching, smoothing, and leveling, as required.
7. Other preparation specified.
8. Adhesive bond and compatibility test.
9. Protection.

C. Remediations:
1. Active Water Leaks or Continuing Moisture Migration to Surface of Slab: Correct this condition before doing any other remediation; re-test after correction.
2. Excessive Moisture Emission or Relative Humidity: If an adhesive that is resistant to the level of moisture present is available and acceptable to flooring manufacturer, use that adhesive for installation of the flooring; if not, apply remedial floor coating or remedial sheet membrane over entire suspect floor area.
3. Excessive Alkalinity (pH): If remedial floor coating is necessary to address excessive moisture, no additional remediation is required; if not, if an adhesive that is resistant to the level present is available and acceptable to the flooring manufacturer, use that adhesive for installation of the flooring; otherwise, apply a skim coat of specified patching compound over entire suspect floor area.

3.02 PRELIMINARY CLEANING

A. Clean floors of dust, solvents, paint, wax, oil, grease, asphalt, residual adhesive, adhesive removers, film-forming curing compounds, sealing compounds, alkaline salts, excessive laitance, mold, mildew, and other materials that might prevent adhesive bond.
B. Do not use solvents or other chemicals for cleaning.

3.03 MOISTURE VAPOR EMISSION TESTING

A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.
B. Where this specification conflicts with the referenced test method, comply with the requirements of this section.

C. Test in accordance with ASTM F1869 and as follows.
D. Plastic sheet test and mat bond test may not be substituted for the specified ASTM test method, as those methods do not quantify the moisture content sufficiently.
E. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if test values exceed 3 pounds per 1000 square feet per 24 hours.
F. Report: Report the information required by the test method.

3.04 ALKALINITY TESTING

A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.
B. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if alkalinity (pH) test value is over 10.

3.05 PREPARATION

A. See individual floor covering section(s) for additional requirements.
B. Comply with requirements and recommendations of floor covering manufacturer.
C. Fill and smooth surface cracks, grooves, depressions, control joints and other non-moving joints, and other irregularities with patching compound.
D. Do not fill expansion joints, isolation joints, or other moving joints.

3.06 ADHESIVE BOND AND COMPATIBILITY TESTING

A. Comply with requirements and recommendations of floor covering manufacturer.

3.07 APPLICATION OF REMEDIAL FLOOR COATING

A. Comply with requirements and recommendations of coating manufacturer.

3.08 PROTECTION

A. Cover prepared floors with building paper or other durable covering.

END OF SECTION 09 0561

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SECTION 09 2116
GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Performance criteria for gypsum board assemblies.
B. Metal stud wall framing.
C. Metal channel ceiling framing.
D. Acoustic insulation.
E. Gypsum sheathing.
F. Cementitious backing board.
G. Gypsum wallboard.
H. Joint treatment and accessories.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Wood blocking product and execution requirements.

1.03 REFERENCE STANDARDS

A. AISI S100-12 - North American Specification for the Design of Cold-Formed Steel Structural Members 2012.
B. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units 2010 (Reaffirmed 2016).
C. ANSI A118.9 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units 1999 (Reaffirmed 2016).
D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2019a.
E. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board 2017.
F. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members 2018.
G. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing 2017.
H. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products 2018.
I. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board 2018b.
J. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness 2018.

K. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs 2018.
L. ASTM C1047 - Standard Specification for Accessories For Gypsum Wallboard and Gypsum Veneer Base 2014a.
M. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing 2013.
N. ASTM C1278/C1278M - Standard Specification for Fiber-Reinforced Gypsum Panel 2017.
O. ASTM C1280 - Standard Specification for Application of Exterior Gypsum Panel Products for Use as Sheathing 2018.
P. ASTM C1325 - Standard Specification for Non-Asbestos Fiber-Mat Reinforced Cementitious Backer Units 2017a.
Q. ASTM C1396/C1396M - Standard Specification for Gypsum Board 2017.
R. ASTM C1658/C1658M - Standard Specification for Glass Mat Gypsum Panels 2018.
S. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber 2016.
T. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi 2015.
U. GA-216 - Application and Finishing of Gypsum Panel Products 2016.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide data on metal framing, gypsum board, accessories, and joint finishing system.
C. Product Data: Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.
D. Test Reports: For stud framing products that do not comply with ASTM C645 or ASTM C754, provide independent laboratory reports showing maximum stud heights at required spacings and deflections.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing gypsum board installation and finishing, with minimum five years of experience.

PART 2 PRODUCTS

2.01 GYPSUM BOARD ASSEMBLIES

A. Provide completed assemblies complying with ASTM C840 and GA-216.
    1. See PART 3 for finishing requirements.

2.02 METAL FRAMING MATERIALS

A. Manufacturers - Metal Framing, Connectors, and Accessories:

1. ClarkDietrich: www.clarkdietrich.co.
2. Marino: www.marinoware.com.
3. Phillips Manufacturing Co: www.phillipsmfg.com.
4. Substitutions: See Section 01 6000 - Product Requirements.

B. Non-structural Framing System Components: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/120 at 5 psf.
1. Studs: "C" shaped with flat or formed webs with knurled faces.
2. Runners: U shaped, sized to match studs.
3. Ceiling Channels: C-shaped.
4. Furring Members: Hat-shaped sections, minimum depth of 7/8 inch.

C. Partition Head to Structure Connections: Provide mechanical anchorage devices that accommodate deflection using slotted holes, screws and anti-friction bushings, preventing rotation of studs while maintaining structural performance of partition.
1. Structural Performance: Maintain lateral load resistance and vertical movement capacity required by applicable code, when evaluated in accordance with AISI S100-12.
2. Material: ASTM A653/A653M steel sheet, SS Grade 50/340, with G60/Z180 hot dipped galvanized coating.

2.03 BOARD MATERIALS

A. Manufacturers - Gypsum-Based Board:
1. American Gypsum Company: www.americangypsum.com.
2. Continental Building Products: www.continental-bp.com.
3. Georgia-Pacific Gypsum: www.gpgypsum.com.
4. National Gypsum Company: www.nationalgypsum.com.
5. USG Corporation: www.usg.com.
6. Substitutions: See Section 01 6000 - Product Requirements.

B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
2. Glass mat faced gypsum panels as defined in ASTM C1658/C1658M, suitable for paint finish, of the same core type and thickness may be substituted for paper-faced board.
3. Unfaced fiber-reinforced gypsum panels as defined in ASTM C1278/C1278M, suitable for paint finish, of the same core type and thickness may be substituted for paper-faced board.
4. Lightweight gypsum panels meeting ASTM C1396/C1396M with a weight of 1.8lb./sq.ft., may be substituted for standard weight paper-faced board.

5. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
    a. Mold resistant board is required at all locations.
6. Thickness:
    a. Vertical Surfaces: 5/8 inch.
    b. Ceilings: 1/2 inch.
    c. Multi-Layer Assemblies: Thicknesses as indicated on drawings.

C. Backing Board For Wet Areas: One of the following products:
1. Application: Surfaces behind tile in wet areas including tub and shower surrounds, shower ceilings, and wet walls in restrooms.
2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
3. ANSI Cement-Based Board: Non-gypsum-based; aggregated Portland cement panels with glass fiber mesh embedded in front and back surfaces complying with ANSI A118.9 or ASTM C1325.
    a. Thickness: 1/2 inch.
    b. Manufacturers:
        1) Custom Building Products: www.custombuildingproducts.com.
        2) National Gypsum Company: www.nationalgypsum.com.
        3) USG Corporation: www.usg.com.
        4) Substitutions: See Section 01 6000 - Product Requirements.

D. Backing Board For Non-Wet Areas: Water-resistant gypsum backing board as defined in ASTM C1396/C1396M; sizes to minimum joints in place; ends square cut.
1. Application: Vertical surfaces behind thinset tile, except in wet areas.
2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
3. At Assemblies Indicated with Fire-Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL or WH listed.
4. Type: Regular and Type X, in locations indicated.
5. Type X Thickness: 5/8 inch.
6. Regular Board Thickness: 5/8 inch.
7. Edges: Tapered.

E. Exterior Sheathing Board: Sizes to minimize joints in place; ends square cut.
1. Application: Exterior sheathing, unless otherwise indicated.
2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
3. Fungal Resistance: No fungal growth when tested in accordance with ASTM G21.
4. Glass Mat Faced Sheathing: Glass mat faced gypsum substrate as defined in ASTM C1177/C1177M.
5. Type X Thickness: 5/8 inch.
6. Edges: Square.

2.04 GYPSUM WALLBOARD ACCESSORIES

A. Acoustic Insulation: ASTM C665; preformed glass fiber, friction fit type, unfaced. Thickness: 2 inch.

B. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.

C. Water-Resistive Barrier: As specified in Section 07 2500.

D. Finishing Accessories: ASTM C1047, galvanized steel or rolled zinc, unless noted otherwise.

1. Types: As detailed or required for finished appearance.
2. Products:
    a. Same manufacturer as framing materials.
    b. Phillips Manufacturing Co: www.phillipsmfg.com.
    c. Trim-tex, Inc: www.trim-tex.com.

E. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.

1. Fiberglass Tape: 2 inch wide, coated glass fiber tape for joints and corners, except as otherwise indicated.
2. Joint Compound: Setting type, field-mixed.

F. Screws for Fastening of Gypsum Panel Products to Cold-Formed Steel Studs Less than 0.033 inch in Thickness and Wood Members: ASTM C1002; self-piercing tapping screws, corrosion resistant.

G. Screws for Fastening of Gypsum Panel Products to Steel Members from 0.033 to 0.112 inch in Thickness: ASTM C954; steel drill screws, corrosion resistant.

H. Anchorage to Substrate: Tie wire, nails, screws, and other metal supports, of type and size to suit application; to rigidly secure materials in place.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that project conditions are appropriate for work of this section to commence.

3.02 FRAMING INSTALLATION

A. Metal Framing: Install in accordance with ASTM C754 and manufacturer's instructions.

B. Suspended Ceilings and Soffits: Space framing and furring members as indicated.

1. Level ceiling system to a tolerance of 1/1200.
2. Laterally brace entire suspension system.

C. Studs: Space studs at 16 inches on center.

1. Extend partition framing to structure where indicated and to ceiling in other locations.

2. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer's instructions.
3. Partitions Terminating at Structure: Attach top runner to structure, maintain clearance between top of studs and structure, and connect studs to track using specified mechanical devices in accordance with manufacturer's instructions; verify free movement of top of stud connections; do not leave studs unattached to track.

D. Openings: Reinforce openings as required for weight of doors or operable panels, using not less than double studs at jambs.

E. Standard Wall Furring: Install at concrete walls scheduled to receive gypsum board, not more than 4 inches from floor and ceiling lines and abutting walls. Secure in place on alternate channel flanges at maximum 24 inches on center.
1. Orientation: Horizontal.
2. Spacing: As indicated.

F. Blocking: Install wood blocking for support of:
1. Wall mounted cabinets.
2. Toilet partitions.
3. Toilet accessories.

3.03 ACOUSTIC ACCESSORIES INSTALLATION

A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.

B. Acoustic Sealant: Install in accordance with manufacturer's instructions.

3.04 BOARD INSTALLATION

A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.

B. Single-Layer Non-Rated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.

C. Exterior Sheathing: Comply with ASTM C1280. Install sheathing vertically, with edges butted tight and ends occurring over firm bearing.
1. Seal joints, cut edges, and holes with water-resistant sealant.

D. Cementitious Backing Board: Install over steel framing members and plywood substrate where indicated, in accordance with ANSI A108.11 and manufacturer's instructions.

E. Installation on Metal Framing: Use screws for attachment of gypsum board.

3.05 INSTALLATION OF TRIM AND ACCESSORIES

A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.

1. Not more than 30 feet apart on walls and ceilings over 50 feet long.
2. At exterior soffits, not more than 30 feet apart in both directions.

B. Corner Beads: Install at external corners, using longest practical lengths.

C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.

3.06 JOINT TREATMENT

A. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
1. Level 5: Walls and ceilings to receive semi-gloss or gloss paint finish and other areas specifically indicated.
2. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
3. Level 2: In utility areas, behind cabinetry, and on backing board to receive tile finish.
4. Level 1: Fire rated wall areas above finished ceilings, whether or not accessible in the completed construction.

B. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
1. Feather coats of joint compound so that camber is maximum 1/32 inch.

C. Where Level 5 finish is indicated, spray apply high build drywall surfacer over entire surface after joints have been properly treated; achieve a flat and tool mark-free finish.

D. Fill and finish joints and corners of cementitious backing board as recommended by manufacturer.

3.07 TOLERANCES

A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction.

END OF SECTION 09 2116

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SECTION 09 3000
TILING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Tile for floor applications.
B. Tile for wall applications.
C. Non-ceramic trim.

1.02 RELATED REQUIREMENTS

A. Section 07 9200 - Joint Sealants: Sealing joints between tile work and adjacent construction and fixtures.
B. Section 09 2116 - Gypsum Board Assemblies: Tile backer board.
C. Section 22 4000 - Plumbing Fixtures: Shower receptor.

1.03 REFERENCE STANDARDS

A. ANSI A108/A118/A136 - American National Standard Specifications for the Installation of Ceramic Tile (Compendium). 2017.
B. ANSI A108.1a - American National Standard Specifications for Installation of Ceramic Tile in the Wet-Set Method, with Portland Cement Mortar 2014.
C. ANSI A108.1b - American National Standard Specifications for Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex-Portland Cement Mortar 2017.
D. ANSI A108.1c - Contractor's Option: Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar or Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex-Portland Cement Mortar 1999 (Reaffirmed 2021).
E. ANSI A108.4 - American National Standard Specifications for Installation of Ceramic Tile with Organic Adhesive or Water Cleanable Tile-Setting Epoxy Adhesive 2019.
F. ANSI A108.5 - American National Standard Specifications for Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar 2021.
G. ANSI A108.6 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and -Grout Epoxy 1999 (Reaffirmed 2019).
H. ANSI A108.8 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant Furan Resin Mortar and Grout 1999 (Reaffirmed 2019).
I. ANSI A108.9 - American National Standard Specifications for Installation of Ceramic Tile with Modified Epoxy Emulsion Mortar/Grout 1999 (Reaffirmed 2019).
J. ANSI A108.10 - American National Standard Specifications for Installation of Grout in Tilework 2017.

K. ANSI A108.12 - American National Standard for Installation of Ceramic Tile with EGP (Exterior Glue Plywood) Latex-Portland Cement Mortar 1999 (Reaffirmed 2019).
L. ANSI A108.13 - American National Standard for Installation of Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone 2005 (Reaffirmed 2010).
M. ANSI A108.19 - American National Standard Specifications for Interior Installation of Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs by the Thin-Bed Method Bonded with Modified Dry-Set Cement Mortar or Improved Modified Dry-Set Cement Mortar 2017.
N. ANSI A118.3 - American National Standard Specifications for Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy and Water Cleanable Tile-Setting Epoxy Adhesive 2013 (Revised).
O. ANSI A118.7 - American National Standard Specifications for High Performance Cement Grouts for Tile Installation 2010 (Reaffirmed 2016).
P. ANSI A118.10 - American National Standard Specifications for Load Bearing, Bonded, Waterproof Membranes For Thin-Set Ceramic Tile And Dimension Stone Installation 2014.
Q. ANSI A118.12 - American National Standard Specifications for Crack Isolation Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation 2014.
R. ANSI A137.1 - American National Standard Specifications for Ceramic Tile 2022.
S. ASTM C373 - Standard Test Methods for Determination of Water Absorption and Associated Properties by Vacuum Method for Pressed Ceramic Tiles and Glass Tiles and Boil Method for Extruded Ceramic Tiles and Non-tile Fired Ceramic Whiteware Products 2018.
T. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation 2017.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by all affected installers.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide manufacturers' data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.
C. Samples: Provide two samples of each tile and tile size used on project.
D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
E. Maintenance Data: Include recommended cleaning methods, cleaning materials, and stain removal methods.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Extra Tile: 10 square feet of each size, color, and surface finish combination.

1.06 QUALITY ASSURANCE

A. Maintain one copy of and ANSI A108/A118/A136 and TCNA (HB) on site.
B. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, with minimum five years of documented experience.
C. Installer Qualifications:
   1. Company specializing in performing tile installation, with minimum of five years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

1.08 FIELD CONDITIONS

A. Maintain ambient and substrate temperature above 50 degrees F and below 100 degrees F during installation and curing of setting materials.

PART 2 PRODUCTS

2.01 TILE

A. Manufacturers: All products of each type by the same manufacturer.
   1. Crossville, Inc.: www.crossvilleinc.com.
   2. Dal-Tile Corporation: www.daltile.com.
   3. Emser Tile, LLC: www.emser.com.
   4. Specialty Tile: www.specialtytile.com.
   5. Trinity Surfaces: www.trinitysurfaces.com.
   6. Substitutions: See Section 01 6000 - Product Requirements.
B. Glazed Wall Tile: ANSI A137.1 standard grade.
   1. Moisture Absorption: 7.0 to 20.0 percent as tested in accordance with ASTM C373.
   2. Size(s): As indicated on drawings.
   3. Surface Finish: As indicated on drawings..
   4. Color(s): As indicated on drawings.
C. Porcelain Tile: ANSI A137.1 standard grade.
   1. Moisture Absorption: 0 to 0.5 percent as tested in accordance with ASTM C373.
   2. Size(s): As indicated on drawings.
   3. Color(s): As indicated on drawings.
   4. Trim Units: Matching cove base shapes in sizes coordinated with field tile.

2.02 TRIM AND ACCESSORIES

A. Non-Ceramic Trim: Brushed stainless steel, style and dimensions to suit application, for setting using tile mortar or adhesive.
   1. Applications:
      a. Open edges of wall tile.
      b. Open edges of floor tile.
      c. Transition between floor finishes of different heights.
      d. Floor to wall joints.
   2. Manufacturers:
      a. Schluter-Systems: www.schluter.com.
      b. Genesis APS International: www.genesis-aps.com.
      c. Substitutions: See Section 01 6000 - Product Requirements.

2.03 SETTING MATERIALS

A. Manufacturers:
   1. ARDEX Engineered Cements: www.ardexamericas.com.
   2. Bostik Inc: www.bostik-us.com.
   3. Custom Building Products: www.custombuildingproducts.com.
   4. LATICRETE International, Inc: www.laticrete.com.
   5. Merkrete, by Parex USA, Inc: www.merkrete.com.
   6. Substitutions: See Section 01 6000 - Product Requirements.

B. Epoxy Adhesive and Mortar Bond Coat: ANSI A118.3.
   1. Applications: Use this type of bond coat where indicated and where no other type of bond coat is indicated.

2.04 GROUTS

A. Manufacturers:
   1. ARDEX Engineered Cements: www.ardexamericas.com.
   2. Bostik Inc: www.bostik-us.com.
   3. Custom Building Products: www.custombuildingproducts.com.
   4. LATICRETE International, Inc: www.laticrete.com.
   5. Merkrete, by Parex USA, Inc: www.merkrete.com.
   6. Substitutions: See Section 01 6000 - Product Requirements.

B. High Performance Polymer Modified Grout: ANSI A118.7 polymer modified cement grout.
   1. Applications: Use this type of grout where indicated and at all wall tile.
   2. Use sanded grout for joints 1/8 inch wide and larger; use unsanded grout for joints less than 1/8 inch wide.
   3. Color(s): As selected by Architect from manufacturer's full line.

C. Epoxy Grout: ANSI A118.3 chemical resistant and water-cleanable epoxy grout.

1. Applications: Where indicated and where no other type of grout is indicated.
2. Color(s): As selected by Architect from manufacturer's full line.

2.05 ACCESSORY MATERIALS

A. Concrete Floor Slab Crack Isolation Membrane: Material complying with ANSI A118.12; not intended as waterproofing.
   1. Crack Resistance: No failure at 1/16 inch gap, minimum.
   2. Fluid or Trowel Applied Type:
      a. Thickness: 20 mils, maximum.
      b. Products:
         1) LATICRETE International, Inc; LATICRETE Blue 92 Anti-Fracture Membrane: www.laticrete.com/#sle.
         2) Merkrete, by Parex USA, Inc; Merkrete Fracture Guard: www.merkrete.com/#sle.
         3) Substitutions: See Section 01 6000 - Product Requirements.

B. Waterproofing Membrane at Floors: Specifically designed for bonding to cementitious substrate under thick mortar bed or thin-set tile; complying with ANSI A118.10.
   1. Bonded Sheet Membrane Type:
      a. Material: Polyethylene sheet membrane with non-woven fabric laminated to both sides, 20 to 30 mils thick, nominal.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that sub-floor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive tile.
B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive tile.
C. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of setting materials to sub-floor surfaces.
D. Cementitious Subfloor Surfaces: Verify that substrates are ready for tiling installation by testing for moisture and alkalinity (pH).
   1. Test in accordance with Section 09 0561.
   2. Obtain instructions if test results are not within limits recommended by tiling material manufacturer and setting material manufacturer.
E. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

A. Protect surrounding work from damage.
B. Vacuum clean surfaces and damp clean.
C. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.

D. Prepare substrate surfaces for adhesive installation in accordance with adhesive manufacturer's instructions.

3.03 INSTALLATION - GENERAL

A. Install tile, thresholds, and stair treads and grout in accordance with applicable requirements of ANSI A108.1a through ANSI A108.19 , manufacturer's instructions, and TCNA (HB) recommendations.

B. Lay tile to pattern indicated. Do not interrupt tile pattern through openings.

C. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor joints.

D. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make grout joints without voids, cracks, excess mortar or excess grout, or too little grout.

E. Form internal angles square and external angles bullnosed.

F. Install non-ceramic trim in accordance with manufacturer's instructions.

G. Sound tile after setting. Replace hollow sounding units.

H. Keep control and expansion joints free of mortar, grout, and adhesive.

I. Prior to grouting, allow installation to completely cure; minimum of 48 hours.

J. Grout tile joints unless otherwise indicated. Use standard grout unless otherwise indicated.

K. At changes in plane and tile-to-tile control joints, use tile sealant instead of grout, with either bond breaker tape or backer rod as appropriate to prevent three-sided bonding.

3.04 INSTALLATION - FLOORS - THIN-SET METHODS

A. Over interior concrete substrates, install in accordance with TCNA (HB) Method F115, with epoxy grout, unless otherwise indicated.

3.05 INSTALLATION - WALL TILE

A. Over gypsum wallboard on wood or metal studs install in accordance with TCNA (HB) Method W243, thin-set with dry-set or latex-Portland cement bond coat, unless otherwise indicated.

B. Over interior concrete and masonry install in accordance with TCNA (HB) Method W202, thin-set with dry-set or latex-Portland cement bond coat.

3.06 CLEANING

A. Clean tile and grout surfaces.

3.07 PROTECTION

A. Do not permit traffic over finished floor surface for 4 days after installation.

END OF SECTION 09 3000

SECTION 09 5100
ACOUSTICAL CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Suspended metal grid ceiling system.
B. Acoustical units.

1.02 REFERENCE STANDARDS

A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2019a.
B. ASTM C635/C635M - Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings 2017.
C. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels 2019.
D. ASTM E1264 - Standard Classification for Acoustical Ceiling Products 2014.
E. CHPS (HPPD) - High Performance Products Database Current Edition at www.chps.net/.
F. UL (GGG) - GREENGUARD Gold Certified Products Current Edition.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.
B. Do not install acoustical units until after interior wet work is dry.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide data on suspension system components and acoustical units.
C. Samples: Submit two samples 6 by 6 inch in size illustrating material and finish of acoustical units.
D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
    1. See Section 01 6000 - Product Requirements, for additional provisions.
    2. Extra Acoustical Units: Quantity equal to 5 percent of total installed.

1.05 QUALITY ASSURANCE

A. Suspension System Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
B. Acoustical Unit Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.06 FIELD CONDITIONS

A. Maintain uniform temperature of minimum 60 degrees F, and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acoustic Tiles/Panels:
   1. Armstrong World Industries, Inc: www.armstrongceilings.com.
   2. CertainTeed Corporation: www.certainteed.com.
   3. USG Corporation: www.usg.com/ceilings.
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. Suspension Systems:
   1. Same as for acoustical units.
   2. Substitutions: See Section 01 6000 - Product Requirements.

2.02 ACOUSTICAL UNITS

A. Acoustical Units - General: ASTM E1264, Class A.
   1. VOC Content: Certified as Low Emission by one of the following:
      a. Product listing in UL (GGG).
      b. Product listing in CHPS (HPPD).

B. Acoustical Panels: Painted mineral fiber, with the following characteristics:
   1. Classification: ASTM E1264 Type III.
      a. Form: 1 and 2, Nodular and water felted.
      b. Pattern: "E" - lightly textured, and "G" smooth
   2. Size: 24 by 24 inches.
   3. Thickness: 3/4 inch.
   4. Light Reflectance: .89 percent, determined in accordance with ASTM E1264.
   5. NRC Range: .70 to .80, determined in accordance with ASTM E1264.
   6. Ceiling Attenuation Class (CAC): 35, determined in accordance with ASTM E1264.
   7. Tile Edge: Beveled.
   8. Color: White.
   9. Suspension System: Exposed grid.
   10. Basis of Design Products:
      a. USG Corporation; Mars "CLIMA PLUS" #86985 Fineline Bevel Profile

2.03 SUSPENSION SYSTEM(S)

A. Metal Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with perimeter moldings, hold down clips, stabilizer bars, clips, and splices as required.
   1. Materials:
      a. Steel Grid: ASTM A653/A653M, G30 coating, unless otherwise indicated.

B. Exposed Suspension System: Hot-dipped galvanized steel grid with aluminum cap.
   1. Application(s): Seismic.
   2. Structural Classification: Intermediate-duty, when tested in accordance with ASTM C635/C635M.
   3. Profile: Tee; 9/16 inch face width.
   4. Finish: Baked enamel.
   5. Color: White.
   6. Products:
      a. USG Corporation; Donn Centricitee Acoustical Suspension System DXT/DXLT T Bar Grid, 9/16": www.usg.com/ceilings/#sle.
      b. Substitutions: See Section 01 6000 - Product Requirements.

2.04 ACCESSORIES

A. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.
B. Hanger Wire: 12-gage 0.08 inch galvanized steel wire.
C. Perimeter Moldings: Same metal and finish as grid.
   1. Size: As required for installation conditions.
   2. Angle Molding: L-shaped, for mounting at same elevation as face of grid.
D. Touch-up Paint: Type and color to match acoustical and grid units.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.
B. Verify that layout of hangers will not interfere with other work.

3.02 INSTALLATION - SUSPENSION SYSTEM

A. Install suspension system in accordance with ASTM C636/C636M and manufacturer's instructions and as supplemented in this section.
B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.
C. Locate system on room axis according to reflected plan.
D. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
   1. Use longest practical lengths.
   2. Overlap and rivet corners.
E. Suspension System, Non-Seismic: Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.
F. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.

G. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.
H. Support fixture loads using supplementary hangers located within 6 inches of each corner, or support components independently.
I. Do not eccentrically load system or induce rotation of runners.

3.03 INSTALLATION - ACOUSTICAL UNITS

A. Install acoustical units in accordance with manufacturer's instructions.
B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.
C. Fit border trim neatly against abutting surfaces.
D. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.
E. Cutting Acoustical Units:
    1. Cut to fit irregular grid and perimeter edge trim.
    2. Make field cut edges of same profile as factory edges.

3.04 TOLERANCES

A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.
B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

END OF SECTION 09 5100

SECTION 09 6500
RESILIENT FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Resilient tile flooring.
B. Resilient base.
C. Installation accessories.

1.02 RELATED REQUIREMENTS

A. Section 09 0561 - Common Work Results for Flooring Preparation: Removal of existing floor coverings, cleaning, and preparation.

1.03 REFERENCE STANDARDS

A. ASTM F1700 - Standard Specification for Solid Vinyl Floor Tile 2018a.
B. ASTM F1861 - Standard Specification for Resilient Wall Base 2016.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.
C. Verification Samples: Submit two full size samples of each resilient flooring product illustrating color and pattern of each product specified. For resilient base samples, submit two samples, full height by 4 inches long in size illustrating color and pattern of each product specified.
D. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.
E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
    1. See Section 01 6000 - Product Requirements, for additional provisions.
    2. Extra Flooring Material: 10 square feet of each type and color.
    3. Extra Wall Base: 100 linear feet of each type and color.
    4. Extra Stair Materials: Quantity equivalent to 5 percent of each type and color.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing specified flooring with minimum three years documented experience.
B. Installer Qualifications: Company specializing in installing specified flooring with minimum three years documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Upon receipt, immediately remove any shrink-wrap and check materials for damage and the correct style, color, quantity and run numbers.

B. Store all materials off of the floor in an acclimatized, weather-tight space.
C. Maintain temperature in storage area between 55 degrees F and 90 degrees F.

PART 2 PRODUCTS

2.01 TILE FLOORING

A. Vinyl Tile - Type LVT Plank Flooring: Printed film type, with transparent or translucent wear layer.
   1. Manufacturers:
      a. Armstrong Flooring, Inc.: www.armstrongflooring.com.
      b. Johnsonite, a Tarkett Company: www.johnsonite.com.
      c. Mannington Commercial:www.manningtoncommercial.com.
      d. Tandus Centiva: www.tandus-centiva.com.
      e. Substitutions: See Section 01 6000 - Product Requirements.
   2. Minimum Requirements: Comply with ASTM F1700, of Class corresponding to type specified.
   3. Plank Tile Size: 3 by 36 inch.
   4. Wear Layer Thickness: 0.020 inch.
   5. Total Thickness: .120 inch.
   6. Pattern: As indicated on drawings.
   7. Color: As indicated on drawings.

2.02 RESILIENT BASE

A. Resilient Base: ASTM F1861, Type TS rubber, vulcanized thermoset; top set Style B, Cove.
   1. Manufacturers:
      a. Burke Flooring: www.burkeflooring.com.
      b. Johnsonite, a Tarkett Company: www.johnsonite.com.
      c. Roppe Corp: www.roppe.com.
      d. Substitutions: See Section 01 6000 - Product Requirements.
   2. Height: 4 inch.
   3. Thickness: 0.125 inch.
   4. Finish: Satin.
   5. Length: Roll.
   6. Color: As indicated on drawings.

2.03 ACCESSORIES

A. Subfloor Filler: White premix latex; type recommended by adhesive material manufacturer.
B. Primers, Adhesives, and Seam Sealer: Waterproof; types recommended by flooring manufacturer.
C. Moldings, Transition and Edge Strips: Same material as flooring.

D. Filler for Coved Base: Plastic.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of flooring to substrate.

B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive resilient base.

C. Cementitious Subfloor Surfaces: Verify that substrates are ready for resilient flooring installation by testing for moisture and alkalinity (pH).

1. Test in accordance with Section 09 0561.
2. Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.

3.02 INSTALLATION - GENERAL

A. Starting installation constitutes acceptance of subfloor conditions.

B. Install in accordance with manufacturer's written instructions.

3.03 INSTALLATION - TILE FLOORING

A. Mix tile from container to ensure shade variations are consistent when tile is placed, unless otherwise indicated in manufacturer's installation instructions.

B. Lay flooring with joints and seams parallel to building lines to produce symmetrical pattern.

C. Install square tile to ashlar pattern. Allow minimum 1/2 full size tile width at room or area perimeter.

D. Install plank tile with a random offset of at least 6 inches from adjacent rows.

3.04 INSTALLATION - RESILIENT BASE

A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches between joints.

B. Miter internal corners. At external corners, 'V' cut back of base strip to 2/3 of its thickness and fold.

C. Install base on solid backing. Bond tightly to wall and floor surfaces.

D. Scribe and fit to door frames and other interruptions.

3.05 CLEANING

A. Remove excess adhesive from floor, base, and wall surfaces without damage.

B. Clean in accordance with manufacturer's written instructions.

3.06 PROTECTION

A. Prohibit traffic on resilient flooring for 48 hours after installation.

END OF SECTION 09 6500

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SECTION 09 9113
EXTERIOR PAINTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.
B. Field application of paints.
C. Scope: Finish exterior surfaces exposed to view, unless fully factory-finished and as noted on drawings .
D. Do Not Paint or Finish the Following Items:
   1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
   2. Items indicated to receive other finishes.
   3. Items indicated to remain unfinished.
   4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
   5. Non-metallic roofing and flashing.
   6. Stainless steel, anodized aluminum, bronze, terne coated stainless steel, zinc, and lead.
   7. Marble, granite, slate, and other natural stones.
   8. Floors, unless specifically indicated.
   9. Ceramic and other types of tiles.
   10. Brick, glass unit masonry, architectural concrete, cast stone, integrally colored plaster and stucco.
   11. Glass.
   12. Concealed pipes, ducts, and conduits.

1.02 DEFINITIONS

A. Comply with ASTM D16 for interpretation of terms used in this section.

1.03 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency current edition.
B. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications 2016.
C. MPI (APL) - Master Painters Institute Approved Products List; Master Painters and Decorators Association Current Edition.
D. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual Current Edition.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide complete list of products to be used, with the following information for each:
   1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
   2. MPI product number (e.g. MPI #47).
   3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
   4. Manufacturer's installation instructions.

C. Samples: Submit two painted samples, illustrating selected colors and textures for each color and system selected with specified coats cascaded. Submit on tempered hardboard, 8 1/2 x 11 inch in size.

D. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, material safety data sheets (MSDS), care and cleaning instructions, touch-up procedures, repair of painted and finished surfaces, and color samples of each color and finish used.

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Extra Paint and Finish Materials: 1 gallon of each color; from the same product run, store where directed.
   3. Label each container with color in addition to the manufacturer's label.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum three years experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.07 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Provide paints and finishes used in any individual system from the same manufacturer; no exceptions.

B. Paints:

1. Benjamin Moore & Co.: www.benjaminmoore.com.
2. PPG Paints: www.ppgpaints.com.
3. Sherwin-Williams Company: www.sherwin-williams.com.

C. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PAINTS AND FINISHES - GENERAL

A. Paints and Finishes: Ready mixed, unless required to be a field-catalyzed paint.

1. Where MPI paint numbers are specified, provide products listed in Master Painters Institute Approved Product List, current edition available at www.paintinfo.com, for specified MPI categories, except as otherwise indicated.
2. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
3. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
4. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color.
5. Supply each paint material in quantity required to complete entire project's work from a single production run.
6. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.

B. Volatile Organic Compound (VOC) Content:

1. Provide paints and finishes that comply with the most stringent requirements specified in the following:
    a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
    b. Ozone Transport Commission (OTC) Model Rule, Architectural, Industrial, and Maintenance Coatings; www.otcair.org; specifically:
        1) Opaque, Flat: 50 g/L, maximum.

2) Opaque, Nonflat: 150 g/L, maximum.
3) Opaque, High Gloss: 250 g/L, maximum.

2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.

C. Flammability: Comply with applicable code for surface burning characteristics.
D. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.
E. Colors: As indicated on drawings.
1. Extend colors to surface edges; colors may change at any edge as directed by Architect.

2.03 PAINT SYSTEMS - EXTERIOR

A. Exterior Surfaces to be Painted, Unless Otherwise Indicated: Including concrete masonry units, primed metal, and bare steel.
1. Two top coats and one coat primer.
2. Top Coat(s): Exterior Latex; MPI #10, 11, 15, 119, or 214.
3. Top Coat Sheen:
a. Semi-Gloss: MPI gloss level 5; use this sheen at all locations.
4. Primer: As recommended by top coat manufacturer for specific substrate.

PART 3 EXECUTION

3.01 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to application.
B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces for finishing.
D. Seal surfaces that might cause bleed through or staining of topcoat.
E. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
F. Masonry:
G. Exterior Plaster: Fill hairline cracks, small holes, and imperfections with exterior patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.

3.02 APPLICATION

A. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".

B. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
C. Apply each coat to uniform appearance.
D. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
E. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.03 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.04 PROTECTION

A. Protect finishes until completion of project.
B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION 09 9113

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SECTION 09 9123
INTERIOR PAINTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.
B. Field application of paints.
C. Scope: Finish interior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.
    1. Both sides and edges of plywood backboards for electrical and telecom equipment before installing equipment.
    2. Mechanical and Electrical:
        a. In finished areas, paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, mechanical equipment, and electrical equipment, unless otherwise indicated.
        b. Paint interior surfaces of air ducts and convector and baseboard heating cabinets that are visible through grilles and louvers with one coat of flat black paint to visible surfaces.
        c. Paint dampers exposed behind louvers, grilles, and convector and baseboard cabinets to match face panels.
D. Do Not Paint or Finish the Following Items:
    1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
    2. Items indicated to receive other finishes.
    3. Items indicated to remain unfinished.
    4. Fire rating labels, equipment serial number and capacity labels, bar code labels, and operating parts of equipment.
    5. Stainless steel, anodized aluminum, bronze, terne coated stainless steel, and lead items.
    6. Floors, unless specifically indicated.
    7. Ceramic and other tiles.
    8. Brick, architectural concrete, cast stone, integrally colored plaster and stucco.
    9. Glass.
    10. Acoustical materials, unless specifically indicated.
    11. Concealed pipes, ducts, and conduits.

1.02 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency current edition.

B. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials 2016.
C. CARB (SCM) - Suggested Control Measure for Architectural Coatings; California Air Resources Board 2007.
D. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual Current Edition.
E. SCAQMD 1113 - Architectural Coatings 1977 (Amended 2016).
F. SSPC-SP 1 - Solvent Cleaning 2015, with Editorial Revision (2016).
G. SSPC-SP 6 - Commercial Blast Cleaning 2007.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide complete list of products to be used, with the following information for each:
   1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
   2. MPI product number (e.g. MPI #47).
   3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.
   1. Where sheen is specified, submit samples in only that sheen.
D. Manufacturer's Instructions: Indicate special surface preparation procedures.
E. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, material safety data sheets (MSDS), care and cleaning instructions, touch-up procedures, repair of painted and finished surfaces, and color samples of each color and finish used.
F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Extra Paint and Finish Materials: 1 gallon of each color; from the same product run, store where directed.
   3. Label each container with color in addition to the manufacturer's label.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.
B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum 3 years experience and approved by manufacturer.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.06 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Provide paints and finishes used in any individual system from the same manufacturer; no exceptions.

B. Paints:

1. Base Manufacturer: . Scuffmaster: www.scuffmaster.com
2. PPG Paints: www.ppgpaints.com/#sle.
3. Sherwin-Williams Company: www.sherwin-williams.com/#sle.
4. Benjamin Moore & Co.: www.benjaminmoore.com

C. Primer Sealers: Same manufacturer as top coats.

D. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PAINTS AND FINISHES - GENERAL

A. Paints and Finishes: Ready mixed, unless intended to be a field-catalyzed paint.

1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
3. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color.

4. Supply each paint material in quantity required to complete entire project's work from a single production run.
5. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.

B. Volatile Organic Compound (VOC) Content:
1. Provide paints and finishes that comply with the most stringent requirements specified in the following:
a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
b. SCAQMD 1113 Rule.
c. CARB (SCM).
d. Ozone Transport Commission (OTC) Model Rule, Architectural, Industrial, and Maintenance Coatings; www.otcair.org; specifically:
1) Opaque, Flat: 50 g/L, maximum.
2) Opaque, Nonflat: 150 g/L, maximum.
3) Opaque, High Gloss: 250 g/L, maximum.
2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.

C. Flammability: Comply with applicable code for surface burning characteristics.

D. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.

E. Colors: As indicated on drawings.
1. Selection to be made by Architect after award of contract.
2. Allow for minimum of three colors for each system, unless otherwise indicated, without additional cost to Owner.
3. Extend colors to surface edges; colors may change at any edge as directed by Architect.
4. In finished areas, finish pipes, ducts, conduit, and equipment the same color as the wall/ceiling they are mounted on/under.

2.03 PAINT SYSTEMS - INTERIOR

A. Paint I-OP - Interior Surfaces to be Painted, Unless Otherwise Indicated: Including gypsum board, concrete, concrete masonry units, brick, wood, plaster, uncoated steel, shop primed steel, galvanized steel, and aluminum.
1. Two top coats and one coat primer.
2. Top Coat(s): High Performance Polyerethane Coating
a. Products:

1) Scuffmaster Scrubtough
2) Substitutions: Section 01 6000 - Product Requirements.

3. Top Coat Sheen:
   a. Eggshell: MPI gloss level 3; use this sheen at all locations.
4. Primer: As recommended by top coat manufacturer for specific substrate.

B. Paint I-OP-MD-DT - Medium Duty Door/Trim: For surfaces subject to frequent contact by occupants, including metals and wood:
1. Medium duty applications include doors, door frames, railings, handrails, guardrails, and balustrades.
2. Two top coats and one coat primer.
3. Top Coat(s) High Performance
   a. Products:
      1) Scruffmaster Scrubtough Max.
      2) Substitutions: Section 01 6000 - Product Requirements.
4. Top Coat Sheen:
   a. Semi-Gloss: MPI gloss level 5; use this sheen at all locations.
5. Primer: As recommended by top coat manufacturer for specific substrate.

2.04 ACCESSORY MATERIALS

A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.
B. Patching Material: Latex filler.
C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.
C. Test shop-applied primer for compatibility with subsequent cover materials.
D. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
1. Gypsum Wallboard: 12 percent.
2. Plaster and Stucco: 12 percent.
3. Masonry, Concrete, and Concrete Masonry Units: 12 percent.
4. Interior Wood: 15 percent, measured in accordance with ASTM D4442.

3.02 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to application.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
C. Remove or repair existing paints or finishes that exhibit surface defects.
D. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.
E. Seal surfaces that might cause bleed through or staining of topcoat.
F. Masonry:
    1. Remove efflorescence and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces or if alkalinity of mortar joints exceed that permitted in manufacturer's written instructions. Allow to dry.
    2. Prepare surface as recommended by top coat manufacturer.
G. Gypsum Board: Fill minor defects with filler compound. Spot prime defects after repair.
H. Plaster: Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.
I. Aluminum: Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
J. Galvanized Surfaces:
K. Ferrous Metal:
    1. Solvent clean according to SSPC-SP 1.
    2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.
    3. Remove rust, loose mill scale, and other foreign substances using using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning". Protect from corrosion until coated.
L. Wood Surfaces to Receive Opaque Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats. Back prime concealed surfaces before installation.
M. Wood Doors to be Field-Finished: Seal wood door top and bottom edge surfaces with clear sealer.

3.03 APPLICATION

A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
B. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".

C. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
D. Apply each coat to uniform appearance in thicknesses specified by manufacturer.
E. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply as many coats as necessary for complete hide.
F. Sand wood and metal surfaces lightly between coats to achieve required finish.
G. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
H. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.05 PROTECTION

A. Protect finishes until completion of project.
B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION 09 9123

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SECTION 09 9600
HIGH-PERFORMANCE COATINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. High performance coatings.

B. Surface preparation.

1.02 RELATED REQUIREMENTS

A. Section 09 9113 - Exterior Painting.

1.03 REFERENCE STANDARDS

A. MPI (APL) - Master Painters Institute Approved Products List; Master Painters and Decorators Association Current Edition.

B. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual Current Edition.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide complete list of all products to be used, with the following information for each:

1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
2. MPI product number (e.g. MPI #47).
3. Cross-reference to specified coating system(s) product is to be used in; include description of each system.

C. Samples: Submit two samples 8 by 8 inch in size illustrating colors available for selection as indicated below.

1. Step coats on samples to show each coat required for system.
2. Label each coat of each sample.
3. Label each sample for location and application area.

1.05 QUALITY ASSURANCE

A. Maintain one copy of each referenced document that applies to application on site.

B. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of coating, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Coating Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.07 FIELD CONDITIONS

A. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

B. Do not apply exterior coatings during rain or snow, or when relative humidity is outside the humidity ranges required by the coating product manufacturer.

C. Do not install materials when temperature is below 55 degrees F or above 90 degrees F.

D. Maintain this temperature range, 24 hours before, during, and 72 hours after installation of coating.

E. Restrict traffic from area where coating is being applied or is curing.

1.08 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Only materials (primers, coatings, etc.) listed in the latest edition of the MPI Approved Product List (APL) are acceptable for use on this project.

B. High-Performance Coatings:

1. Dow: www.dow.com/#sle.
2. PPG Paints: www.ppgpaints.com/#sle.
3. Precision Coatings: www.precisioncoatingsinc.com/#sle.
4. PPG Architectural Finishes, Inc: www.ppgac.com
5. Substitutions: Section 01 6000 - Product Requirements.

2.02 HIGH-PERFORMANCE COATINGS

A. MPI Standards: Provide products that comply with MPI standards indicated and are listed in MPI Approved Products List.

B. Provide coating systems that meet the following minimum performance criteria, unless more stringent criteria are specified:

2.03 TOP COAT MATERIALS

A. Coatings - General: Provide complete multi-coat systems formulated and recommended by manufacturer for the applications indicated, in the thicknesses indicated; number of coats specified does not include primer or filler coat.

B. Shellac: Pure, white type.

2.04 PRIMERS

A. Primers: Provide the following unless other primer is required or recommended by coating manufacturer.
   1. Anti-Corrosive for Metal, Alkyd; MPI #79.
   2. Anti-Corrosive for Metal, Epoxy; MPI #101.
   3. Rust-Inhibitive, Water Based; MPI #107.
   4. Primer for Galvanized Metal, Water Based; MPI #134.
   5. Alkali Resistant, Water Based; MPI #3.

2.05 ACCESSORY MATERIALS

A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of coated surfaces.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.
B. Do not begin application of coatings until substrates have been properly prepared.
C. Verify that substrate surfaces are ready to receive work as instructed by the coating manufacturer. Obtain and follow manufacturer's instructions for examination and testing of substrates.
D. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

3.02 PREPARATION

A. Protect adjacent surfaces and materials not receiving coating from spatter and overspray; mask if necessary to provide adequate protection. Repair damage.
B. Clean surfaces of loose foreign matter.
C. Remove substances that would bleed through finished coatings. If unremovable, seal surface with shellac.
D. Remove finish hardware, fixture covers, and accessories and store.

3.03 PRIMING

A. Apply primer to all surfaces, unless specifically not required by coating manufacturer. Apply in accordance with coating manufacturer's instructions.

3.04 COATING APPLICATION

A. Apply coatings in accordance with manufacturer's written instructions, to thicknesses specified and recommendations in MPI - Architectural Painting and Specification Manual.
B. Apply in uniform thickness coats, without runs, drips, pinholes, brush marks, or variations in color, texture, or finish. Finish edges, crevices, corners, and other changes in dimension with full coating thickness.

3.05 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements for general requirements for field inspection.

B. Owner will provide field inspection.

C. Dry Film Thickness Testing: Owner will engage the services of a qualified testing and inspecting agency to inspect and test coatings for dry film thickness.

3.06 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

B. Clean surfaces immediately of overspray, splatter, and excess material.

C. After coating has cured, clean and replace finish hardware, fixtures, and fittings previously removed.

3.07 PROTECTION

A. Protect finished work from damage.

END OF SECTION 09 9600

SECTION 10 1400
SIGNAGE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Room and door signs.
B. Interior directional and informational signs.
C. Emergency evacuation maps.
D. Building identification signs.

1.02 REFERENCE STANDARDS

A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines current edition.
B. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design 2010.
C. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Manufacturer's printed product literature for each type of sign, indicating sign styles, font, foreground and background colors, locations, overall dimensions of each sign.
C. Signage Schedule: Provide information sufficient to completely define each sign for fabrication, including room number, room name, other text to be applied, sign and letter sizes, fonts, and colors.
    1. When room numbers to appear on signs differ from those on drawings, include the drawing room number on schedule.
    2. When content of signs is indicated to be determined later, request such information from Owner through Architect at least 2 months prior to start of fabrication; upon request, submit preliminary schedule.
    3. Submit for approval by Owner through Architect prior to fabrication.
D. Selection Samples: Where colors are not specified, submit two sets of color selection charts or chips.
E. Verification Samples: Submit samples showing colors specified.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Package signs as required to prevent damage before installation.

B. Package room and door signs in sequential order of installation, labeled by floor or building.
C. Store tape adhesive at normal room temperature.

1.06 FIELD CONDITIONS

A. Do not install tape adhesive when ambient temperature is lower than recommended by manufacturer.
B. Maintain this minimum temperature during and after installation of signs.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Flat Signs:
   1. Best Sign Systems, Inc: www.bestsigns.com/#sle.
   2. Mohawk Sign Systems, Inc: www.mohawksign.com/#sle.
   3. APCO Graphics, Inc.: www.apcosigns.com
   4. ASI Sign Systems, Inc.: www.asisignage.com
   5. Substitutions: See Section 01 6000 - Product Requirements.
B. Dimensional Letter Signs:
   1. A.R.K. Ramos Architectural Signage Systems; Cast Aluminum Letters: www.arkramos.com/#sle.
   2. Cosco Industries; Cast Aluminum: www.coscoarchitecturalsigns.com/#sle.
   3. Inpro: www.inprocorp.com/#sle.
   4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 SIGNAGE APPLICATIONS

A. Accessibility Compliance: Signs are required to comply with ADA Standards and ICC A117.1, unless otherwise indicated; in the event of conflicting requirements, comply with the most comprehensive and specific requirements.
B. Room and Door Signs: Provide a sign for every doorway, whether it has a door or not, not including corridors, lobbies, and similar open areas.
   1. Sign Type: Flat signs with engraved panel media as specified.
   2. Provide "tactile" signage, with letters raised minimum 1/32 inch and Grade II braille.
   3. Character Height: 1 inch.
   4. Sign Height: 2 inches, unless otherwise indicated.
   5. Office Doors: Identify with room numbers to be determined later, not the numbers indicated on drawings; in addition, provide "window" section for replaceable occupant name.
   6. Conference and Meeting Rooms: Identify with room numbers to be determined later, not the numbers indicated on drawings; in addition, provide "window" section with sliding "In Use/Vacant" indicator.

7. Service Rooms: Identify with room names and numbers to be determined later, not those indicated on drawings.
8. Rest Rooms: Identify with pictograms, the names "MEN" and "WOMEN", room numbers to be determined later, and braille.

C. Interior Directional and Informational Signs:
1. Sign Type: Same as room and door signs.
2. Allow for 20 signs 4 inches high by 16 inches long.

D. Emergency Evacuation Maps:
1. Map content to be provided by Owner.
2. Use clear plastic panel silk-screened on reverse, in brushed aluminum frame, screw-mounted.

E. Building Identification Signs:
1. Use individual metal letters.
2. Mount on outside wall in location indicated on drawings.

2.03 SIGN TYPES

A. Flat Signs: Signage media without frame.
1. Edges: Square.
2. Corners: Square.
3. Wall Mounting of One-Sided Signs: Tape adhesive.

B. Color and Font: Unless otherwise indicated:
1. Character Font: Helvetica, Arial, or other sans serif font.
2. Character Case: Upper case only.
3. Background Color: Clear.
4. Character Color: Contrasting color.

2.04 TACTILE SIGNAGE MEDIA

A. Engraved Panels: Laminated colored plastic; engraved through face to expose core as background color:
1. Total Thickness: 1/16 inch.

B. Injection Molded Panels: One-piece acrylic plastic, with raised letters and braille.
1. Total Thickness: 1/8 inch.

2.05 NON-TACTILE SIGNAGE MEDIA

A. Silk Screened Plastic Panels: Letters and graphics silk screened onto reverse side of plastic surface:
1. Sign Color: Clear.
2. Total Thickness: 1/8 inch.

2.06 DIMENSIONAL LETTERS

A. Metal Letters:
1. Metal: Aluminum casting.

2. Metal Thickness: 1/8 inch minimum.
3. Text and Typeface:
    a. Character Font: Helvetica, Arial, or other sans serif font.
    b. Character Case: Upper case only.
4. Finish: Brushed, satin.
5. Mounting: Concealed screws.

2.07 ACCESSORIES

A. Concealed Screws: Stainless steel, galvanized steel, chrome plated, or other non-corroding metal.

B. Tape Adhesive: Double sided tape, permanent adhesive.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install neatly, with horizontal edges level.

C. Protect from damage until Substantial Completion; repair or replace damaged items.

END OF SECTION 10 1400

SECTION 10 2113.17
PHENOLIC TOILET COMPARTMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Phenolic toilet compartments.

B. Urinal and vestibule screens.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Blocking and supports.

B. Section 10 2800 - Toilet, Bath, and Laundry Accessories.

1.03 REFERENCE STANDARDS

A. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2015.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate the work with placement of support framing and anchors in walls and ceilings.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on panel construction, hardware, and accessories.

C. Shop Drawings: Indicate partition plan, elevation views, dimensions, details of wall supports, door swings.

D. Samples: Submit two samples of partition panels, 12 by 12 inch in size illustrating panel finish, color, and sheen.

E. Manufacturer's Installation Instructions: Indicate special procedures.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Phenolic Toilet Compartments:

1. All American Metal Corp - AAMCO: www.allamericanmetal.com/#sle.
2. Partition Systems International of South Carolina; Phenolic Toilet Partitions: www.psisc.com/#sle.
3. Bobrick Washroom Equipment, Inc.: www.bobrick.com
4. Substitutions: Section 01 6000 - Product Requirements.

2.02 PHENOLIC TOILET COMPARTMENTS

A. Toilet Compartments: Factory fabricated doors, pilasters, and divider panels made of solid phenolic core panels with integral melamine finish, floor-mounted unbraced.

B. Doors:

1. Thickness: 3/4 inch.
2. Width: 28 inch.
3. Width for Handicapped Use: 36 inch, out-swinging.

4. Height: 58 inch.

C. Panels:
   1. Thickness: 1/2 inch.
   2. Height: 58 inch.
   3. Depth: As indicated on drawings.

D. Pilasters:
   1. Thickness: 3/4 inch.
   2. Width: As required to fit space; minimum 3 inch.

E. Screens: Without doors; to match compartments; mounted to wall with two panel brackets with vertical support/bracing same as compartments.

2.03 ACCESSORIES

A. Pilaster Shoes: Formed ASTM A666 Type 304 stainless steel with No. 4 finish, 3 inch high, concealing floor fastenings.

B. Attachments, Screws, and Bolts: Stainless steel , tamper proof type.

C. Hardware: Polished stainless steel:
   1. Pivot hinges, gravity type, adjustable for door close positioning; two per door.
   2. Door Latch: Slide type with exterior emergency access feature.
   3. Door strike and keeper with rubber bumper; mounted on pilaster in alignment with door latch.
   4. Coat hook with rubber bumper; one per compartment, mounted on door.
   5. Provide door pull for outswinging doors.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify correct spacing of and between plumbing fixtures.

C. Verify correct location of built-in framing, anchorage, and bracing.

3.02 INSTALLATION

A. Install partitions secure, rigid, plumb, and level in accordance with manufacturer's instructions.

B. Maintain 3/8 inch to 1/2 inch space between wall and panels and between wall and end pilasters.

C. Attach panel brackets securely to walls using anchor devices.

D. Attach panels and pilasters to brackets. Locate head rail joints at pilaster center lines.

E. Field touch-up of scratches or damaged finish will not be permitted. Replace damaged or scratched materials with new materials.

3.03 TOLERANCES

A. Maximum Variation From True Position: 1/4 inch.

B. Maximum Variation From Plumb: 1/8 inch.

3.04 ADJUSTING

A. Adjust and align hardware to uniform clearance at vertical edge of doors, not exceeding 3/16 inch.

B. Adjust hinges to position doors in partial opening position when unlatched. Return out-swinging doors to closed position.

C. Adjust adjacent components for consistency of line or plane.

END OF SECTION 10 2113.17

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SECTION 10 2600
WALL AND DOOR PROTECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Corner guards.

1.02 RELATED REQUIREMENTS

A. Section 09 2116 - Gypsum Board Assemblies: Placement of supports in stud wall construction.

1.03 REFERENCE STANDARDS

A. ASTM D256 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics 2010 (Reapproved 2018).

B. ASTM F476 - Standard Test Methods for Security of Swinging Door Assemblies 2014.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Indicate physical dimensions, features, wall mounting brackets with mounted measurements, anchorage details, and rough-in measurements.

C. Samples: Submit samples illustrating component design, configurations, joinery, color and finish.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver wall and door protection items in original, undamaged protective packaging. Label items to designate installation locations.

B. Do not deliver products to project site until areas for storage and installation are fully enclosed, and interior temperature and humidity are in compliance with manufacturer's recommendations for each type of item.

C. Store products in either horizontal or vertical position, in compliance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Corner Guards:

1. Babcock-Davis: www.babcockdavis.com/#sle.
2. Construction Specialties, Inc; Acrovyn Solid Color and Chameleon Crash Rails: www.c-sgroup.com/#sle.
3. Inpro: www.inprocorp.com/#sle.
4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PERFORMANCE CRITERIA

A. Impact Strength: Unless otherwise noted, provide protection products and assemblies that have been successfully tested for compliance with applicable provisions of ASTM D256 and/or ASTM F476.

2.03 PRODUCT TYPES

A. Corner Guards - Surface Mounted:
   1. Material: Type 304 stainless steel, No. 4 finish, 16 gage, .064 inch thick.
   2. Width of Wings: 3 1/2 inches.
   3. Corner: Square.
   4. Color: As selected from manufacturer's standard colors.
   5. Length: One piece.

B. Adhesives and Primers: As recommended by manufacturer.

2.04 FABRICATION

A. Fabricate components with tight joints, corners and seams.

PART 3 EXECUTION

3.01 INSTALLATION

A. Position corner guard 4 inches above finished floor to 72 inches high.

3.02 TOLERANCES

A. Maximum Variation From Required Height: 1/4 inch.

3.03 CLEANING

A. See Section 01 7419 - Construction Waste Management and Disposal, for additional requirements.

B. Clean wall and door protection items of excess adhesive, dust, dirt, and other contaminants.

END OF SECTION 10 2600

SECTION 10 2800
TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Commercial toilet accessories.
B. Commercial shower and bath accessories.
C. Electric hand/hair dryers.
D. Diaper changing stations.
E. Utility room accessories.

1.02 RELATED REQUIREMENTS

A. Section 06 1000: Concealed supports for accessories, including in wall framing and plates.
B. Section : Placement of concealed anchor devices.
C. Section 09 3000 - Tiling: Ceramic washroom accessories.

1.03 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design 2010.
B. ASME A112.18.9 - Protectors/Insulators for Exposed Waste and Supplies on Accessible Fixtures 2011 (Reaffirmed 2017).
C. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service 2015a (Reapproved 2019).
D. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2015.
E. ASTM C1036 - Standard Specification for Flat Glass 2016.
F. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass 2018.
G. ASTM C1822 - Standard Specification for Insulating Covers on Accessible Lavatory Piping 2015.
H. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2019b.
I. ASTM F2285 - Standard Consumer Safety Performance Specification for Diaper Changing Tables for Commercial Use 2004, with Editorial Revision (2016).
J. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi 2015.
K. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with the placement of internal wall reinforcement, concealed ceiling supports, and reinforcement of toilet partitions to receive anchor attachments.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.

C. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Commercial Toilet, Shower, and Bath Accessories:
   1. AJW Architectural Products: www.ajw.com/#sle.
   2. American Specialties, Inc: www.americanspecialties.com/#sle.
   3. Bradley Corporation: www.bradleycorp.com/#sle.
   4. Basis of Design: Bobrick Washroom Equipment, Inc.; www.bobrick.com
   5. Substitutions: Section 01 6000 - Product Requirements.

B. Electric Hand/Hair Dryers:
   1. Basis of Design: Excel Dryer: www.exceldryer.com/#sle.
   2. Basis of Design: Bobrick Washroom Equipment, Inc.; www.bobrick.com
   3. Substitutions: Section 01 6000 - Product Requirements.

C. Diaper Changing Stations:
   1. American Specialties, Inc: www.americanspecialties.com/#sle.
   2. Bradley Corporation: www.bradleycorp.com/#sle.
   3. Koala Kare Products: www.koalabear.com/#sle.
   4. Substitutions: 01 6000 - Product Requirements.

2.02 MATERIALS

A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.
   1. Grind welded joints smooth.
   2. Fabricate units made of metal sheet of seamless sheets with flat surfaces.

B. Keys: Provide [_____] keys for each accessory to Owner; master key lockable accessories.

C. Mirror Glass: Tempered safety glass, ASTM C1048; and ASTM C1036 Type I, Class 1, Quality Q2, with silvering as required.

D. Adhesive: Two component epoxy type, waterproof.

E. Fasteners, Screws, and Bolts: Hot dip galvanized; tamper-proof; security type.

F. Expansion Shields: Fiber, lead, or rubber as recommended by accessory manufacturer for component and substrate.

2.03 FINISHES

A. Stainless Steel: Satin finish, unless otherwise noted.

B. Baked Enamel: Pretreat to clean condition, apply one coat primer and minimum two coats epoxy baked enamel.

2.04 COMMERCIAL TOILET ACCESSORIES

A. See drawings for Basis of Design products.

B. Toilet Paper Dispenser: Double roll, surface mounted bracket type, stainless steel, eccentric-shaped plastic spindle for 1/2 revolution delivery designed to prevent theft of tissue roll.
   1. Products: Basis of Design Product: (TT1, TT2): Bobrick B-2740
      a. Substitutions: Section 01 6000 - Product Requirements.

C. Paper Towel Dispenser: Folded paper type, stainless steel, semi-recessed, with viewing slots on sides as refill indicator and tumbler lock.
   1. Capacity: 400 multifold minimum.
   2. Products: Basis of Design Product (PT1) Bobrick B-4262
      a. Substitutions: Section 01 6000 - Product Requirements.

D. Soap Dispenser: Liquid soap dispenser, deck-mounted on vanity, with polyethylene container concealed below deck; piston and 4 inch spout of stainless steel with bright polished finish; chrome-plated deck escutcheon.
   1. Products: Basis of Design Product (SD1): Bobrick B-2111
      a. Substitutions: Section 01 6000 - Product Requirements.

E. Mirrors: Stainless steel framed, 1/4 inch thick tempered safety glass; ASTM C1048.
   1. Size: See Drawings.
   2. Frame: 0.05 inchangle shapes, with mitered and welded and ground corners, and tamperproof hanging system; satin finish.
   3. Backing: Full-mirror sized, minimum 0.03 inch galvanized steel sheet and nonabsorptive filler material.
   4. Products: Basis of Design Product (M1): Bobrick B-165
      a. Substitutions: Section 01 6000 - Product Requirements.

F. Grab Bars: Stainless steel, smooth surface.
   1. Standard Duty Grab Bars:
      a. Push/Pull Point Load: 250 pound-force, minimum.
      b. Dimensions: 1-1/4 inch outside diameter, minimum 0.05 inch wall thickness, exposed flange mounting, 1-1/2 inch clearance between wall and inside of grab bar.
      c. Finish: Satin.
      d. Length and Configuration: As indicated on drawings.
      e. Products: Basis of Design Product (GB1,GB2,GB3,GB4): Bobrick B-6806

1) Substitutions: Section 01 6000 - Product Requirements.

G. Sanitary Napkin Disposal Unit: Stainless steel, surface-mounted, self-closing door, locking bottom panel with full-length stainless steel piano-type hinge, removable receptacle.
   1. Products: Basis of Design Product (SND-1): Bobrick B-270
      a. Substitutions: Section 01 6000 - Product Requirements.

2.05 COMMERCIAL SHOWER AND BATH ACCESSORIES

A. Robe Hook: Heavy-duty stainless steel, double-prong, rectangular-shaped bracket and backplate for concealed attachment, satin finish.
   1. Products: Basis of Design Product (H1): Bobrick B-6727
      a. Substitutions: Section 01 6000 - Product Requirements.

2.06 ELECTRIC HAND/HAIR DRYERS

A. Electric Hand Dryers: Traditional fan-in-case type, with downward fixed nozzle.
   1. Operation: Automatic, sensor-operated on and off.
   2. Mounting: Surface mounted.
   3. Cover: Stainless steel with brushed finish.
      a. Tamper-resistant screw attachment of cover to mounting plate.
   4. Electric Hand Dryer Products: Basis of Design Product: Bobrick B-7128
      a. Substitutions: Section 01 6000 - Product Requirements.

2.07 DIAPER CHANGING STATIONS

A. Diaper Changing Station: Wall-mounted folding diaper changing station for use in commercial toilet facilities, meeting or exceeding ASTM F2285.
   1. Material: Stainless steel.
   2. Mounting: Surface.
   3. Color: Gray.
   4. Minimum Rated Load: 250 pounds.
   5. Products:
   6. Basis of Design Product (BC1): Bobrick KB110-SSWM
      a. Substitutions: 01 6000 - Product Requirements.

2.08 UTILITY ROOM ACCESSORIES

A. Combination Utility Shelf/Mop and Broom Holder: 0.05 inch thick stainless steel, Type 304, with 1/2 inch returned edges, 0.06 inch steel wall brackets.
   1. Hooks: Two, 0.06 inch stainless steel rag hooks at shelf front.
   2. Mop/broom holders: Three spring-loaded rubber cam holders at shelf front.
   3. Length: 36 inches.
   4. Products:
      a. Substitutions: 01 6000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.
B. Verify exact location of accessories for installation.
C. For electrically-operated accessories, verify that electrical power connections are ready and in the correct locations.

3.02 PREPARATION

A. Deliver inserts and rough-in frames to site for timely installation.
B. Provide templates and rough-in measurements as required.

3.03 INSTALLATION

A. Install accessories in accordance with manufacturers' instructions in locations indicated on drawings.
B. Install plumb and level, securely and rigidly anchored to substrate.
C. Mounting Heights: As required by accessibility regulations, unless otherwise indicated.

3.04 PROTECTION

A. Protect installed accessories from damage due to subsequent construction operations.

END OF SECTION 10 2800

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SECTION 10 4400
FIRE PROTECTION SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fire extinguisher cabinets.

B. Accessories.

1.02 REFERENCE STANDARDS

A. NFPA 10 - Standard for Portable Fire Extinguishers 2017, with Errata (2018).

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide extinguisher operational features.

C. Shop Drawings: Indicate locations of cabinets and cabinet physical dimensions.

D. Manufacturer's Installation Instructions: Indicate special criteria and wall opening coordination requirements.

1.04 FIELD CONDITIONS

A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fire Extinguisher Cabinets and Accessories:

1. Activar Construction Products Group - JL Industries: www.activarcpg.com/#sle.
2. Larsen's Manufacturing Co: www.larsensmfg.com/#sle.
3. Potter-Roemer: www.potterroemer.com/#sle.
4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 FIRE EXTINGUISHERS

A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.

B. Multipurpose Dry Chemical Type Fire Extinguishers: Carbon steel tank, with pressure gauge.

1. Class: A:B:C type.
2. Finish: Baked polyester powder coat, red color.
3. Temperature range: Minus 40 degrees F to 120 degrees F .

2.03 FIRE EXTINGUISHER CABINETS

A. Cabinet Construction: Non-fire rated.

1. Formed primed steel sheet; 0.036 inch thick base metal.

B. Cabinet Configuration: Semi-recessed type.

1. Size to accommodate accessories.

C. Door: 0.036 inch metal thickness, reinforced for flatness and rigidity with nylon catch. Hinge doors for 180 degree opening with two butt hinge.
D. Cabinet Mounting Hardware: Appropriate to cabinet, with pre-drilled holes for placement of anchors.
E. Weld, fill, and grind components smooth.
F. Finish of Cabinet Exterior Trim and Door: No. 4 - Brushed stainless steel.
G. Finish of Cabinet Interior: White colored enamel.

2.04 ACCESSORIES

A. Extinguisher Brackets: Formed steel, chrome-plated.
B. Lettering: FIRE EXTINGUISHER decal, or vinyl self-adhering, pre-spaced black lettering in accordance with authorities having jurisdiction (AHJ).

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.
B. Verify rough openings for cabinet are correctly sized and located.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.
B. Secure rigidly in place.
C. Place extinguishers in cabinets.

END OF SECTION 10 4400

SECTION 10 5113
METAL LOCKERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal lockers.
B. Locker benches.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Concrete base construction.
B. Section 06 1000 - Rough Carpentry: Wood blocking and nailers.
C. Section 06 2000 - Finish Carpentry: Bench tops for locker bench support brackets.

1.03 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design 2010.
B. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications 2022.
C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.
D. ASTM A879/A879M - Standard Specification for Steel Sheet, Zinc Coated by the Electrolytic Process for Applications Requiring Designation of the Coating Mass on Each Surface 2022.
E. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable 2021a.
F. ASTM F1267 - Standard Specification for Metal, Expanded, Steel 2018.
G. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.
B. Product Data: Manufacturer's published data on locker construction, sizes, and accessories.
C. Shop Drawings: Indicate locker plan layout, numbering plan and combination lock code.
D. Samples: Submit two samples 3 by 6 inches in size showing color and finish of metal locker material.
E. Manufacturer's Installation Instructions: Indicate component installation assembly.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect locker finish and adjacent surfaces from damage.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Metal Lockers:
   1. Art Metal Products: www.artmetalproducts.com/#sle.
   2. ASI Storage Solutions: www.asi-storage.com/#sle.
   3. Penco Products, Inc: www.pencoproducts.com/#sle.

2.02 LOCKER APPLICATIONS

A. Athletic Lockers: Metal lockers, free-standing with matching closed base.
   1. Configuration: Single tier.
   2. Fittings: Size and configuration as indicated on drawings.
   3. Ventilation: Perforated side panels and doors.
   4. Locking: Built-in combination locks.

2.03 METAL LOCKERS

A. Accessibility: Design units indicated on drawings as 'accessible' to comply with ICC A117.1 and ADA Standards.
B. Locker Case Construction:
   1. Heavy-Duty, Welded Construction: Made of formed and welded together sheet steel; metal edges finished smooth without burrs; baked enamel or powder coat finished inside and out.
C. Latches and Door Handles: Manufacturer's standard.
   1. Latching Components: 300 Series Stainless Steel (ASTM A240/A240M).
D. Locks: Locker manufacturer's standard type indicated in Applications article above.

2.04 LOCKER BENCHES

A. Locker Benches: Stationary type; bench top of laminated birch; painted steel pedestals.
   1. Accessibility: Comply with ICC A117.1 and ADA Standards.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.
B. Place and secure on prepared base.
C. Install lockers plumb and square.
D. Install fittings if not factory installed.
E. Replace components that do not operate smoothly.

END OF SECTION 10 5113

SECTION 12 2113
HORIZONTAL LOUVER BLINDS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Horizontal slat louver blinds.

B. Operating hardware.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Concealed wood blocking for attachment of headrail brackets.

1.03 REFERENCE STANDARDS

A. WCMA A100.1 - Safety of Window Covering Products 2018.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the placement of concealed blocking to support blinds. See Section 06 1000.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data indicating physical and dimensional characteristics.

C. Shop Drawings: Indicate opening sizes, tolerances required, method of attachment, clearances, and operation.

D. Samples: Submit two samples, 6 inch long illustrating slat materials and finish, cord type and color.

E. Manufacturer's Installation Instructions: Indicate special procedures.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Horizontal Louver Blinds Without Side Guides:

1. Hunter Douglas Architectural: www.hunterdouglasarchitectural.com/#sle.
2. Levolor; Metal Blinds: www.levolor.com/commercial/#sle.
3. SWFcontract, a division of Spring Window Fashions, LLC: www.swfcontract.com/#sle.
4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 BLINDS WITHOUT SIDE GUIDES

A. Description: Horizontal slat louvers hung from full-width headrail with full-width bottom rail.

B. Metal Slats: Spring tempered pre-finished aluminum; square slat corners, with manufacturing burrs removed.

1. Width: 1/2 inch.

C. Slat Support: Woven polypropylene cord, ladder configuration.

D. Head Rail: Pre-finished, formed aluminum box, with end caps; internally fitted with hardware, pulleys, and bearings for operation; same depth as width of slats.

1. Color: Same as slats.

E. Bottom Rail: Pre-finished, formed steel; with end caps.

1. Color: Same as headrail.

F. Lift Cord: Braided nylon; continuous loop; complying with WCMA A100.1.

1. Color: As selected by Architect.

G. Control Wand: Extruded hollow plastic; hexagonal shape.

1. Length of window opening height less 3 inch.
2. Color: As selected by Architect.

H. Headrail Attachment: Wall brackets.

I. Accessory Hardware: Type recommended by blind manufacturer.

2.03 FABRICATION

A. Determine sizes by field measurement.

B. Fabricate blinds to fit within openings with uniform edge clearance of 1/2 inch.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that openings are ready to receive the work.

B. Ensure structural blocking and supports are correctly placed. See Section 06 1000.

3.02 INSTALLATION

A. Install blinds in accordance with manufacturer's instructions.

B. Secure in place with flush countersunk fasteners.

3.03 TOLERANCES

A. Maximum Variation of Gap at Window Opening Perimeter: 1/4 inch.

B. Maximum Offset From Level: 1/8 inch.

3.04 ADJUSTING

A. Adjust blinds for smooth operation.

3.05 CLEANING

A. Clean blind surfaces just prior to occupancy.

END OF SECTION 12 2113

SECTION 12 3600
COUNTERTOPS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Countertops for architectural cabinet work.

B. Sinks molded into countertops.

1.02 REFERENCE STANDARDS

A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards 2014, with Errata (2018).

B. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards 2021, with Errata.

C. ISFA 2-01 - Classification and Standards for Solid Surfacing Material 2013.

D. NEMA LD 3 - High-Pressure Decorative Laminates 2005.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:

1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Specimen warranty.

C. Shop Drawings: Complete details of materials and installation ; combine with shop drawings of cabinets and casework specified in other sections.

D. Verification Samples: For each finish product specified, minimum size 6 inches square, representing actual product, color, and patterns.

E. Test Reports: Chemical resistance testing, showing compliance with specified requirements.

F. Installation Instructions: Manufacturer's installation instructions and recommendations.

G. Maintenance Data: Manufacturer's instructions and recommendations for maintenance and repair of countertop surfaces.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than three years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

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

B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.06 FIELD CONDITIONS

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

PART 2 PRODUCTS

2.01 COUNTERTOPS

A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.

B. Solid Surfacing Countertops: Solid surfacing sheet or plastic resin casting over continuous substrate.

1. Flat Sheet Thickness: 1/2 inch, minimum.
2. Solid Surfacing Sheet and Plastic Resin Castings: Complying with ISFA 2-01 and NEMA LD 3; acrylic or polyester resin, mineral filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard woodworking tools; no surface coating; color and pattern consistent throughout thickness.
    a. Manufacturers:
        1) Avonite Surfaces: www.avonitesurfaces.com/#sle.
        2) Dupont: www.corian.com/#sle.
        3) Formica Corporation: www.formica.com/#sle.
        4) Wilsonart: www.wilsonart.com/#sle.
        5) Substitutions: See Section 01 6000 - Product Requirements.
    b. Finish on Exposed Surfaces: Matte, gloss rating of 5 to 20.
    c. Color and Pattern: As indicated on drawings.
3. Other Components Thickness: 1/2 inch, minimum.
4. Exposed Edge Treatment: Built up to minimum 1-1/4 inch thick; square edge; use marine edge at sinks.
5. Back and End Splashes: Same sheet material, square top; minimum 4 inches high.

2.02 FABRICATION

A. Fabricate tops and splashes in the largest sections practicable, with top surface of joints flush.

1. Join lengths of tops using best method recommended by manufacturer.
2. Fabricate to overhang fronts and ends of cabinets 1 inch except where top butts against cabinet or wall.
3. Prepare all cutouts accurately to size; replace tops having improperly dimensioned or unnecessary cutouts or fixture holes.

B. Provide back/end splash wherever counter edge abuts vertical surface unless otherwise indicated.

1. Secure to countertop with concealed fasteners and with contact surfaces set in waterproof glue.
2. Height: 4 inches, unless otherwise indicated.

C. Solid Surfacing: Fabricate tops and wall panels up to 144 inches long in one piece; join pieces with adhesive sealant in accordance with manufacturer's recommendations and instructions.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.
B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
C. Verify that wall surfaces have been finished and mechanical and electrical services and outlets are installed in proper locations.

3.02 PREPARATION

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

3.03 INSTALLATION

A. Securely attach countertops to cabinets using concealed fasteners. Make flat surfaces level; shim where required.
B. Seal joint between back/end splashes and vertical surfaces.

3.04 TOLERANCES

A. Variation From Horizontal: 1/8 inch in 10 feet, maximum.
B. Offset From Wall, Countertops: 1/8 inch maximum; 1/16 inch minimum.
C. Field Joints: 1/8 inch wide, maximum.

3.05 CLEANING

A. Clean countertops surfaces thoroughly.

3.06 PROTECTION

A. Protect installed products until completion of project.
B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION 12 3600

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SECTION 22 0500
COMMON WORK RESULTS FOR PLUMBING

PART 1 GENERAL

1.01 APPLICABILITY

A. **The instructions outlined in this section shall apply to all sections under Division 22, except where specifically noted otherwise in the individual specification sections.**

1.02 RELATED REQUIREMENTS

A. Section 01 1000 - Summary: Contract descriptions, description of alterations work, work by others, future work, occupancy conditions, use of site and premises, work sequence.

B. Section 01 3000 - Administrative Requirements: Submittal procedures, project meetings, progress schedules and documentation, reports, coordination.

C. Related Documents: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to and supplement all work specified in Division 22. If conflicts arise, the Contractor shall be responsible for communicating the conflict to the Architect prior to performing any work or ordering any equipment. **The Plumbing Drawings are diagrammatic. Refer to Architectural, Structural, and Civil drawings for all building dimensions.**

1.03 DEFINITIONS

A. Exposed: Revealed to view or subject to weather.

B. Fittings: All connecting pieces of a system.

C. Provide: Furnish, install, and connect completely.

D. Piping: Pipe installed with all required fittings, valves, and accessories, and forming a complete system.

E. Wiring: Wire or cable installed in raceway with all required boxes, fittings, connectors, and accessories completely installed.

1.04 CODES AND STANDARDS

A. **These specifications and associated design drawings do not give permission, implicit or inferred, to ignore the requirements of the applicable building codes or the Authority Having Jurisdiction (AHJ). By placing a bid on this project, Contractor acknowledges and agrees to the requirement that they shall be versed in all applicable code requirements relevant to this specific project, and shall bring any conflicts to the attention of the Architect prior to performing any work. <u>If work performed is found to be in violation of code, Contractor shall rectify any such work at their own expense.</u>**

1.05 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate the installation of all equipment and systems with size, location and installation of service utilities.

B. Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner, and that coordination between all affected installers has been performed to ensure proper installation order of all systems (e.g., electrical, mechanical, fire protection, millwork, etc.).

C. The locations, arrangement, and extent of equipment, devices, piping, and other appurtenances related to the installation of the Plumbing work shown on the drawings are approximate and define the intent of the design. Contractor shall not scale the Plumbing drawings but shall refer to the Architectural drawings for exact dimensions of building components. Should a conflict exist between the Architectural and Plumbing drawings regarding dimensions and scale, notify the Architect of the discrepancy.

D. At the discretion of Owner, Architect, or the Authority Having Jurisdiction (AHJ), relocate all conflicts arising from uncoordinated piping, equipment, etc. installed, should such installation be determined to interfere with the proper installation and mounting of equipment, ceilings, piping, conduit, or any other Architectural or Structural systems or finishes. **Corrective work arising from these conditions shall be performed without additional expense to the contract.**

1. Stacking of piping, conduit, etc. where it would cause an obstruction or restricted path for egress or serviceability of equipment from any trade is prohibited.
2. Coordinate the elevations of all piping and equipment above ceilings and in exposed areas with the work of all other disciplines prior to installation. In areas where more than one trade is required to use common openings in structure, joists, chases, shafts, and sleeves to route conduits, raceways, piping, or any other materials, coordinate the positions of all piping and equipment to be furnished under this section so that all items – including the materials and equipment of other trades – may be accommodated within the space available.
3. Confirm that work to be performed under Division 22 does not interfere with the clearances required for finished soffits, columns, millwork, pilasters, partitions, walls, or other Architectural or Structural elements as shown on the Drawings or Specifications. **Work that interferes with the Architectural design or building structure shall be removed and relocated at the direction of the Owner or Architect at no additional cost to the contract.**

4. All piping shall be run tight to structure, regardless of whether piping and equipment are above or below structural elements. Free-standing piping and equipment spanning open spaces or voids is prohibited. All piping routed through areas with exposed ceilings, cloud ceilings, or any other areas where piping may be visible to building occupants shall be routed to maintain a low-profile installation or shall be hidden from view, to provide the least-visible installation possible.
    a. **If any of these conditions are identified in the field by Owner, Architect, or the Authority Having Jurisdiction (AHJ), remove and reinstall the indicated piping, specialties, or equipment in accordance with these directions at no additional cost to the Contract.**
    b. If there are areas where necessary routing cannot comply with these instructions, furnish a sketch to the Architect identifying such areas and how the design drawing routing in the indicated areas will differ from these instructions, and obtain written approval to proceed with the proposed routing from the Architect prior to installation.

1.06 PERMITS, UTILITIES, SERVICES, AND FEES

A. Sanitary: Provide sanitary drainage, connecting to sewer. Make arrangements for and pay all fees in connection with this installation.
B. Water: Provide domestic (City) water, connecting to water mains. Arrange for tap to main and installation of meter. Pay all fees associated with new water service.
C. Natural Gas: Provide natural gas service, connecting to gas mains. Arrange with local gas company for installation of gas service including meter. Pay all fees associated with new or revised gas service.
D. Obtain all permits, inspections and approvals as required by all Authorities Having Jurisdiction and deliver certificates of approval to the Architect. Assume and pay all fees and costs of any nature whatsoever incidental to these permits.

1.07 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Plumbing systems and all associated equipment, piping, accessories, and specialties shall not be installed without first coordinating the installation of the same with all other building trades (Architectural, Structural, Mechanical, etc.). **Coordination shall be accomplished prior to, and shall be reflected in, the equipment submittals for approval.**
C. ELECTRICAL COORDINATION STATEMENT: Submit a written statement confirming coordination of voltage and power connection requirements for all Plumbing equipment and controls requiring an electrical connection. Statement shall bear the names and signatures of the Plumbing and Electrical subcontractors.

D. LICENSING: Submit current Plumbing Contractor and Welder licenses specific to the state in which the work is to be performed for each onsite supervisor that will have responsible charge over the work. Submit a minimum of (2) licenses to ensure that at least one licensed supervisor will be onsite at all times during the installation.

E. RECORD DRAWINGS: Submit record drawings no more than 14 days after completion of equipment installation and acceptance testing. Update Plumbing system drawings to reflect final record as-built conditions after related work is completed. As-built drawings shall be performed using CAD or Revit. Hand-drawn "hard copy" markups and hand-edited PDF markups are not acceptable.

1. **Record drawing submittal shall include digital images** (minimum resolution of 1152 x 864 pixels in JPEG standard image file format, and delivered via email, CD, or solid state thumb drive) **of any and all installed underground utilities or piping,and shall include a reference drawing indicating the location and direction of where each picture was taken.** The reference drawing shall dimension the utility or pipe from a prominent fixed object that is demonstrably unaltered from the time the photo was taken to the time when the file is delivered.

1.08 QUALITY ASSURANCE

A. Manufacturer Qualifications: Unless specifically noted otherwise in the specifications or drawings, all products shall be manufactured by a company specializing in manufacturing the specific products used in this project, with at least three years of documented experience.

B. Fabricator Qualifications: Unless specifically noted otherwise in the specifications or drawings, a company specializing in fabricating the specific products used in this project, with at least three years of documented experience.

C. Installer Qualifications: Unless specifically noted otherwise in the specifications or drawings, a company specializing in performing work of the type specified and with at least three years of documented experience and approved by manufacturer.

D. Copies of Documents at Project Site: Maintain at the project site a copy of each referenced document that prescribes execution requirements.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Store all products and equipment under cover and elevated above grade, protected completely against weather. **Do not install materials or equipment in a partially constructed structure exposed to weather**, unless all material and equipment is continuously protected from damage by weather or the construction process.

B. Products such as copper piping and fittings that are stored outside must be protected against contamination by the elements within sealed plastic containers, or must be plugged and purged per the manufacturer's recommendations to ensure no damage to the inside of the piping.

C. **Material and equipment with suspected or observable damage caused by improper protection during construction is subject to replacement based on the judgment of Architect at no cost to Owner.**

1.10 WARRANTY

A. The installation and Plumbing equipment and components shall be provided with a one-year warranty from the date of final acceptance by Owner unless specifically noted otherwise in the contract documents. The warranty shall cover all materials and workmanship. During this warranty period, correct all defects in materials and workmanship by repair or replacement without incurring any additional cost to the owner. Warranty defects shall be corrected within thirty (30) days after being notified in writing of failure to meet the warranty. Failure to perform repairs within the specified period constitutes grounds for having the corrective action and repairs performed by others and billing the cost to the Contractor.

B. Correct any and all defective Work uncovered within a five year period after Date of Substantial Completion.

C. See Section 01 7800 - Closeout Submittals, as well as all individual specifications sections for additional warranty requirements.

PART 2 PRODUCTS

2.01 EQUIPMENT

A. MOTORS:

1. Unless otherwise specified, single-phase fractional-horsepower alternating-current motors must be high efficiency types corresponding to the applications listed in NEMA MG 11.
2. Unless otherwise specified, polyphase motors must be selected based on high efficiency characteristics relative to the applications as listed in NEMA MG 10. Additionally, polyphase squirrel-cage medium induction motors with continuous ratings must meet or exceed energy efficient ratings in accordance with Table 12-6C of NEMA MG 1.
3. Provide controllers for motors rated 1 horsepower and larger with electronic phase-voltage monitors designed to protect motors from phase-loss, undervoltage, and overvoltage. Provide protection for motors from immediate restart by a time adjustable restart relay.

2.02 MANUFACTURERS

A. If substitution of alternate equipment is requested, the Contractor is responsible for any and all costs required by the substitution, including necessary engineering and construction revisions in their – or any – contract or trade to satisfy the design intent shown on the Drawings and described in the Specifications.

B. If the products and equipment used as the basis of design are modified, coordinate with all other trades prior to purchasing any material or equipment. **Such coordination shall occur before purchasing and delivering equipment from the manufacturer and shall be clearly indicated on the shop drawings.** Perform all related modifications without incurring cost to the Contract.

C. Substitutions: See Section 01 6000 - Product Requirements.

2.03 MATERIALS

A. All products shall be new and shall bear the Underwriter's Laboratories, Inc. (UL) label or the Factory Mutual Underwriters (FM) label unless specifically indicated otherwise. Furnish materials and equipment compatible with the existing system.

B. Materials, equipment, or labor not indicated but which can be reasonably inferred to be necessary for a complete installation shall be provided. Drawings and Specifications are not intended to indicate every item of material, equipment, or labor required to produce a complete and properly functioning installation.

C. **FLAME SPREAD AND SMOKE DEVELOPED RATINGS OF MATERIALS:**

1. Materials and adhesives used throughout the mechanical systems for any system shall have a flame spread rating not over 25, and a smoke developed rating not to exceed 50. If such materials are to be applied with adhesives, test them as applied with such adhesives, or the adhesives used shall have a flame spread rating not over 25 and a smoke developed rating not to exceed 50.
2. Determine flame spread rating and smoke developed rating by the Method of Testing of Surface Burning Characteristics of Building Materials, NFPA 255, ASTM E84, and Underwriters' Laboratories, Inc. standards.

2.04 SOURCE QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Provide materials and equipment that are standard products of manufacturers regularly engaged in the manufacture of such products, which are of a similar material, design and workmanship. Standard products must have been in satisfactory commercial or industrial use for three years prior to bid opening. The three-year use must include applications of equipment and materials under similar circumstances and of similar size. The product must have been for sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the three-year period.

1. Products having less than a three-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6,000 hours, exclusive of the manufacturer's factory or laboratory tests, can be shown.

PART 3 EXECUTION

3.01 GENERAL

A. The Plumbing drawings do not give exact elevations or location of lines, nor do they show all the offsets, control lines or installation details. Carefully lay out the work at the site to conform to the structural conditions, to provide proper grading of lines, to avoid all obstructions.

B. Properly locate and size of all slots and openings in the building structure pertaining to the work and correctly locate sleeves, inserts, and cores.

C. Offset valves in piping systems down to within one foot of the access point. Group runs of piping whenever it is feasible to do so.

D. Provide access to equipment and valves requiring operation, service or maintenance within the life of the system. Equipment located above lay-in type ceilings is considered accessible.

E. Piping and insulation located in air plenums shall conform to NFPA 90A requirements. Piping located in shafts that constitute air ducts or that enclose air ducts shall be noncombustible in accordance with NFPA 90A. Installation of plastic pipe where in compliance with NFPA may be installed in accordance with PPFA Fire Man.

3.02 EXAMINATION

A. Verification of Conditions: Verify existing conditions and operability of all existing equipment and systems prior to beginning work.

B. The work shall be carefully laid out in advance, to avoid unnecessary cutting of construction. Damage to building, piping, wiring, or equipment as a result of cutting shall be repaired by workers skilled in the trade(s) involved.

3.03 INSTALLATION

A. Install all equipment and materials in accordance with manufacturer's instructions.

B. Minor deviations from the drawings required to conform to space conditions and to provide the designed operation, service, or maintenance accessibility shall be made at no additional cost, and shall be subject to approval by the Owner.

C. All piping shall be run parallel with the lines of the building, in a neat and workmanlike manner.

D. Piping, equipment, or ductwork shall not be installed in electrical equipment rooms, unless such piping serves equipment inside these spaces exclusively. Do not locate or route piping, ductwork, or equipment within 42" in front (and rear, if free-standing) of electrical equipment, or within 36" of sides of equipment. Clearances shall apply from floor level to underside of structural deck, and shall apply to the following electrical equipment:
   1. Switchboards
   2. Panel boards
   3. Power panels
   4. Motor control centers
   5. Dry-type transformers

E. Sewer and water pipes shall be laid in separate trenches, except when otherwise shown. If trenches are closed or the pipes are otherwise covered before being connected to the service lines, the location of the end of each plumbing utility shall be marked with a stake or other acceptable means.

F. Exterior underground utilities shall be at least 12 inches below the average local frost depth or as indicated on the drawings; whichever is deeper.

G. The supply line to each item of equipment or fixture, except faucets, flush valves, or other control valves which are supplied with integral stops, shall be equipped with a shutoff valve to enable isolation of the item for repair and maintenance without interfering with operation of other equipment or fixtures. Supply piping to fixtures, faucets, hydrants, shower heads, and flushing devices shall be anchored to prevent movement. Valves shall be installed with control no lower than the valve body.

H. Cover ends of open pipes during construction except when working on such end prohibits covering. Pipe openings shall be closed with caps or plugs during installation. The use of duct tape or similar improvised coverings is not acceptable. Fixtures and equipment shall be tightly covered and protected against dirt, water, chemicals, and mechanical injury. Upon completion of the work, the fixtures, materials, and equipment shall be thoroughly cleaned, adjusted, and operated. Safety guards shall be provided for exposed rotating equipment.

I. Provide access to equipment and valves requiring operation, service or maintenance within the life of the system. Locate such equipment where access will not require installation of access panels wherever possible. If an access panel is required to be installed in hard ceilings, walls, soffits, etc., and is not shown on the Architectural drawings, Contractor shall notify Architect in writing. Such notification shall include both the specific equipment requiring access, and the proposed location and size of the access panel, and Contractor shall obtain written approval to proceed prior to installation. All access panels shall be located in the least-visible location possible. If written approval for the required access panel location is not obtained prior to installation, Architect reserves the right to direct Contractor to remove and relocate the equipment or valves requiring access to a less visible location as chosen by Architect at no additional cost to the Contract. Equipment located above lay-in type ceilings is considered accessible.

J. Expansion and Contraction of Piping: Allowance shall be made throughout for expansion and contraction of water pipe. Each hot-water and hot-water circulation system shall have expansion loops or other provisions such as offsets and changes in direction where indicated. Risers shall be securely anchored to force expansion to loops. Branch connections from risers shall be made with ample swing or offset to avoid undue strain on fittings or short pipe lengths. Horizontal runs of pipe over 50 feet in length shall be anchored to the wall or the supporting construction about midway on the run to force expansion, evenly divided, toward the ends. Sufficient flexibility shall be provided on branch runouts from mains and risers to provide for expansion and contraction of piping. Flexibility shall be provided by installing one or more turns in the line so that piping will spring enough to allow for expansion without straining. If mechanical grooved pipe coupling systems are provided, the deviation from design requirements for expansion and contraction may be allowed pending approval of the Architect.

K. Thrust Restraint: Plugs, caps, tees, valves and bends deflecting 11.25 degrees or more, either vertically or horizontally, in waterlines 4 inches in diameter or larger shall be provided with thrust blocks, where indicated, to prevent movement. Thrust blocking shall be concrete of a mix not leaner than: 1 cement, 2-1/2 sand, 5 gravel; and having a compressive strength of not less than 2000 psi after 28 days. Blocking shall be placed between solid ground and the fitting to be anchored. Unless otherwise indicated or directed, the base and thrust bearing sides of the thrust block shall be poured against undisturbed earth. The side of the thrust block not subject to thrust shall be poured against forms. The area of bearing will be as shown. Blocking shall be placed so that the joints of the fitting are accessible for repair. Steel rods and clamps, protected by galvanizing or by coating with bituminous paint, shall be used to anchor vertical down bends into gravity thrust blocks.

L. Supply pipes, valves, and fittings shall be kept a sufficient distance from other work and other services to permit not less than 1/2 inch between finished covering on the different services. Bare and insulated water lines shall not bear directly against building structural elements so as to transmit sound to the structure or to prevent flexible movement of the lines. Water pipe shall not be buried in or under floors unless specifically indicated or approved. Changes in pipe sizes shall be made with reducing fittings. Use of bushings will not be permitted except for use in situations in which standard factory fabricated components are furnished to accommodate specific accepted installation practice. Change in direction shall be made with fittings, except that bending of pipe 4 inches and smaller will be permitted, provided a pipe bender is used and wide sweep bends are formed. The center-line radius of bends shall be not less than six diameters of the pipe. Bent pipe showing kinks, wrinkles, flattening, or other malformations will not be acceptable.

M. Sound Stopping: Provide sound stopping and operating clearance to prevent structure contact where piping penetrates walls, floors, or ceilings; into occupied spaces adjacent to equipment rooms; where similar penetrations occur between occupied spaces; and where penetrations occur from pipe chases into occupied spaces. Occupied spaces include space above ceiling where no special acoustic treatment of ceiling is provided. Construct penetrations with finishes compatible with surface being penetrated. Sound stopping and vapor-barrier sealing of pipe shafts, and large floor and wall openings may be accomplished by packing with mineral fiber insulation installed and supported in accordance with manufacturer's instructions, or by foaming-in-place with self-extinguishing 2-pound-density polyurethane foam to a depth not less than 6 inches. Finish foam with a rasp. Ensure vapor barrier is not less than 1/8-inch thickness of vinyl mastic applied to visible and accessible surfaces. Where fire stopping is a consideration, use only mineral fiber, and, in addition, cover openings with 16-gauge sheet metal.

N. Vibration Isolation: Mechanical equipment, including compressors and pumps, shall be isolated from the building structure by specified vibration-absorbing features, unless otherwise shown. Each foundation shall include an adequate number of standard isolation units. Each unit shall consist of machine and floor or foundation fastening, together with intermediate isolation material, and shall be a standard product with printed load rating. Piping connected to mechanical equipment shall be provided with flexible connectors.

3.04 WELDING

A. Piping requiring welding shall be welded in accordance with qualified procedures using performance-qualified welders and welding operators in accordance with ASME BPVC SEC IX. Welding procedures qualified by others, and welders and welding operators qualified by another employer, may be accepted as permitted by ASME B31.1. The Authority Having Jurisdiction (AHJ) shall be notified 24 hours in advance of tests, and the tests shall be performed at the work site if practicable. Welders or welding operators shall apply their assigned symbols near each weld they make as a permanent record.

3.05 SYSTEM STARTUP

A. See individual specifications sections for systems startup instructions for systems and equipment.

3.06 CLEANING

A. System Flushing: Before operational tests or disinfection, flush new water piping systems with hot potable water. Sufficient water shall be used to produce a water velocity that is capable of entraining and removing debris in all portions of the piping system. This requires simultaneous operation of all fixtures on a common branch or main in order to produce a flushing velocity of approximately 4 fps through all portions of the piping system.
   1. In the event that this is impossible due to size of system, the Authority Having Jurisdiction (AHJ) shall specify the number of fixtures to be operated during flushing.
   2. Contractor shall provide adequate personnel to monitor the flushing operation and to ensure that drain lines are unobstructed in order to prevent flooding of the facility. Contractor shall be responsible for any flood damage resulting from flushing of the system.
   3. Flushing shall be continued until entrained dirt and other foreign materials have been removed and until discharge water shows no discoloration.
   4. All faucets and drinking water fountains, to include any device considered as an end point device by NSF/ANSI 61, Section 9, shall be flushed a minimum of 0.25 gallons per 24 hour period, ten times over a 14 day period.
   5. After flushing, system shall be drained at low points, and strainer screens shall be removed, cleaned, and replaced.
   6. After flushing and cleaning, systems shall be prepared for testing by immediately filling water piping with clean, fresh potable water.
   7. Any stoppage, discoloration, or other damage to the finish, furnishings, or parts of the building due to Contractor failure to properly clean the piping system shall be repaired by Contractor at no additional expense to Owner.
   8. When the system flushing is complete, the hot-water system shall be adjusted for uniform circulation. Flushing devices and automatic control systems shall be adjusted for proper operation according to manufacturer's instructions.
B. Disinfection: See STERILIZATION section below.
C. Remove all stickers, rust, stains, labels and temporary covers before final acceptance.
D. Leave equipment rooms clean.
E. At the completion of the work, clean all parts of the installation. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system. Adjust automatic control devices for proper operation.
F. See Section 01 7419 - Construction Waste Management and Disposal, for additional requirements.

3.07 STERILIZATION

A. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

B. Clean and disinfect potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:
    a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
    b. Fill and isolate system according to either of the following:
        1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
        2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.

C. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.

3.08 FLAME SPREAD AND SMOKE DEVELOPED RATINGS OF MATERIALS

A. Materials and adhesives used throughout the mechanical systems for any system shall have a flame spread rating not over 25, and a smoke developed rating not to exceed 50. If such materials are to be applied with adhesives, test them as applied with such adhesives, or the adhesives used shall have a flame spread rating not over 25 and a smoke developed rating not to exceed 50.

B. Determine flame spread rating and smoke developed rating by the Method of Testing of Surface Burning Characteristics of Building Materials, NFPA 255, ASTM E84, and Underwriters' Laboratories, Inc. standards.

C. Failure to adhere to these requirements will require Contractor to replace the non-compliant materials with compliant equivalents at no additional cost to Owner.

3.09 TESTS

A. Upon completion of flushing and prior to disinfection procedures, Contractor shall subject the plumbing system to operating tests to demonstrate satisfactory installation, connections, adjustments, and functional and operational efficiency. Such operating tests shall cover a period of not less than 8 hours for each system and shall include the following information in a report with conclusion as to the adequacy of the system:

1. Time, date, and duration of test.
2. Water pressures at the most remote and the highest fixtures.

3. Operation of each fixture and fixture trim.
4. Operation of each valve, hydrant, and faucet.
5. Pump suction and discharge pressures.
6. Temperature of each domestic hot-water supply.
7. Operation of each floor and roof drain by flooding with water.
8. Operation of each vacuum breaker and backflow preventer.

B. Contractor is responsible for approved disposal of contaminated water used for all system tests.

C. Prior to acceptance of the work, test completed systems in the presence of the Authority Having Jurisdiction (AHJ). Upon approval, provide certificates of testing.

D. Conduct a hydrostatic test, unless otherwise specified. Use only potable water for testing.

E. Test domestic hot- and cold-water piping for a continuous period of not less than four hours at a hydrostatic pressure of not less than 125 psig and make free from leaks. Completely remake leaky joints with piping dry. Retest system after leaks are corrected.

F. Plug all necessary openings in the drainage and vent piping systems and fill the entire system with water to the level of the highest vent stack above the roof. Hold this water for 30 minutes without showing a drop in water level greater than 4 inches. Final test shall include a smoke test.

G. Backflow Prevention Assemblies: Backflow prevention assembly shall be tested using gauges specifically designed for the testing of backflow prevention assemblies.

H. Shower Pans: After installation of the pan and finished floor, the drain shall be temporarily plugged below the weep holes. The floor area shall be flooded with water to a minimum depth of 1 inch for a period of 24 hours. Any drop in the water level during test, except for evaporation, will be reason for rejection, repair, and retest.

3.10 ADJUSTING

A. Perform the following adjustments before operation:
1. Close drain valves, hydrants, and hose bibbs.
2. Open shutoff valves to fully open position.
3. Open throttling valves to proper setting.
4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.

B. Remove plugs used during testing of piping and plugs used for temporary sealing of piping during installation.

C. Remove and clean strainer screens. Close drain valves and replace drain plugs.

D. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.

E. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.11 CLOSEOUT ACTIVITIES

A. See Section 01 7800 - Closeout Submittals, for closeout submittals.

B. See Section 01 7900 - Demonstration and Training, for additional requirements.

3.12 MAINTENANCE

A. See Section 01 7000 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.

END OF SECTION 22 0500

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SECTION 22 0517
SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pipe sleeves.
B. Pipe sleeve-seals.

1.02 RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping.
B. Section 09 9113 - Exterior Painting: Preparation and painting of exterior piping systems.
C. Section 09 9123 - Interior Painting: Preparation and painting of interior piping systems.

1.03 REFERENCE STANDARDS

A. ASTM C592 - Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type) 2022a.
B. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems 2013a (Reapproved 2017).

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.
B. Shop Drawings: Indicate pipe materials used, jointing methods, supports, floor and wall penetration seals. Indicate installation, layout, weights, mounting and support details, and piping connections.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
B. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store sleeve and sleeve seals in shipping containers, with labeling in place.

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 PIPE SLEEVES

A. Manufacturers:
   1. Flexicraft Industries; Pipe Wall Sleeve: www.flexicraft.com/#sle.
B. Vertical Piping:
   1. Sleeve Length: 2 inch above finished floor.
   2. Provide sealant for watertight joint.

C. Plastic or Sheet Metal: Pipe passing through interior walls, partitions, and floors, unless steel or brass sleeves are specified below.
D. Pipe Passing Through Below Grade Exterior Walls:
   1. Zinc coated or cast iron pipe.
   2. Provide watertight space with link rubber or modular seal between sleeve and pipe on both pipe ends.
E. Clearances:
   1. Provide allowance for insulated piping.
   2. Wall, Floor, Partitions, and Beam Flanges: two pipe sizes greater than external pipe diameter.
   3. All Rated Openings: Caulked tight with fire stopping material complying with ASTM E814 in accordance with Section 07 8400 to prevent the spread of fire, smoke, and gases.

2.02 PIPE-SLEEVE SEALS

A. Manufacturers:
   1. Advance Products & Systems, LLC; Innerlynx: www.apsonline.com/#sle.
   2. Flexicraft Industries; PipeSeal: www.flexicraft.com/#sle.

PART 3 EXECUTION

3.01 INSTALLATION

A. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.
B. Install piping and pipe sleeves to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
C. Structural Considerations: Do not penetrate building structural members unless indicated.
D. Provide sleeves when penetrating footings, floors, walls, and rated assemblies. Seal pipe including sleeve penetrations to achieve fire resistance equivalent to fire separation required.
   1. Underground Piping: Caulk pipe sleeve watertight with lead and oakum or mechanically expandable chloroprene inserts with bitumen sealed metal components.
   2. Aboveground Piping:
      a. Pack solid using mineral fiber complying with ASTM C592.
      b. Fill space with an elastomer caulk to a depth of 0.50 inch where penetrations occur between conditioned and unconditioned spaces.
   3. All Rated Openings: Caulk tight with fire stopping material complying with ASTM E814 in accordance with Section 07 8400 to prevent the spread of fire, smoke, and gases.

E. Manufactured Sleeve-Seal Systems:
   1. Install manufactured sleeve-seal systems in sleeves located in grade slabs and exterior concrete walls at piping entrances into building.
   2. Provide sealing elements of the size, quantity, and type required for the piping and sleeve inner diameter or penetration diameter.
   3. Locate piping in center of sleeve or penetration.
   4. Install field assembled sleeve-seal system components in annular space between sleeve and piping.
   5. Tighten bolting for a water-tight seal.
   6. Install in accordance with manufacturer's recommendations.

F. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

END OF SECTION 22 0517

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SECTION 22 0519
METERS AND GAUGES FOR PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pressure Gauges:
   1. Bourdon tube for liquids and gases.
B. Thermometers.
C. Pressure-Temperature test plugs.

1.02 REFERENCE STANDARDS

A. ASME B40.100 - Pressure Gauges and Gauge Attachments 2013.
B. ASTM E1 - Standard Specification for ASTM Liquid-in-Glass Thermometers 2014 (Reapproved 2020).
C. ASTM E77 - Standard Test Method for Inspection and Verification of Thermometers 2014 (Reapproved 2021).
D. NSF 61 - Drinking Water System Components - Health Effects 2021.
E. NSF 372 - Drinking Water System Components - Lead Content 2022.
F. UL 393 - Indicating Pressure Gauges for Fire-Protection Service Current Edition, Including All Revisions.
G. UL 404 - Gauges, Indicating Pressure, for Compressed Gas Service Current Edition, Including All Revisions.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.
B. Product Data: Provide red-marked product data sheets for each furnished item with associated components and accessories.

PART 2 PRODUCTS

2.01 PRESSURE GAUGES

A. Manufacturers:
   1. Dwyer Instruments, Inc: https://www.dwyer-inst.com/#sle.
   2. Moeller Instrument Company, Inc: www.moellerinstrument.com/#sle.
   3. Omega Engineering, Inc: www.omega.com/#sle.
   4. Weksler Glass Thermometer Corp: www.wekslerglass.com/#sle.
   5. Substitutions: See Section 01 6000 - Product Requirements.
B. Bourdon Tube for Liquids and Gases:
   1. Dial Size and Cover: 4-1/2 inch diameter scale with polycarbonate window.
   2. Dial Text and Markings: Black color on white background with scaled kPa and psi units.
   3. Accuracy: ASME B40.100, adjustable commercial grade (D) with 5 percent of span.

4. Process Connection: Lower-back, 1/4 inch NPT male except where noted.
5. Gauge Wetted Materials: Painted steel case and brass socket rated to match process pressure and temperature range.
6. Comply with UL 393 when used for fire protection service or UL 404 when used for compressed gas service.

C. Accessories:
1. Gauge Cock: Carbon steel with tee or lever handle for maximum 150 psi.

2.02 THERMOMETERS

A. Manufacturers:
1. Dwyer Instruments, Inc: www.dwyer-inst.com/#sle.
2. Moeller Instrument Company, Inc: www.moellerinstrument.com/#sle.
3. Watts Water Technologies, Inc: www.watts.com/#sle.
4. Weiss Instruments, LLC: www.weissinstruments.com/#sle.
5. Weksler Glass Thermometer Corp: www.wekslerglass.com/#sle.
6. Substitutions: See Section 01 6000 - Product Requirements.

B. General:
1. Product Compliance: ASTM E1.
2. Lens: Clear glass or polycarbonate (indoors, not exposed to direct sunlight only), except where stated.
3. Accuracy: One percent, when tested in accordance with ASTM E77, except where stated.
4. Scale: Black markings depicting single scale in degrees F where expected process value falls half-span of standard temperature range.

C. Thermometers - Adjustable Angle: 7 inch v-shape aluminum case with window scale, 6 inch NPT stem, red or blue organic non-toxic liquid filled glass tube, and adjustable joint with positive locking device allowing 360 degrees in horizontal plane or 180 degrees in vertical plane adjustments.

2.03 PRESSURE-TEMPERATURE TEST PLUGS:

A. Size: 500 psi capacity; 1/2 inch MPT brass fitting with gasket, cap, and retaining strap for 1/8 inch pressure gauge or temperature probe.

B. Wetted Materials per Temperature Range:
1. Up to 200 degrees F: Brass probe with neoprene core.

C. Accessories: Brass, lever-handle cock and snubber-filter.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not install instrumentation when areas are under construction, except for required rough-in, taps, supports, and test plugs.

3.02 INSTALLATION

A. Install metering products in accordance with manufacturer's instructions for intended fluid type and service.

B. Install pressure gauges as follows:
   1. At Pumps: Place single gauge before strainer, suction side and discharge side.
   2. Include gauge cock to isolate each gauge and extend nipples for insulation clearance.
   3. Adjust gauges to selected viewing angle, clean thoroughly, and calibrate to zero.

C. Install thermometers as follows:
   1. HWater Heaters: Place upstream and downstream of heater. Add one on the inlet end when using steam as the water heating medium.
   2. Piping: Install thermometers in branch butt weld connection fitting or socket-weld thermowell. Enlarge pipes smaller than 2-1/2 inch to accommodate sockets. Ensure sockets are above insulation clearance.

D. Locate test plugs adjacent to thermometers and thermometer sockets, adjacent to pressure gauges and pressure gauge taps, adjacent to control device sockets, and where indicated.

3.03 SCHEDULES

A. Pressure Gauges, Location and Scale Range:
   1. Pumps, 0 to 200 psi.
   2. Pressure reducing valves, 0 to 200 psi.
   3. Backflow preventers and Reduced Pressure Zone Assemblies (RPZA) - Street side of service, 0 to 200 psi.

B. Pressure Gauge Tappings, Location:
   1. Control valves 3/4 inch & larger - inlets and outlets.

C. Thermometers, Location and Scale Range:
   1. Domestic water heaters - supply outlet and recirculation within 5 feet of last fixture served at end of line (or integral to pump), 0 to 240 degrees F.

END OF SECTION 22 0519

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SECTION 22 0523
GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Ball valves.
B. Check valves.
C. Gate valves.
D. Lubricated plug valves.

1.02 RELATED REQUIREMENTS

A. Section 08 3100 - Access Doors and Panels.
B. Section 22 1005 - Plumbing Piping.

1.03 ABBREVIATIONS AND ACRONYMS

A. CWP: Cold working pressure.
B. EPDM: Ethylene propylene copolymer rubber.
C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.
D. NRS: Non-rising stem.
E. OS&Y: Outside screw and yoke.
F. PTFE: Polytetrafluoroethylene.
G. RS: Rising stem.
H. TFE: Tetrafluoroethylene.
I. WOG: Water, oil, and gas.

1.04 REFERENCE STANDARDS

A. API STD 594 - Check Valves: Flanged, Lug, Wafer, and Butt-Welding 2022.
B. ASME B1.20.1 - Pipe Threads, General Purpose, Inch 2013 (Reaffirmed 2018).
C. ASME B16.5 - Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard 2020.
D. ASME B16.10 - Face-to-Face and End-to-End Dimensions of Valves 2022.
E. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings 2021.
F. ASME B16.34 - Valves — Flanged, Threaded, and Welding End 2020.
G. ASME B31.9 - Building Services Piping 2020.
H. ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings 2004 (Reapproved 2019).
I. ASTM A536 - Standard Specification for Ductile Iron Castings 1984, with Editorial Revision (2019).
J. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings 2017.
K. MSS SP-45 - Drain and Bypass Connections 2020.
L. MSS SP-71 - Gray Iron Swing Check Valves, Flanged and Threaded Ends 2018.

M. MSS SP-72 - Ball Valves with Flanged or Butt-Welding Ends for General Service 2010a.
N. MSS SP-80 - Bronze Gate, Globe, Angle, and Check Valves 2019.
O. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends 2010, with Errata .
P. NSF 61 - Drinking Water System Components - Health Effects 2021.
Q. NSF 372 - Drinking Water System Components - Lead Content 2022.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.
B. Product Data: Provide data on valves including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Use the following precautions during storage:
    1. Maintain valve end protection and protect flanges and specialties from dirt.
        a. Provide temporary inlet and outlet caps.
        b. Maintain caps in place until installation.
    2. Store valves in shipping containers and maintain in place until installation.
        a. Store valves indoors in dry environment.
        b. Store valves off the ground in watertight enclosures when indoor storage is not an option.

1.07 EXERCISE THE FOLLOWING PRECAUTIONS FOR HANDLING:

A. Avoid the use of operating handles or stems as rigging or lifting points.

PART 2 PRODUCTS

2.01 APPLICATIONS

A. See drawings for specific valve locations.
B. Listed pipe sizes shown using nominal pipe sizes (NPS) and nominal diameter (DN).
C. Provide the following valves for the applications if not indicated on drawings:
    1. Shutoff: Ball, or gate.
    2. Swing Check (Pump Outlet):
        a. 2 inch and Smaller: Bronze swing check valves with bronze or nonmetallic disc.
        b. 2-1/2 inch and Larger for Domestic Water: Iron swing check valves with closure control, metal or resilient seat check valves.
D. Substitutions of valves with higher CWP classes or WSP ratings for same valve types are permitted when specified CWP ratings or WSP classes are not available.
E. Required Valve End Connections for Non-Wafer Types:
    1. Copper Tube:

a. 2 inch and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
b. 2-1/2 inch to 4 inch: Grooved or flanged ends except where threaded valve-end option is indicated in valve schedules below.

F. Domestic, Hot and Cold Water Valves:
1. 2 inch and Smaller:
a. Bronze and Brass: Provide with solder-joint ends.
b. Ball: One piece, full port, brass with brass trim.
c. Bronze Swing Check: Class 125, bronze disc.
d. Bronze Gate: Class 125, NRS.
2. 2-1/2 inch and Larger:
a. Iron, 2-1/2 inch to 4 inch: Provide with threaded ends.
b. Iron Ball: Class 150.
c. Iron Swing Check: Class 125, metal seats.
d. Iron Grooved-End Swing Check: 300 CWP.
e. Iron Gate: Class 125, NRS.
f. Iron Globe: Class 125.

2.02 GENERAL REQUIREMENTS

A. Valve Pressure and Temperature Ratings: No less than rating indicated; as required for system pressures and temperatures.
B. Valve Sizes: Match upstream piping unless otherwise indicated.
C. Valve Actuator Types:
1. Handwheel: Valves other than quarter-turn types.
2. Hand Lever: Quarter-turn valves 6 inch and smaller except plug valves.
D. Insulated Piping Valves: With 2 inch stem extensions and the following features:
1. Gate Valves: Rising stem.
2. Ball Valves: Extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
E. Valve-End Connections:
1. Threaded End Valves: ASME B1.20.1.
2. Pipe Flanges and Flanged Fittings 1/2 inch through 24 inch: ASME B16.5.
F. General ASME Compliance:
1. Ferrous Valve Dimensions and Design Criteria: ASME B16.10 and ASME B16.34.
2. Solder-joint Connections: ASME B16.18.
3. Building Services Piping Valves: ASME B31.9.
G. Potable Water Use:
1. Certified: Approved for use in compliance with NSF 61 and NSF 372.

2. Lead-Free Certified: Wetted surface material includes less than 0.25 percent lead content.

H. Valve Bypass and Drain Connections: MSS SP-45.

2.03 BRASS, BALL VALVES

A. One Piece, Full Port with Brass Trim and Push-to-fit or Threaded Connections:
1. Comply with MSS SP-110.
2. CWP Rating: 200 psi.
3. Body: Forged brass.
4. Seats: PTFE.
5. Stem: Brass.
6. Ball: Chrome-plated brass.
7. Operator: Handle.

2.04 IRON, BALL VALVES

A. Class 125, Full Port, Stainless Steel Trim:
1. Comply with MSS SP-72.
2. CWP Rating: 200 psi.
3. Body: ASTM A536 Grade 65-45-12, ductile iron.
4. End Connections: Flanged.
5. Seats: PTFE.
6. Operator: Lever with locking handle.

2.05 BRONZE, SWING CHECK VALVES

A. General:
1. Fabricate from dezincification resistant material.
2. Copper alloys containing more than 15 percent zinc are not permitted.

B. Class 125:
1. Pressure and Temperature Rating: MSS SP-80, Type 3.
2. Design: Y-pattern, horizontal or vertical flow.
3. WOG Rating: 200 psi.
4. Body: Bronze, ASTM B62.
5. End Connections: Threaded.
6. Disc: Bronze.

2.06 IRON, SWING CHECK VALVES WITH CLOSURE CONTROL

A. Class 125 with Lever and Spring-Closure Control.
1. Comply with MSS SP-71, Type I.
2. Description:
a. CWP Rating: 200 psi.
b. Design: Clear or full waterway.
c. Body: ASTM A126, gray iron with bolted bonnet.

d. Ends: Flanged as indicated.
e. Trim: Bronze.
f. Gasket: Asbestos free.
g. Closer Control: Factory installed, exterior lever, and weight.

PART 3 EXECUTION

3.01 EXAMINATION

A. Discard all packing materials and verify that valve interior, including threads and flanges are completely clean without signs of damage or degradation that could result in leakage.
B. Verify valve parts to be fully operational in all positions from closed to fully open.
C. Confirm gasket material to be suitable for the service, to be of correct size, and without defects that could compromise effectiveness.
D. Should valve is determined to be defective, replace with new valve.

3.02 INSTALLATION

A. Provide unions or flanges with valves to facilitate equipment removal and maintenance while maintaining system operation and full accessibility for servicing.
B. Provide separate valve support as required and locate valve with stem at or above center of piping, maintaining unimpeded stem movement.
C. Where valve support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welds.
D. Install check valves where necessary to maintain direction of flow as follows:

END OF SECTION 22 0523

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SECTION 22 0529

HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

Retain or delete this article in all Sections of Project Manual.

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

1.02 SUMMARY

A. Section Includes:
   1. Metal pipe hangers and supports.
   2. Trapeze pipe hangers.
   3. Thermal hanger-shield inserts.
   4. Equipment supports.

B. Section 01 2100 - Allowances: Cash, testing, and contingency allowances.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 PRODUCTS

2.01 METAL PIPE HANGERS AND SUPPORTS

Manufacturers and products listed in SpecAgent and MasterWorks Paragraph Builder are neither recommended nor endorsed by the AIA or AVITRU. Before inserting names, verify that manufacturers and products listed there comply with requirements retained or revised in descriptions and are both available and suitable for the intended applications. For definitions of terms and requirements for Contractor's product selection, see Section 016000 "Product Requirements."

A. Carbon-Steel Pipe Hangers and Supports:
   1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
   2. Galvanized Metallic Coatings: Pre-galvanized, hot-dip galvanized, or electro-galvanized.
   3. Nonmetallic Coatings: Plastic coated or epoxy powder coated.
   4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
   5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

2.02 TRAPEZE PIPE HANGERS

Trapeze pipe hanger in "Description" Paragraph below requires calculating and detailing at each use.

A. Description: MSS SP-58, Type 59, shop- or field-fabricated pipe-support assembly, made from structural-carbon-steel shapes, with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.03 THERMAL HANGER-SHIELD INSERTS

A. Insulation-Insert Material for Cold Piping: ASTM C552, Type II cellular glass with 100-psig minimum compressive strength and vapor barrier.

B. Insulation-Insert Material for Hot Piping: Water-repellent-treated, ASTM C533, Type I calcium silicate with 100-psig minimum compressive strength.

C. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

D. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

E. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

PART 3 EXECUTION

3.01 APPLICATION

A. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping materials and installation, for penetrations through fire-rated walls, ceilings, and assemblies.

B. Strength of Support Assemblies: Where not indicated, select sizes of components, so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

3.02 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-58. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

Trapeze pipe hanger in "Metal Trapeze Pipe-Hanger Installation" Paragraph below requires calculating and detailing at each use.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-58. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size, or install intermediate supports for smaller-diameter pipes as specified for individual pipe hangers.
2. Field fabricate from ASTM A36/A36M carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Thermal Hanger-Shield Installation: Install in pipe hanger or shield for insulated piping.

Pipe stand in "Pipe Stand Installation" Paragraph below requires calculating and detailing at each use.

D. Pipe Stand Installation:
   1. Pipe Stand Types, except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
   2. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. See Section 077200 "Roof Accessories" for curbs.

E. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
   Equipment support in "Equipment Support Installation" Paragraph below requires calculating and detailing at each use.

F. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

G. 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.

H. Install lateral bracing with pipe hangers and supports to prevent swaying.

I. Load Distribution: Install hangers and supports, so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

J. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

K. Insulated Piping:
   Specify parts in first three subparagraphs below as galvanized or painted, as required. Other materials are available in place of wooden blocks.
   1. Attach clamps and spacers to piping.
      a. Piping Operating Above Ambient Air Temperature: Clamp may project through insulation.
      b. Piping Operating Below Ambient Air Temperature: Use thermal hanger-shield insert with clamp sized to match OD of insert.
      c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
   2. Install MSS SP-58, Type 39 protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
      a. Option: Thermal hanger-shield inserts may be used. Include steel weight-distribution plate for pipe 4 inches and larger if pipe is installed on rollers.

High-compressive-strength inserts may permit use of shorter shields or shields with less arc span. Revise first subparagraph below to suit Project.

3. Install MSS SP-58, Type 40 protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

3.03 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.04 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.

3.05 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.

3.06 PAINTING

Retain first "Touchup" Paragraph below if Section 099113 "Exterior Painting" or Section 099123 "Interior Painting" is not in Project Manual.

A. Touchup: Clean field welds and abraded, shop-painted areas. Paint exposed areas immediately after erecting hangers and supports. Use same materials as those used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

Retain "Touchup" Paragraph below if Section 099113 "Exterior Painting" or Section 099123 "Interior Painting" is in Project Manual. Revise reference if Section 099600 "High-Performance Coatings" applies instead.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas, and apply galvanizing-repair paint to comply with ASTM A780/A780M.

3.07 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-58 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finishes.
D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
E. Use carbon-steel pipe hangers and supports and metal trapeze pipe hangers and attachments for general service applications.
F. Use padded hangers for piping that is subject to scratching.
G. Use thermal hanger-shield inserts for insulated piping and tubing.
H. 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: For suspension of non-insulated or insulated, stationary pipes ½ inches to and larger.
    2. Carbon or Alloy-Steel, Double-Bolt Pipe Clamps: For suspension of pipes ¾ inches and larger, requiring clamp flexibility and up to 4 in of insulation.
    3. Steel Pipe Clamps: For suspension of cold and hot pipes ½ inches and larger if little or no insulation is required.
    4. Pipe Hangers: For suspension of pipes ½ inches thru 4 inches, to allow off-center closure for hanger installation before pipe erection.
    5. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of no-ninsulated, stationary pipes ½ inches thru 8 inches.
    6. Pipe Saddle Supports (MSS Type 36): For support of pipes 4 inches to 36 inches, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
    7. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes 2-1/2 inches to 36 inches if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
I. 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 3/4 inch to 24 inches.
J. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
    1. Steel Turnbuckles (MSS Type 13): For adjustment of up to 6 inches for heavy loads.
    2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
    3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11 split pipe rings.

4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.

K. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Steel or Malleable-Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
   2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
   3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
   4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
   5. C-Clamps (MSS Type 23): For structural shapes.
   6. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
   7. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
   8. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

L. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
   2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
   3. Thermal Hanger-Shield Inserts: For supporting insulated pipe.

M. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
   2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.

N. Comply with MSS SP-58 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

O. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

Verify suitability of fasteners in this article for use in lightweight concrete or concrete slabs less than 4 inches (100 mm) thick. Powder-actuated fasteners may be banned for use in certain occupancies. Consult authorities having jurisdiction and the Owner's project requirements.

P. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

Q. Use pipe-positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION 22 0529

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SECTION 22 0553

IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SUMMARY

1.02 ACTION SUBMITTALS

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

PART 2 PRODUCTS

2.01 EQUIPMENT LABELS

A. Metal Labels for Equipment:

Retain multiple material options in "Material and Thickness" Subparagraph below to allow Contractor to retain most cost-effective material.

1. Material and Thickness: aluminum, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Letter Color: Black.
3. Background Color: White.
4. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
5. Minimu]m Letter Size: 1/2 inch. .
6. Fasteners: Stainless-steel rivets.
7. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

In "Label Content" Paragraph below, the objective of labeling equipment is to coordinate it with Drawings, including plans, details, and schedules. This will allow other information, such as capacities and operating characteristics, to be obtained.

B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and 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) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.02 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: White.
D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
F. Minimum Letter Size: 1/2 inch.
G. Fasteners: Stainless-steel rivets.
H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
In "Label Content" Paragraph below, the objective of labeling equipment is to coordinate it with Drawings, including plans, details, and schedules. This will allow other information, such as capacities and operating characteristics, to be obtained.
I. Label Content: Include caution and warning information plus emergency notification instructions.

2.03 PIPE LABELS

A. Retain this article if these devices will identify some or all piping. Identification of piping by color-coded painting is covered in "Pipe Label Installation" Article.
Do not use pipe labels or plastic tapes for bare pipes conveying fluids at temperatures of 125 deg F (52 deg C) or higher.
B. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
C. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to partially cover circumference of pipe and to attach to pipe without fasteners or adhesive.
D. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
E. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; also include pipe size and an arrow indicating flow direction.
1. Flow-Direction Arrows: Integral with piping-system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.

PART 3 EXECUTION

3.01 EQUIPMENT LABEL INSTALLATIONVERIFICATION OF CONDITIONS: VERIFY THAT [____].

A. Install or permanently fasten labels on each major item of mechanical equipment.
B. Locate equipment labels where accessible and visible.

3.02 PIPE LABEL INSTALLATION

A. Pipe Label Locations: 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 and o]n both sides of through walls, floors, ceilings, and inaccessible enclosures.
   4. At access doors, manholes, and similar access points that permit view of concealed piping.
   5. Near major equipment items and other points of origination and termination.
   6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
   7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

B. Pipe Label Color Schedule:
   1. The colors listed in subparagraphs below comply with color designations according to ASME A13.1. Background and lettering colors should comply with recommendations in ASME A13.1 unless otherwise indicated. Note also that all colors listed in ASME A13.1 preceded by the word "Safety" are required to comply with ANSI Z535.1.
   2. Domestic Water Piping
      a. Background: Safety green.
      b. Letter Colors: White.

3.03 INSTALLATIONPIPE LABEL INSTALLATION

END OF SECTION 22 0553

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SECTION 22 0719
PLUMBING PIPING INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Glass fiber insulation.
B. Jacketing and accessories.
C. Insulation Schedules for:
   1. Domestic Hot Water Supply
   2. Domestic Hot Water Recirculation
   3. Domestic Cold Water
   4. Field-Applied Jacketing

1.02 RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping.
B. Section 22 0553 - Identification for Plumbing Piping and Equipment: Labeling formatting, colors, and additional instructions for insulation and field-applied jacketing.
C. Section 22 1005 - Plumbing Piping: Placement of hangers and hanger inserts .

1.03 REFERENCE STANDARDS

A. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus 2019.
B. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement 2007 (Reapproved 2019).
C. ASTM C449 - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement 2007 (Reapproved 2019).
D. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation 2022.
E. ASTM C755 - Standard Practice for Selection of Water Vapor Retarders for Thermal Insulation 2020.
F. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel 2008 (Reapproved 2018).
G. ASTM D1784 - Standard Classification System and Basis for Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds 2020.
H. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2022.
I. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials 2022.
J. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi 2015, with Editorial Revision (2021).

K. MIL-A-3316 - Adhesives, Fire-Resistant, Thermal Insulation 1987c (Amended 1990).

L. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

C. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

1.06 FIELD CONDITIONS

A. Maintain ambient conditions required by manufacturers of each product.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

B. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C871.

C. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C795.

2.02 GLASS FIBER INSULATION

A. Manufacturers:

1. CertainTeed Corporation: www.certainteed.com/#sle.
2. Johns Manville Corporation: www.jm.com/#sle.
3. Knauf Insulation: www.knaufinsulation.com/#sle.
4. Owens Corning Corporation: www.ocbuildingspec.com/#sle.

B. Insulation: ASTM C547 and ASTM C795; rigid molded, noncombustible.

1. K Value: ASTM C177, 0.24 at 75 degrees F.
2. Maximum Service Temperature: 850 degrees F.
3. Maximum Moisture Absorption: 0.2 percent by volume.

C. Vapor Barrier Jacket: White Kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm inch.

D. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.

E. Vapor Barrier Lap Adhesive: Compatible with insulation, and complying with MIL-A-3316C.

F. Insulating Cement/Mastic: ASTM C195; hydraulic setting on mineral wool.

G. Indoor Vapor Barrier Finish:

1. Vinyl emulsion type acrylic, compatible with insulation, black color. Suitable for indoor use on below-ambient services.
    a. Water-Vapor Permeance: Comply with ASTM C755, Section 7.2.2, Table 2 for insulation type and service conditions.
    b. Service temperature range: -20°F to 180°F .

H. Insulating Cement: ASTM C449.

2.03 JACKETING AND ACCESSORIES

1. Jacket: High-impact resistant, UV-resistant PVC complying with ASTM D1784, Class 16354-C; one-piece molded type fitting covers and sheet material, off-white color.
    a. Minimum Service Temperature: 0 degrees F.
    b. Maximum Service Temperature: 150 degrees F.
    c. Moisture Vapor Permeability: 0.002 perm inch, maximum, when tested in accordance with ASTM E96/E96M.
    d. Thickness: 10 mil, 0.010 inch.
    e. Connections: Brush on welding adhesive as recommended by jacket material manufacturer.
    f. Factory-fabricated fitting covers to match jacket.
        1) Shapes: 45° and 90° short- and long-radius ells, Tees, Valves, Flanges, Unions, Reducers, End caps, Soil-pipe hubs, Traps, Mechanical joints, and P-trap and supply water piping covers for lavatories.
2. Jacket: One piece molded type fitting covers and sheet material, off-white color.
    a. Minimum Service Temperature: Minus 40 degrees F.
    b. Maximum Service Temperature: 180 degrees F.
    c. Moisture Vapor Permeability: 0.012 perm inch, when tested in accordance with ASTM E96/E96M.
    d. Thickness: 30 mil, 0.03 inch.
    e. Connections: Brush on welding adhesive.

PART 3 EXECUTION

3.01 EXAMINATION

A. **IMPORTANT! Verify that piping system has been tested <u>before</u> applying insulation materials.**

B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.

B. Install in accordance with North American Insulation Manufacturers Association (NAIMA) National Insulation Standards.

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 multiple layers of insulation with longitudinal and end seams staggered.

E. Exposed Piping: Locate insulation and cover seams in least visible locations.

F. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, and expansion joints.

G. Insulation Methods for 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.**

H. Glass fiber insulated pipes conveying fluids below ambient temperature:
1. Provide vapor barrier jackets, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure-sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.

I. Glass fiber insulated pipes conveying fluids above ambient temperature:
1. Provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure-sensitive adhesive. Secure with outward clinch expanding staples.
2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.

J. Flexible Elastomeric Insulated pipes:
1. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

K. Inserts and Shields:
   1. Application: Piping 1-1/2 inches diameter or larger.
   2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
   3. Insert Location: Between support shield and piping and under the finish jacket.
   4. Insert Configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.
   5. Insert Material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.

L. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, see Section 07 8400.

M. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 10 feet above finished floor): Finish with canvas jacket sized for finish painting.

N. Penetrations:
   1. Install insulation continuously through floor and wall penetrations, including fire-rated walls and partitions. Seal penetrations through fire-rated assemblies in accordance with Section 07 8400 - Firestopping.
   2. Install insulation continuously through exterior wall and roof penetrations. Seal penetrations with flashing sealant.
   3. For applications requiring only indoor insulation, terminate insulation on exterior of wall or roof surface and seal with joint sealant.

O. Field-Applied Jacketing:
   1. PVC Plastic or ABS Plastic Jackets: Install with 1-inch overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive. Apply minimum of two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge, in addition to sealant beads directed by manufacturer.

3.03 FINISHES

A. Paint jacket with primer compatible with jacket material, and finish with minimum two finish coats. Add fungicidal agent to render insulation and jacketing materials mildew-resistant. See Section 09 9113 - Exterior Painting and 09 9123 - Interior Painting for additional instructions.

B. Label piping with system information as indicated in Section 22 0553 - Identification for Plumbing Piping and Equipment.

3.04 SCHEDULES

A. Plumbing System Insulation:
   1. Domestic Hot Water Supply:

a. Glass Fiber Insulation: All locations, except exterior or high humidity locations.

Pipe Size Range	Insulation Depth
Up to 1" Dia.	1" Thickness
1-1/4" to 3-1/2" Dia.	1-1/2" Thickness
4" Dia. and above	2" Thickness

b. Polyethylene Insulation: All locations, including exterior and high humidity locations.

Pipe Size Range	Insulation Depth
Up to 1" Dia.	1" Thickness
1-1/4" to 3-1/2" Dia.	1-1/2" Thickness
4" Dia. and above	2" Thickness

2. Domestic Hot Water Recirculation:
   a. Glass Fiber Insulation: All locations, except exterior or high humidity locations.

Pipe Size Range	Insulation Depth
Up to 1" Dia.	1" Thickness
1-1/4" to 3-1/2" Dia.	1-1/2" Thickness
4" Dia. and above	2" Thickness

3. Domestic Cold Water:
   a. Glass Fiber Insulation: All locations, except exterior or high humidity locations.

Pipe Size Range	Insulation Depth
Up to 1" Dia.	1" Thickness
1-1/4" to 3-1/2" Dia.	1-1/2" Thickness
4" Dia. and above	2" Thickness

B. Field-Applied Jacketing
   a. Not exposed to view, not subject to damage: None.

END OF SECTION 22 0719

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SECTION 22 1005
PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Sanitary waste piping, buried within 5 feet of building.
B. Sanitary waste piping, above grade.
C. Domestic water piping, buried within 5 feet of building.
D. Domestic water piping, above grade.

1.02 RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping.
B. Section 08 3100 - Access Doors and Panels.
C. Section 09 9113 - Exterior Painting.
D. Section 09 9123 - Interior Painting.
E. Section 22 0553 - Identification for Plumbing Piping and Equipment.
F. Section 22 0719 - Plumbing Piping Insulation.

1.03 REFERENCE STANDARDS

A. ANSI Z21.22 - American National Standard for Relief Valves for Hot Water Supply Systems 2015 (Reaffirmed 2020).
B. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300 2021.
C. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings 2021.
D. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings 2021.
E. ASME B16.23 - Cast Copper Alloy Solder Joint Drainage Fittings: DWV 2021.
F. ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder-Joint Drainage Fittings - DWV 2017.
G. ASME B31.1 - Power Piping 2020.
H. ASME B31.9 - Building Services Piping 2020.
I. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators 2021.
J. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless 2020.
K. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service 2019.
L. ASTM B32 - Standard Specification for Solder Metal 2020.
M. ASTM B42 - Standard Specification for Seamless Copper Pipe, Standard Sizes 2020.
N. ASTM B88 - Standard Specification for Seamless Copper Water Tube 2020.
O. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric) 2020.
P. ASTM B306 - Standard Specification for Copper Drainage Tube (DWV) 2020.

Q. ASTM B813 - Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube 2016.
R. ASTM B828 - Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings 2016.
S. ASTM D2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems 2020.
T. ASTM D2665 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings 2020.
U. ASTM D2729 - Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings 2021.
V. ASTM D2855 - Standard Practice for the Two-Step (Primer and Solvent Cement) Method of Joining Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Piping Components with Tapered Sockets 2020.
W. ASTM D3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings 2021.
X. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2022.
Y. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings 2017.
Z. AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast 2017, with Errata (2018).
AA. NSF 61 - Drinking Water System Components - Health Effects 2021.
BB. NSF 372 - Drinking Water System Components - Lead Content 2022.
CC. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.
B. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.

1.05 QUALITY ASSURANCE

A. Perform work in accordance with applicable codes.
B. Valves: Manufacturer's name and pressure rating marked on valve body.
C. Welding Materials and Procedures: Comply with ASME BPVC-IX and applicable state labor regulations.
D. Welder Qualifications: Certified in accordance with ASME BPVC-IX.
E. Identify pipe with marking including size, ASTM material classification, ASTM specification, potable water certification, water pressure rating.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary protective coating on cast iron and steel valves.
C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Potable Water Supply Systems: Provide piping, pipe fittings, and solder and flux (if used), that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.
B. Plenum-Installed Acid Waste Piping: Flame-spread index equal or below 25 and smoke-spread index equal or below 50 according to ASTM E84 or UL 723 tests.

2.02 SANITARY WASTE PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. PVC Pipe: ASTM D2665 or ASTM D3034.
   1. Fittings: PVC.
   2. Joints: Solvent welded, with ASTM D2564 solvent cement.

2.03 SANITARY WASTE PIPING, ABOVE GRADE

A. Copper Tube: ASTM B306, DWV.
   1. Fittings: ASME B16.29, wrought copper, or ASME B16.23, sovent.
   2. Joints: ASTM B32, alloy Sn50 solder.
B. Copper Pipe: ASTM B42.
   1. Fittings: ASME B16.23, cast copper, or ASME B16.29, wrought copper.
   2. Joints: ASTM B32, alloy Sn50 solder.
C. PVC Pipe: ASTM D2729. **(PROHIBITED IN RETURN AIR PLENUMS)**
   1. Fittings: PVC.
   2. Joints: Solvent welded, with ASTM D2564 solvent cement.

2.04 DOMESTIC WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Copper Pipe: ASTM B42, hard drawn.
   1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22 wrought copper and bronze.
   2. Joints: ASTM B32, alloy Sn95 solder.
B. Ductile Iron Pipe: AWWA C151/A21.51.
   1. Fittings: Ductile or gray iron, standard thickness.
   2. Joints: AWWA C111/A21.11, styrene butadiene rubber (SBR) or vulcanized SBR gasket with 3/4 inch diameter rods.

2.05 DOMESTIC WATER PIPING, ABOVE GRADE

A. Copper Tube: ASTM B88 (ASTM B88M), Type L (B), Drawn (H).

1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
2. Joints: Grooved mechanical couplings.
3. Mechanical Press Sealed Fittings: Double-pressed type, NSF 61 and NSF 372 approved or certified, utilizing EPDM, nontoxic, synthetic rubber sealing elements.
    a. Manufacturers:
        1) Anvil International: www.anvilintl.com/#sle.
        2) Apollo Valves: www.apollovalves.com/#sle.
        3) Grinnell Products: www.grinnell.com/#sle.
        4) Viega LLC: www.viega.us/#sle.
        5) Substitutions: See Section 01 6000 - Product Requirements.

2.06 NATURAL GAS PIPING, ABOVE GRADE

A. Steel Pipe: ASTM A53/A53M Schedule 40 black.
    1. Fittings: ASME B16.3, malleable iron, or ASTM A234/A234M, wrought steel welding type.
    2. Joints: Threaded or welded to ASME B31.1.

2.07 PIPE FLANGES, UNIONS, AND COUPLINGS

A. Unions for Pipe Sizes 3 inch and Under:
    1. Ferrous Pipe: Class 150 malleable iron threaded unions.
    2. Copper Tube and Pipe: Class 150 bronze unions with soldered joints.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that excavations are to required grade, dry, and not over-excavated.

3.02 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
B. Remove scale and dirt, on inside and outside, before assembly.
C. Prepare piping connections to equipment with flanges or unions.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.
B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.
C. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.
D. Install piping to maintain headroom, conserve space, and not interfere with use of space.
E. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.
F. Provide access where valves and fittings are not exposed.

1. Coordinate size and location of access doors with Section 08 3100.

G. Establish elevations of buried piping outside the building to ensure sufficient cover as to place piping not less than 12 inches below frost line.

H. Install vent piping penetrating roofed areas to maintain integrity of roof assembl.

I. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc-rich primer to welding.

J. Prepare exposed, unfinished pipe, fittings, supports, and accessories for finish painting.
   1. See Section 09 9123 for painting of interior plumbing systems and components.
   2. See Section 09 9113 for painting of exterior plumbing systems and components.

K. Copper Pipe and Tube: Make soldered joints in accordance with ASTM B828, using specified solder, and flux meeting ASTM B813; in potable water systems use flux also complying with NSF 61 and NSF 372.

L. PVC Pipe: Make solvent-welded joints in accordance with ASTM D2855.

M. Pipe Hangers and Supports:
   1. Install in accordance with ASME B31.9 and Section 22 0529 - Hangers and Supports for Plumbing Piping and Equipment.
   2. Support horizontal piping as indicated.
   3. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
   4. Place hangers within 12 inches of each horizontal elbow.
   5. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
   6. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.

3.04 APPLICATION

A. Install unions downstream of valves and at equipment or apparatus connections.

B. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.

3.05 TOLERANCES

A. Drainage Piping: Establish invert elevations within 1/2 inch vertically of location indicated and slope to drain at minimum of 1/4 inch per foot slope.

B. Water Piping: Slope at minimum of 1/32 inch per foot and arrange to drain at low points.

3.06 FIELD TESTS AND INSPECTIONS

A. Verify and inspect systems according to requirements by the Authority Having Jurisdiction. In the absence of specific test and inspection procedures proceed as indicated below.

B. Domestic Water Systems:
   1. Perform hydrostatic testing for leakage prior to system disinfection.
   2. Test Preparation: Close each fixture valve or disconnect and cap each connected fixture.
   3. General:
      a. Fill the system with water and raise static head to 10 psi above service pressure. Minimum static head of 50 to 150 psi. As an exception, certain codes allow a maximum static pressure of 80 psi.

C. Test Results: Document and certify successful results, otherwise repair, document, and retest.

3.07 SCHEDULES

A. Pipe Hanger Spacing:
   1. Metal Piping:
      a. Pipe Size: 1/2 inch to 1-1/4 inch:
         1) Maximum Hanger Spacing: 6.5 ft.
         2) Hanger Rod Diameter: 3/8 inches.
      b. Pipe Size: 1-1/2 inch to 2 inch:
         1) Maximum Hanger Spacing: 10 ft.
         2) Hanger Rod Diameter: 3/8 inch.
      c. Pipe Size: 2-1/2 inch to 3 inch:
         1) Maximum Hanger Spacing: 10 ft.
         2) Hanger Rod Diameter: 1/2 inch.
      d. Pipe Size: 4 inch to 6 inch:
         1) Maximum Hanger Spacing: 10 ft.
         2) Hanger Rod Diameter: 5/8 inch.
      e. Pipe Size: 8 inch to 12 inch:
         1) Maximum hanger spacing: 14 ft.
         2) Hanger Rod Diameter: 7/8 inch.
   2. Plastic Piping:
      a. All Sizes:
         1) Maximum Hanger Spacing: 6 ft.
         2) Hanger Rod Diameter: 3/8 inch.

END OF SECTION 22 1005

SECTION 22 1006
PLUMBING PIPING SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Drains.
B. Cleanouts.
C. Hose bibbs.
D. Hydrants.
E. Backflow preventers.
F. Water hammer arrestors.
G. Mixing valves.
H. Air vents.
I. Floor drain trap seals.

1.02 RELATED REQUIREMENTS

A. Section 01 1000 - Summary: Product requirements for Owner furnished kitchen equipment.
B. Section 22 1005 - Plumbing Piping.
C. Section 22 3000 - Plumbing Equipment.

1.03 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design 2010.
B. ASSE 1011 - Performance Requirements for Hose Connection Vacuum Breakers 2017.
C. ASSE 1012 - Performance Requirements for Backflow Preventers with an Intermediate Atmospheric Vent 2021.
D. ASSE 1013 - Performance Requirements for Reduced Pressure Principle Backflow Prevention Assemblies 2021.
E. NSF 61 - Drinking Water System Components - Health Effects 2021.
F. NSF 372 - Drinking Water System Components - Lead Content 2022.
G. PDI-WH 201 - Water Hammer Arresters 2017.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.
B. Product Data: Provide component sizes, rough-in requirements, service sizes, and finishes.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Accept specialties on site in original factory packaging. Inspect for damage.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Specialties in Potable Water Supply Systems: Provide products that comply with NSF 61 and NSF 372 for maximum lead content.

2.02 DRAINS

A. Manufacturers:
   1. Jay R. Smith Manufacturing Company: www.jrsmith.com
   2. Josam Company: www.josam.com
   3. MIFAB, Inc: www.mifab.com
   4. Zurn Industries, LLC: www.zurn.com

B. Floor Drains:
   1. Manufacturers:
      a. ACO, Inc: www.acobuildingdrainage.us
      b. Jay R. Smith Manufacturing Company: www.jrsmith.com
      c. MIFAB, Inc: www.mifab.com
      d. Zurn Industries, LLC: www.zurn.com
      e. Substitutions: See Section 01 6000 - Product Requirements.

2.03 CLEANOUTS

A. Manufacturers:
   1. Jay R. Smith Manufacturing Company: www.jrsmith.com
   2. Josam Company: www.josam.com
   3. MIFAB, Inc: www.mifab.com
   4. Zurn Industries, LLC: www.zurn.com
   5. Substitutions: See Section 01 6000 - Product Requirements.

B. Cleanouts at Exterior Surfaced Areas:
   1. Round cast nickel bronze access frame and non-skid cover.

C. Cleanouts at Exterior Unsurfaced Areas:
   1. Line type with lacquered cast iron body and round epoxy coated gasketed cover.

D. Cleanouts at Interior Finished Wall Areas:
   1. Line type with lacquered cast iron body and round epoxy coated gasketed cover, and round stainless steel access cover secured with machine screw.

E. Cleanouts at Interior Unfinished Accessible Areas: Calked or threaded type. Provide bolted stack cleanouts on vertical rainwater leaders.

2.04 HOSE BIBBS

A. Manufacturers:
   1. Jay R. Smith Manufacturing Company: www.jrsmith.com
   2. Watts Regulator Company: www.wattsregulator.com
   3. Zurn Industries, LLC: www.zurn.com
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. Interior Hose Bibbs:

1. Bronze or brass with integral mounting flange, replaceable hexagonal disc, hose thread spout, chrome-plated where exposed with handwheel, integral vacuum breaker in compliance with ASSE 1011.

2.05 HYDRANTS

A. Manufacturers:
   1. Jay R. Smith Manufacturing Company: www.jrsmith.com
   2. Watts Regulator Company;: www.wattsregulator.com
   3. Zurn Industries, LLC: www.zurn.com
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. Wall Hydrants:

2.06 BACKFLOW PREVENTERS

A. Manufacturers:
   1. Apollo Valves: www.apollovalves.com
   2. MIFAB, Inc: www.mifab.com
   3. Watts Regulator Company, a part of Watts Water Technologies: www.wattsregulator.com
   4. Zurn Industries, LLC: www.zurn.com
   5. Substitutions: See Section 01 6000 - Product Requirements.

B. Reduced Pressure Backflow Preventer Assembly:
   1. ASSE 1013; cast bronze body and stainless steel springs; two independently operating, spring loaded check valves; diaphragm type differential pressure relief valve located between check valves; third check valve that opens under back pressure in case of diaphragm failure, and non-threaded vent outlet.

2.07 WATER HAMMER ARRESTORS

A. Manufacturers:
   1. Jay R. Smith Manufacturing Company: www.jrsmith.com
   2. Watts Regulator Company, a part of Watts Water Technologies: www.wattsregulator.com
   3. Zurn Industries, LLC: www.zurn.com
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. Water Hammer Arrestors:
   1. Stainless steel construction, bellows type sized in accordance with PDI-WH 201, precharged suitable for operation in temperature range minus 100 to 300 degrees F and maximum 250 psi working pressure.

2.08 MIXING VALVES

A. Thermostatic Mixing Valves:
   1. Manufacturers:
      a. ESBE: www.esbe.se/en.

b. Honeywell International Inc: www.honeywellhome.com
c. Leonard Valve Company: www.leonardvalve.com
d. Watts Regulator Company;: www.wattsregulator.com
e. Substitutions: See Section 01 6000 - Product Requirements.

2. Valve: Chrome-plated cast brass body, stainless steel or copper alloy bellows, integral temperature adjustment.
3. Accessories:
   a. Check valve on inlets.
   b. Volume control shut-off valve on outlet.

2.09 AIR VENTS

A. Manufacturers:
   1. Cash Acme, a brand of Reliance Worldwide Corporation: www.cashacme.com
   2. ITT Bell & Gossett: www.bellgossett.com
   3. Taco, Inc: www.taco-hvac.com

2.10 FLOOR DRAIN TRAP SEALS

A. Manufacturers:
   1. Green Drains: www.greendrains.com
   2. MIFAB, Inc: www.mifab.com
   3. RectorSeal; Sureseal: https://rectorseal.com
   4. Substitutions: See Section 01 6000 - Product Requirements.
B. Description: Mechanical trap Push-fit EPDM or silicone fitting with a one-way membrane.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.
B. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.
C. Encase exterior cleanouts in concrete flush with grade.
D. Install floor cleanouts at elevation to accommodate finished floor.
E. Install approved potable water protection devices on plumbing lines where contamination of domestic water may occur; on boiler feed water lines, janitor rooms, fire sprinkler systems, premise isolation, irrigation systems, flush valves, interior and exterior hose bibbs.
F. Pipe relief from backflow preventer to nearest drain or exterior.
G. Install water hammer arrestors complete with accessible isolation valve on cold water supply piping to toilets .

END OF SECTION 22 1006

SECTION 22 3000
PLUMBING EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Commercial gas-fired water heaters.
B. Tankless electric water heaters.
C. Commercial electric water heaters.
D. In-line circulator pumps.

1.02 RELATED REQUIREMENTS

A. Section 26 0583 - Wiring Connections: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

A. AHRI Directory of Certified Product Performance - Air-Conditioning, Heating, and Refrigeration Institute (AHRI) Current Edition.
B. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
C. ICC (IPC) - International Plumbing Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
D. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
E. UL 174 - Standard for Household Electric Storage Tank Water Heaters Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittals procedures.
B. Product Data:
    1. Provide dimension drawings of water heaters indicating components and connections to other equipment and piping.
    2. Indicate pump type, capacity, power requirements.
    3. Provide certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable.
    4. Provide electrical characteristics and connection requirements.
C. Project Record Documents: Record actual locations of components.
D. Operation and Maintenance Data: Include operation, maintenance, and inspection data, replacement part numbers and availability, and service depot location and telephone number.
E. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

B. Certifications:

1. Water Heaters: NSF approved.
2. Gas Water Heaters: AHRI Directory of Certified Product Performance.
3. Electric Water Heaters: UL listed and labeled to UL 174.
4. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

C. Identification: Provide pumps with manufacturer's name, model number, and rating/capacity identified by permanently attached label.

D. Performance: Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, operate within 25 percent of midpoint of published maximum efficiency curve.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Provide five year manufacturer warranty for domestic water heaters.

PART 2 PRODUCTS

2.01 WATER HEATERS

A. Manufacturers:

1. A.O. Smith Water Products Co: www.hotwater.com/#sle.
2. Rheem Manufacturing Company: www.rheem.com/#sle.
3. PVI.
4. State

B. Commercial Gas-Fired Water Heaters:

1. Type: Automatic, natural gas-fired, vertical storage.
2. Minimum Efficiency Required: ASHRAE Std 90.1 I-P.
3. Accessories:
   a. Water Connections: Brass.
   b. Dip Tube: Brass.
   c. Drain valve.
   d. Anode: Magnesium.
   e. Temperature and Pressure Relief Valve: ASME labeled.

C. Tankless Electric Water Heater:

1. Manufacturers:

a. Chronomite, Inc: www.chronomite.com/#sle.

2. Minimum Efficiency Required: ASHRAE Std 90.1 I-P.
3. Safeties: Provide internal safeties for water flow, electrical load, and thermal load.

D. Commercial Electric Water Heaters:
1. Manufacturers:
a. Bradford White Corporation; ElectriFLEX Series: www.bradfordwhite.com/#sle.
b. A.O. Smith.
c. State.
2. Type: Factory-assembled and wired, electric, vertical storage.
3. Minimum Efficiency Required: ASHRAE Std 90.1 I-P.

2.02 IN-LINE CIRCULATOR PUMPS

A. Manufacturers:
1. Armstrong Fluid Technology: www.armstrongfluidtechnology.com/#sle.
2. Bell & Gossett, a brand of Xylem, Inc: www.bellgossett.com/#sle.

B. Casing: Bronze, rated for 125 psig working pressure, with stainless steel rotor assembly.

C. Impeller: Bronze.

D. Shaft: Alloy steel with integral thrust collar and two oil lubricated bronze sleeve bearings.

E. Seal: Carbon rotating against a stationary ceramic seat.

F. Drive: Flexible coupling.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install plumbing equipment in accordance with manufacturer's instructions, as required by code, and complying with conditions of certification, if any.

B. Coordinate with plumbing piping and related electrical work to achieve operating system.

C. Pumps:
1. Provide line sized isolating valve and strainer on suction and line sized soft seated check valve on discharge.
2. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.

END OF SECTION 22 3000

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SECTION 22 4000
PLUMBING FIXTURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Flush valve water closets.
B. Wall hung urinals.
C. Lavatories.
D. Under-lavatory pipe supply covers.
E. Showers.
F. Outdoor drinking fountains.
G. Mop sinks.

1.02 RELATED REQUIREMENTS

A. Section 26 0583 - Wiring Connections: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design 2010.
B. ASME A112.6.1M - Floor-Affixed Supports for Off-the-Floor Plumbing Fixtures for Public Use 1997 (Reaffirmed 2017).
C. ASME A112.18.1 - Plumbing Supply Fittings 2018, with Errata.
D. ASME A112.18.9 - Protectors/Insulators for Exposed Waste and Supplies on Accessible Fixtures 2011 (Reaffirmed 2022).
E. ASME A112.19.2 - Ceramic Plumbing Fixtures 2018, with Errata.
F. ASME A112.19.5 - Flush Valves and Spuds for Water Closets, Urinals, and Tanks 2017.
G. ASSE 1016 - Performance Requirements for Automatic Compensating Valves for Individual Showers and Tub/Shower Combinations Current Edition, Including All Revisions and Addenda.
H. ASSE 1070 - Performance Requirements for Water Temperature Limiting Devices 2020.
I. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus 2019.
J. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus 2021.
K. ASTM C1822 - Standard Specification for Insulating Covers on Accessible Lavatory Piping 2021.
L. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2022.
M. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi 2015, with Editorial Revision (2021).
N. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.

O. NSF 61 - Drinking Water System Components - Health Effects 2021.
P. NSF 372 - Drinking Water System Components - Lead Content 2022.
Q. UL (DIR) - Online Certifications Directory Current Edition.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.
B. Product Data: Provide catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.
C. Manufacturer's Instructions: Indicate installation methods and procedures.
D. Maintenance Data: Include fixture trim exploded view and replacement parts lists.
E. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept fixtures on site in factory packaging. Inspect for damage.
B. Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.
B. Provide five year manufacturer warranty for electric water cooler.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Potable Water Systems: Provide plumbing fittings and faucets that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.
B. Water Efficiency: EPA WaterSense label is required for all water closets, urinals, lavatory faucets, and showerheads.
C. **All product requirements listed shall be considered minimum performance standards, and shall be adhered to UNLESS SCHEDULED OR SPECIFIED OTHERWISE ON DRAWINGS. Where the requirements of the Drawings deviate from these specifications, the more stringent requirement of the two shall be maintained.**

2.02 REGULATORY REQUIREMENTS

A. Comply with applicable codes for installation of plumbing systems.
B. Comply with UL (DIR) requirements.
C. Perform work in accordance with local health department regulations.

2.03 FLUSH VALVE WATER CLOSETS

A. Water Closets: Vitreous china, ASME A112.19.2, [_____], siphon jet flush action, china bolt caps.
   1. Manufacturers:
      a. American Standard, Inc: www.americanstandard-us.com/#sle.
      b. Kohler Company: www.kohler.com/#sle.
      c. TotoUSA: https://www.totousa.com/#sle.
      d. Zurn Industries, Inc: www.zurn.com/#sle.
      e. Substitutions: See Section 01 6000 - Product Requirements.

B. Public- and Private-Access Flush Valves: ASME A112.18.1, diaphragm type, complete with vacuum breaker stops and accessories.
   1. Valve Supply Size: 1 inch.
   2. Manufacturers:
      a. American Standard, Inc: www.americanstandard-us.com/#sle.
      b. Sloan Valve Company: www.sloanvalve.com/#sle.
      c. Zurn Industries, Inc: www.zurn.com/#sle.
      d. Substitutions: See Section 01 6000 - Product Requirements.
   3. Sensor-Operated:
      a. Type: ASME A112.19.5; chloramine-resistant clog-resistant dual-seat diaphragm valve complete with vacuum breaker, stops and accessories.
      b. Mechanism: Solenoid-operated piston or electronic motor-actuated operator with low-voltage powered infrared sensor, and mechanical override or override push button.
      c. Supplied Volume Capacity: 1.2 gal per flush.
   4. Exposed Type: Chrome-plated, escutcheon, integral screwdriver stop.

C. Seats:
   1. Manufacturers:
      a. American Standard, Inc: www.americanstandard-us.com/#sle.
      b. Bemis Manufacturing Company: www.bemismfg.com/#sle.
      c. Church Seat Company: www.churchseats.com/#sle.
      d. DXV by American Standard, Inc: www.dxv.com/#sle.
      e. Olsonite: www.olsonite.com/#sle.
      f. Substitutions: See Section 01 6000 - Product Requirements.
   2. Solid white plastic, open front, extended back, self-sustaining hinge, brass bolts, without cover.

D. Water Closet Carriers:
   1. Manufacturers:
      a. Jay R. Smith Manufacturing Company: www.jrsmith.com/#sle.

b. JOSAM Company: www.josam.com/#sle.
c. Zurn Industries, LLC: www.zurn.com/#sle.
d. Substitutions: See Section 01 6000 - Product Requirements.

2. ASME A112.6.1M; adjustable cast iron frame, integral drain hub and vent, adjustable spud, lugs for floor and wall attachment, threaded fixture studs with nuts and washers.

2.04 WALL HUNG URINALS

A. Manufacturers:
1. American Standard, Inc: www.americanstandard-us.com/#sle.
2. Kohler Company: www.kohler.com/#sle.
3. Toto USA : www.totousa.com/#sle.
4. Zurn Industries, Inc: www.zurn.com/#sle.
5. Substitutions: See Section 01 6000 - Product Requirements.

B. Vitreous china, ASME A112.19.2, wall hung with side shields and concealed carrier.
1. Flush Volume: 0.125 gallons, maximum.
2. Flush Style: Washout.
3. Flush Valve: Exposed (top spud).
4. Flush Operation: Sensor operated.
5. Trapway Outlet: Integral.
6. Removable stainless steel strainer.

C. Flush Valves:
1. Manufacturers:
a. American Standard, Inc: www.americanstandard-us.com/#sle.
b. Sloan Valve Company: www.sloanvalve.com/#sle.
c. Zurn Industries, Inc: www.zurn.com/#sle.
d. Substitutions: See Section 01 6000 - Product Requirements.
2. Sensor-Operated:
a. Type: ASME A112.19.5; chloramine-resistant, clog-resistant dual-seat diaphragm valve with vacuum breaker, stops and accessories.
b. Mechanism: Solenoid-operated piston or electronic motor-actuated operator with low-voltage powered infrared sensor, and mechanical override or override push button.
c. Supplied Volume Capacity: 0.125 gal per flush.

D. Urinal Carriers:
1. Manufacturers:
a. Jay R. Smith MFG. Co: www.jrsmith.com/#sle.
b. JOSAM Company: www.josam.com/#sle.
c. Viega LLC: www.viega.us/#sle.

d. Zurn Industries, Inc: www.zurn.com/#sle.
e. Substitutions: See Section 01 6000 - Product Requirements.

2. ASME A112.6.1M; cast iron and steel frame with tubular legs, lugs for floor and wall attachment, threaded fixture studs for fixture hanger, bearing studs.

2.05 LAVATORIES

A. Manufacturers:
1. American Standard, Inc: www.americanstandard-us.com/#sle.
2. Kohler Company: www.kohler.com/#sle.
3. Zurn Industries, Inc: www.zurn.com/#sle.
4. Substitutions: See Section 01 6000 - Product Requirements.

B. Supply Faucet:
1. Manufacturers:
a. American Standard, Inc; [_____]: www.americanstandard-us.com/#sle.
b. Grohe America, Inc; [_____]: www.grohe.com/us/#sle.
c. Kohler Company; [_____]: www.kohler.com/#sle.
d. Zurn Industries, LLC; Aqua Sense Series: www.zurn.com/#sle.
e. Sloan.

C. Sensor Operated Faucet: Cast brass, chrome plated, deck mounted with sensor located on neck of spout.
1. Power Supply:
a. Wired: As indicated on drawings.
2. Water Supply: 3/8 inch compression connections.
3. Manufacturers:
a. American Standard, Inc: www.americanstandard-us.com/#sle.
b. Grohe America, Inc: www.grohe.com/us/#sle.
c. The Chicago Faucet Company: www.chicagofaucets.com/#sle.
d. Sloan Valve Company: www.sloanvalve.com/#sle.
e. Toto USA: www.totousa.com/#sle.
f. Watts: www.watts.com/#sle.
g. Zurn Industries, LLC: www.zurn.com/#sle.
h. Substitutions: See Section 01 6000 - Product Requirements.

D. Thermostatic Mixing Valve:
1. ASSE 1070 listed with combination stop, strainer, and check valves, and flexible stainless steel connectors.
2. Manufacturers:
a. Acorn Engineering Company: www.acorneng.com/#sle.
b. Leonard Valve Company: http://leonardvalve.com/sle#.
c. Symmons, Inc.: https://www.symmons.com/sle#

d. Watts: www.watts.com/#sle.
e. Zurn Industries, Inc: www.zurn.com/#sle.
f. Substitutions: See Section 01 6000 - Product Requirements.

E. Accessories:
1. Chrome-plated 17 gauge, 0.0538 inch brass P-trap with clean-out plug and arm with escutcheon.

F. Lavatory Carrier:
1. Manufacturers:
a. Jay R. Smith Manufacturing Company: www.jrsmith.com/#sle.
b. JOSAM Company: www.josam.com/#sle.
c. Zurn Industries, LLC: www.zurn.com/#sle.
d. Substitutions: See Section 01 6000 - Product Requirements.
2. ASME A112.6.1M; cast iron and steel frame with tubular legs, lugs for floor and wall attachment, threaded studs for fixture hanger, bearing plate and studs.

2.06 UNDER-LAVATORY PIPE SUPPLY COVERS

A. Manufacturers:
1. IPS Corp.; Truebro-LavGuard 2: https://ipscorp.com/#sle.
2. Plumberex Specialty Products, Inc: www.plumberex.com/#sle.
3. Substitutions: See Section 01 6000 - Product Requirements.

B. Basis of Design: Plumberex Specialty Products, Inc; www.plumberex.com/#sle.
1. Fusion Molded Under-Lavatory Insulators (Non-Sewn): Plumberex Handy-Shield Maxx.
2. Slim Fit Under-Lavatory Insulators (Non-Sewn): Plumberex Trap Gear.
3. Under-Lavatory Covers with Snap-Lock Fasteners (Molded): Plumberex Pro-Extreme.

C. General:
1. Insulate exposed drainage piping including hot, cold and tempered water supplies under lavatories or sinks per ADA Standards.
2. Adhesives, sewing threads and two ply laminated materials are prohibited.
3. Exterior Surfaces: Smooth nonabsorbent with no finger recessed indentations for easy cleaning.
4. Construction: 1/8 inch PVC with antimicrobial, antifungal and UV resistant properties.
a. Comply with ASTM E84 for flame and smoke development.
b. Comply with ASTM C1822 Type III for covers on accessible lavatory piping.
c. Comply with ASME A112.18.9 for covers on accessible lavatory piping.
d. Comply with ICC A117.1.
e. Thermal Resistance: R value of 0.504 or lower when tested by ASTM C177.

f. Thermal Conductivity: K value of 0.358 or density of 21.61 pcf per ASTM C518.
g. Microbial and Fungal Resistance for Interior and Exterior: Comply with ASTM G21.

5. Color: High gloss white.
6. Fasteners: Reusable, snap-locking fasteners with no sharp or abrasive external surfaces. **No cable ties allowed.**

2.07 SHOWERS

A. Shower Valve:
1. Comply with ASME A112.18.1 and ASSE 1016.
2. Manufacturers:
a. American Standard, Inc: www.americanstandard-us.com/#sle.
b. Grohe America, Inc: www.grohe.com/us/#sle.
c. Kohler Company: www.kohler.com/#sle.
d. Symmons
e. Substitutions: See Section 01 6000 - Product Requirements.

B. Low-Flow Shower Head:
1. ASME A112.18.1; chrome-plated vandal-proof institutional head with integral wall bracket, built-in 1.5 gpm flow control.
2. Manufacturers:
a. American Standard, Inc: www.americanstandard-us.com/#sle.
b. DXV by American Standard, Inc: www.dxv.com/#sle.
c. Grohe America, Inc: www.grohe.com/us/#sle.
d. Symmons

C. Hand-Held Shower Head:
1. Provide pushbutton flow control.
2. Include 60 inch minimum flexible polished stainless steel hose and in-line vacuum breaker
3. Provide wall bracket to mount hand spray, allowing use of the unit as either a hand-held spray or a fixed shower head.
4. Provide 25 inch grab bar with sliding spray holder that locks at any height, allowing use of unit as either a hand-held spray or a fixed shower head.
5. Manufacturers:
a. American Standard, Inc: www.americanstandard-us.com/#sle.
b. Grohe America, Inc: www.grohe.com/us/#sle.
c. Kohler Company: www.kohler.com/#sle.
d. Symmons
e. Substitutions: See Section 01 6000 - Product Requirements.

D. Thermostatic Mixing Valve **(Upstream and in addition to ASSE 1016-compliant Shower Valve at individual fixture)**: ASSE 1070 listed, with combination stop, strainer, and check valves, and flexible stainless steel connectors.
   1. Manufacturers:
      a. Acorn Engineering Company: www.acorneng.com/#sle.
      b. American Standard, Inc: www.americanstandard-us.com/#sle.
      c. Leonard Valve Company: http://leonardvalve.com/sle#.
      d. Watts: www.watts.com/#sle.
      e. Substitutions: See Section 01 6000 - Product Requirements.

2.08 OUTDOOR DRINKING FOUNTAINS

A. Manufacturers:
   1. Elkay Manufacturing Company: www.elkay.com/#sle.
   2. Haws Corporation: www.hawsco.com/#sle.
   3. Murdock Manufacturing, Inc: www.murdockmfg.com/#sle.
   4. Substitutions: See Section 01 6000 - Product Requirements.

2.09 MOP SINKS

A. Terrazzo Mop Sink Manufacturers:
   1. Acorn Engineering Company: www.acorneng.com/#sle.
   2. Just Manufacturing Company: www.justmfg.com/#sle.
   3. Zurn Industries, LLC: www.zurn.com/#sle.
   4. Fiat.
   5. Substitutions: See Section 01 6000 - Product Requirements.
B. Material: Precast terrazzo composed of marble chips cast in Portland cement.
C. Type: Rectilinear, standard height.
D. Grid strainer: Stainless steel; integral; removable.
E. Dimensions: As indicated on drawings.
F. Accessories:
   1. 5 feet of 1/2 inch diameter plain end reinforced plastic hose.
   2. Hose clamp hanger.
   3. Mop hanger.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that walls and floor finishes are prepared and ready for installation of fixtures.
B. Verify that electric power is available and of the correct characteristics.
C. Confirm that millwork is constructed with adequate provision for the installation of lavatories and sinks, and **confirm that lavatory and sink mounting types (undermount, drop-in, integral, etc.) match those called for on Architectural Millwork drawings and details.**

3.02 PREPARATION

A. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

3.03 INSTALLATION

A. Install each fixture with trap, easily removable for servicing and cleaning.
B. Provide chrome-plated rigid or flexible supplies to fixtures with loose key stops, reducers, and escutcheons.
C. Install components level and plumb.
D. Solidly attach water closets to floor with lag screws. Lead flashing is not intended hold fixture in place.

3.04 INTERFACE WITH WORK OF OTHER SECTIONS

A. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

3.05 ADJUSTING

A. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

3.06 CLEANING

A. Clean plumbing fixtures and equipment.

3.07 PROTECTION

A. Protect installed products from damage due to subsequent construction operations.
B. Do not permit use of fixtures by construction personnel.
C. Repair or replace damaged products before Date of Substantial Completion.

END OF SECTION 22 4000

SECTION 23 0500
COMMON WORK RESULTS FOR MECHANICAL

PART 1 GENERAL

1.01 APPLICABILITY

A. The instructions outlined in this section shall apply to all sections under Division 23, except where specifically noted otherwise in the individual specification sections. Where these instructions and the instructions contained in other sections deviate, the more stringent requirement shall stand.

1.02 RELATED REQUIREMENTS

A. Section 01 1000 - Summary: Contract descriptions, description of alterations work, work by others, future work, occupancy conditions, use of site and premises, work sequence.

B. Section 01 3000 - Administrative Requirements: Submittal procedures, project meetings, progress schedules and documentation, reports, coordination.

C. Related Documents: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to and supplement all work specified in Division 23. If conflicts arise, Contractor shall be responsible for communicating the conflict to Architect prior to performing any work or ordering any equipment. The Mechanical Drawings are diagrammatic except where specifically indicated otherwise. Refer to Architectural, Structural, and Civil drawings for all building dimensions.

1.03 ABBREVIATIONS AND ACRONYMS

A. AHJ : Authorities Having Jurisdiction

B. OSA : Outside Air

1.04 DEFINITIONS

A. Exposed: Revealed to view or subject to weather.

B. Fittings: All connecting pieces of a system.

C. Provide: Furnish, install, and connect completely.

D. Piping: Pipe installed with all required fittings, valves, and accessories, and forming a complete system.

E. Wiring: Wire or cable installed in raceway with all required boxes, fittings, connectors, and accessories completely installed.

1.05 CODES AND STANDARDS

A. These specifications and associated design drawings do not give permission, implicit or inferred, to ignore the requirements of the applicable building codes or the AHJ. By placing a bid on this project, Contractor acknowledges and agrees to the requirement that they shall be versed in all applicable code requirements relevant to this specific project, and shall bring any conflicts to the attention of the Architect prior to performing any work. If work performed is found to be in violation of code, Contractor shall rectify any such work at their own expense.

1.06 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate the installation of all equipment and systems with size, location and installation of service utilities.

B. **MANDATORY TRADE "MEP COORDINATION" PRE-CONSTRUCTION MEETING:**

1. Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers. A minimum of two supervisors from each discipline and trade who will be overseeing daily work shall be in attendance. The MEP Engineer(s) of Record or their designated representative(s) shall attend the meeting to provide direction and highlight specific construction concerns for all MEP systems.
2. Attendance to the meeting shall be recorded, and the meeting shall be video recorded and made accessible and available to all trades on the project, throughout the course of construction.
3. New site supervisors joining the project who did not attend the meeting shall be required to view the video, and must sign a form to indicate they have understood the contents and instructions discussed prior to being allowed to supervise or engage in work on the project. Signed forms must be made available to the Owner or the Architect immediately upon request.

C. Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner, and that coordination between all affected installers has been performed to ensure proper installation order of all systems (e.g., electrical, plumbing, fire protection, millwork, etc.).

D. Include all necessary apparatus, excavating, controls, accessories, and fittings required for a complete and properly functioning Mechanical system.

E. The locations, arrangement, and extent of equipment, devices, piping, and other appurtenances related to the installation of the Plumbing work shown on the drawings are approximate and define the intent of the design. Contractor shall not scale the Engineer's drawings but shall refer to the Architectural drawings for exact dimensions of building components. Should a conflict exist between the Architectural and Engineering drawings regarding dimensions and scale, notify Architect of the discrepancy.

F. At the discretion of the Owner, the Architect, or the AHJ, relocate all conflicts arising from uncoordinated piping, equipment, ductwork, etc. installed, should such installation be determined to interfere with the proper installation and mounting of equipment, ceilings, piping, conduit, or any other Architectural or Structural systems or finishes. Corrective work arising from these conditions shall be performed without additional expense to the contract.

1. Stacking of piping, conduit, ductwork, etc. where it would cause an obstruction or restricted path for egress or serviceability of equipment from any trade is prohibited.
2. Coordinate the elevations of all piping and equipment above ceilings and in exposed areas with the work of all other disciplines prior to installation. In areas where more than one trade is required to use common openings in structure, joists, chases, shafts, and sleeves to route conduits, raceways, piping, ductwork, or any other materials, coordinate the positions of all piping and equipment to be furnished under this section so that all items – including the materials and equipment of other trades – may be accommodated within the space available.
3. Confirm that work to be performed under Division 23 does not interfere with the clearances required for finished soffits, columns, millwork, pilasters, partitions, walls, or other Architectural or Structural elements as shown on the Drawings or Specifications. Work that interferes with the Architectural design or building structure shall be removed and relocated at the direction of the Architect at no additional cost to the contract.
4. All piping and ductwork shall be run tight to structure, regardless of whether piping, ductwork, and equipment are above or below structural elements. Free-standing piping and equipment spanning open spaces or voids is prohibited. All piping routed through areas with exposed ceilings, cloud ceilings, or any other areas where piping may be visible to building occupants shall be routed to maintain a low-profile installation or shall be hidden from view, to provide the least-visible installation possible.

a. If any of these conditions are identified in the field by the Owner, the Architect, or the AHJ, remove and reinstall the indicated piping, ductwork, or equipment in accordance with these directions at no additional cost to the Contract.
b. If there are areas where necessary routing cannot comply with these instructions, furnish a sketch to the Architect identifying such areas and how the design drawing routing in the indicated areas will differ from these instructions, and obtain written approval to proceed with the proposed routing from the Architect prior to installation.

5. Give full cooperation to other trades and furnish all information necessary to permit the work of all trades to be installed satisfactorily, and with the least possible interference or delay.

1.07 PERMITS, UTILITIES, SERVICES, AND FEES

A. Obtain all permits, inspections and approvals as required by all Authorities Having Jurisdiction and deliver certificates of approval to the Architect. Assume and pay all fees and costs of any nature whatsoever incidental to these permits.

1.08 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Mechanical systems and all associated equipment, piping, accessories, and specialties shall not be installed without first coordinating the installation of the same with all other building trades (Architectural, Structural, Plumbing, etc.). Coordination shall be accomplished prior to, and shall be reflected in, the equipment submittals for approval.
C. SHOP DRAWINGS: Submit Mechanical shop drawings for review by the Owner and the Architect prior to beginning work. Background information shall be CAD or other computer-drawn versions of the floor plans or reflected ceiling plans of the Contract Drawings. Drawing from the Contract Documents shall not be copied for use as backgrounds, and hand drawings or sketch "markups" of the Contract Drawings shall not be accepted.
    1. Drawings from the Contract Documents Plan shall detail major elements, components, and system elements of Mechanical systems and materials in relation to other systems, installations, and building components. Sheet metal work shall be drawn using symbols and designations found in the lastest edition of SMACNA *Duct Construction Standards - Metal and Flexible*.
    2. Show detailed space requirements for installation and maintenance access after installation is complete.
    3. Indicate if sequence and coordination of installations with other trades are important to efficient flow of the work.

4. Include the following, at a minimum:
    a. Ductwork and equipment layouts, shown coordinated with required maintenance access for mechanical, electrical, structural, and fire protection equipment and systems, including space for disassembly required for periodic maintenance.
    b. Dampers and valves, with access shown coordinated with architectural ceilings and furniture, and coordinated damper placement or damper cabling used to omit access panels in walls or ceilings wherever possible.
    c. Equipment and accessory service connections and support details.
    d. Location of all control equipment (e.g., thermostats, humidistats, VFDs, control panels, etc.), coordinated with architectural furniture, and with all electrical power connections provided by others.
    e. Exterior wall and foundation penetrations.
    f. Rated wall and floor penetrations (e.g., fire, smoke, etc.).

D. ELECTRICAL COORDINATION STATEMENT: Submit a written statement confirming coordination of voltage and power connection requirements for all Mechanical equipment and controls requiring an electrical connection. Statement shall bear the names and signatures of the Mechanical and Electrical subcontractors.

E. LICENSING: Submit current Mechanical Contractor and Welder licenses specific to the state in which the work is to be performed for each onsite supervisor that will have responsible charge over the work. Submit a minimum of (2) licenses to ensure that at least one licensed supervisor will be onsite at all times during the installation.

F. RECORD DRAWINGS: Submit record drawings no more than 14 days after completion of equipment installation and acceptance testing. Update Mechanical system drawings to reflect final record as-built conditions after related work is completed. As-built drawings shall be performed using CAD or Revit. Hand-drawn "hard copy" markups and hand-edited PDF markups are not acceptable.
    1. Record drawing submittal shall include digital images (minimum resolution of 1152 x 864 pixels in JPEG standard image file format, and delivered via email, CD, or solid state thumb drive) of any and all installed underground utilities or piping, and shall include a reference drawing indicating the location and direction of where each picture was taken. The reference drawing shall dimension the utility or pipe from a prominent fixed object that is demonstrably unaltered from the time the photo was taken to the time when the file is delivered.

1.09 QUALITY ASSURANCE

A. Manufacturer Qualifications: Unless specifically noted otherwise in the specifications or drawings, all products shall be manufactured by a company specializing in manufacturing the specific products used in this project, with at least three years of documented experience.

B. Fabricator Qualifications: Unless specifically noted otherwise in the specifications or drawings, a company specializing in fabricating the specific products used in this project, with at least three years of documented experience.

C. Installer Qualifications: Unless specifically noted otherwise in the specifications or drawings, a company specializing in performing work of the type specified and with at least three years of documented experience and approved by manufacturer.

D. Copies of Documents at Project Site: Maintain at the project site a copy of each referenced document that prescribes execution requirements.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Store all products and equipment under cover and elevated above grade, protected completely against weather. Do not install materials or equipment in a partially constructed structure exposed to weather, unless all material and equipment is continuously protected from damage by weather or the construction process.

B. Products such as refrigerant piping and fittings that are stored outside must be protected against contamination by the elements within sealed plastic containers, or must be plugged and purged per the manufacturer's recommendations to ensure no damage to the inside of the piping.

C. Ductwork and air terminals are required to be covered and stored protected from dust and debris in accordance with most current edition *SMACNA Duct Cleanliness for New Construction Guidelines* "Intermediate" Duct Cleanliness Level unless specifically noted otherwise.

D. Material and equipment with suspected or observable damage caused by improper protection during construction is subject to replacement based on the judgment of Architect at no cost to Owner.

1.11 WARRANTY

A. The installation and mechanical equipment and components shall be provided with a one-year warranty from the date of final acceptance by Owner unless specifically noted otherwise in the contract documents. The warranty shall cover all materials and workmanship. During this warranty period, correct all defects in materials and workmanship by repair or replacement without incurring any additional cost to the owner. Warranty defects shall be corrected within thirty (30) days after being notified in writing of failure to meet the warranty.

B. Provide manufacturer warranty for all air conditioning compressors for an additional four years beyond the initial one-year warranty. This additional warranty shall include parts at a minimum.
C. Provide manufacturer warranty for all heat exchangers for an additional nine years beyond the initial one-year warranty. This additional warranty shall include parts at a minimum.
D. Correct any and all defective Work uncovered within a five year period after Date of Substantial Completion.
E. See Section 01 7800 - Closeout Submittals, as well as all individual specifications sections for additional warranty requirements.

PART 2 PRODUCTS

2.01 EQUIPMENT

A. MOTORS:
   1. Unless otherwise specified, single-phase fractional-horsepower alternating-current motors must be high efficiency types corresponding to the applications listed in NEMA MG 11.
   2. Unless otherwise specified, polyphase motors must be selected based on high efficiency characteristics relative to the applications as listed in NEMA MG 10. Additionally, polyphase squirrel-cage medium induction motors with continuous ratings must meet or exceed energy efficient ratings in accordance with Table 12-6C of NEMA MG 1.
   3. Provide controllers for motors rated 1 horsepower and larger with electronic phase-voltage monitors designed to protect motors from phase-loss, undervoltage, and overvoltage. Provide protection for motors from immediate restart by a time adjustable restart relay.

2.02 MANUFACTURERS

A. If substitution of alternate equipment is requested, the Contractor is responsible for any and all costs required by the substitution, including necessary engineering and construction revisions in their – or any – contract or trade to satisfy the design intent shown on the Drawings and described in the Specifications.
B. If the products and equipment used as the basis of design are modified, coordinate with all other trades prior to purchasing any material or equipment. Such coordination shall occur before purchasing and delivering equipment from the manufacturer and shall be clearly indicated on the shop drawings. Perform all related modifications without incurring cost to the Contract.
C. Substitutions: See Section 01 6000 - Product Requirements.

2.03 MATERIALS

A. All products shall be new and shall bear the Underwriter's Laboratories, Inc. (UL) label or the Factory Mutual Underwriters (FM) label unless specifically indicated otherwise. Furnish materials and equipment compatible with the existing system.

B. Materials, equipment, or labor not indicated but which can be reasonably inferred to be necessary for a complete installation shall be provided. Drawings and Specifications are not intended to indicate every item of material, equipment, or labor required to produce a complete and properly functioning installation.

C. FLAME SPREAD AND SMOKE DEVELOPED RATINGS OF MATERIALS:

1. Materials and adhesives used throughout the mechanical systems for any system shall have a flame spread rating not over 25, and a smoke developed rating not to exceed 50. If such materials are to be applied with adhesives, test them as applied with such adhesives, or the adhesives used shall have a flame spread rating not over 25 and a smoke developed rating not to exceed 50.
2. Determine flame spread rating and smoke developed rating by the Method of Testing of Surface Burning Characteristics of Building Materials, NFPA 255, ASTM E84, and Underwriters' Laboratories, Inc. standards.

2.04 SOURCE QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Provide materials and equipment that are standard products of manufacturers regularly engaged in the manufacture of such products, which are of a similar material, design and workmanship. Standard products must have been in satisfactory commercial or industrial use for three years prior to bid opening. The three-year use must include applications of equipment and materials under similar circumstances and of similar size. The product must have been for sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the three-year period.

1. Products having less than a three-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6,000 hours, exclusive of the manufacturer's factory or laboratory tests, can be shown.

PART 3 EXECUTION

3.01 GENERAL

A. The mechanical, plumbing, and fire protection drawings do not give exact elevations or location of lines, nor do they show all the offsets, control lines or installation details. Carefully lay out the work at the site to conform to the structural conditions, to provide proper grading of lines, to avoid all obstructions.

B. Properly locate and size of all slots and openings in the building structure pertaining to the work and correctly locate sleeves, inserts, and cores.

C. Offset valves in piping systems down to within one foot of the access point. Group runs of piping whenever it is feasible to do so.

D. Do not install piping, equipment or ductwork in electrical rooms, elevator machine rooms or electronic data rooms except as serving only those rooms. Do not run piping or ductwork or locate equipment with respect to switchboards, panelboards, power panels, motor control centers or dry type transformers. Clearances apply vertically from floor to structure:
   1. Within 42" in front of electrical equipment.
   2. Within 36" of sides of electrical equipment.

E. Provide access to equipment and valves requiring operation, service or maintenance within the life of the system. Equipment located above lay-in type ceilings is considered accessible.

F. Valves and dampers for terminal units, grilles, or diffusers shall be located in areas accessible for maintenance and adjustment. Where dampers are installed above hard ceilings, provide damper adjustment cabling to allow remote adjustment of the damper without the use of an access panel.

3.02 EXAMINATION

A. Verification of Conditions: Verify existing conditions and operability of all existing equipment and systems prior to beginning work.

3.03 INSTALLATION

A. Install all equipment and materials in accordance with manufacturer's instructions.

B. Minor deviations from the drawings required to conform to space conditions and to provide the required operation, service, or maintenance accessibility shall be made at no additional cost, and shall be subject to approval by the Owner.

C. Piping, equipment, or ductwork shall not be installed in electrical equipment rooms, unless such piping serves equipment inside these spaces exclusively. Do not locate or route piping, ductwork, or equipment within 42" in front (and rear, if free-standing) of electrical equipment, or within 36" of sides of equipment. Clearances shall apply from floor level to underside of structural deck, and shall apply to the following electrical equipment:
   1. Switchboards
   2. Panel boards
   3. Power panels
   4. Motor control centers
   5. Dry-type transformers

3.04 SLEEVES AND FRAMES

A. Install in concrete, carpentry or masonry construction, all necessary sleeves, frames, hangers, expansion bolts, inserts and other fixtures and appurtenances necessary for the support of all pipe, duct, equipment and devices furnished under Division 23.

B. Cut openings and install sleeves or frames through walls and surfaces in a neat workmanlike manner. Cut openings only as large as required for the installation. Install sleeves and/or frames flush with finished surfaces and grout in place unless otherwise indicated. Leave surfaces around openings smooth and finish to match surrounding surface.

C. Where pipes pass through floor slabs, sleeves shall be standard weight black steel pipe with top of sleeve 1 inch above finished floor. Where pipes pass through walls, sleeves shall be standard weight black steel pipe or 20-gauge galvanized sheet metal with ends flush with both surfaces.

D. Provide each pipe or duct passing through walls, floors, ceilings or partitions with sleeves having an internal diameter 1 inch larger that the outside dimensions of the insulated pipe or duct.

E. Build all pipe sleeves through floors, roofs and masonry walls in place as the affected walls, floors and roofs are built.

F. Pack all penetrations through rated walls and floors with mineral wool and cap off with a silicon caulk. As an alternate, use an approved fire-rated sealant as manufactured by Hilti, 3M or Dow. Materials shall meet or exceed UL 1479 or ASTM E814 requirements.

G. Sleeves through exterior walls shall be steel pipe, cast iron pipe, or Schedule 40 PVC (only in non-plenum-rated spaces) flush with both wall surfaces, and with the space between the pipe and the sleeve caulked watertight in an approved manner.

H. Inserts shall be individual type cast iron or galvanized steel with accommodations for removable nuts and threaded rods up to 3/4 inch diameter and permitting lateral adjustment.

3.05 ESCUTCHEONS

A. Install escutcheons on all pipes where they pass through floors, ceilings, walls, or partitions in finished and exposed construction areas.

B. Escutcheons shall be split, hinged, stamped brass type designed to fit the pipe and to cover the terminating pipe sleeve. Escutcheons shall be chrome plated finish unless otherwise specified with a securing device to hold them tight to the pipe.

C. Allow sufficient spacing between parallel pipe runs to ensure installation of escutcheons without modification. Do not alter the escutcheons in any manner to allow for installation.

3.06 PAINTING

A. New equipment painting must be factory applied or shop applied, and must be as specified herein, and provided under each individual section.

B. Manufacturer's standard factory painting systems may be provided subject to certification that the factory painting system applied will withstand 125 hours in a salt-spray fog test, except that equipment located outdoors must withstand 500 hours in a salt-spray fog test. Salt-spray fog test must be in accordance with ASTM B117 and ASTM B-287, and for that test the acceptance criteria must be as follows: immediately after completion of the test, the paint must show no signs of blistering, wrinkling, or cracking, and no loss of adhesion; and the specimen must show no signs of rust creepage beyond 0.125 inch on either side of the scratch mark. The film thickness of the factory painting system applied on the equipment must not be less than the film thickness used on the test specimen. If manufacturer's standard factory painting system is being proposed for use on surfaces subject to temperatures above 120 degrees F, the factory painting system must be designed for the temperature service.

C. Repaint factory painted equipment that has been scratched or marred to match original factory color.

D. Clean and paint all un-insulated black ferrous metal items exposed to sight inside the building such as piping, equipment hangers, and supports with one coat of zinc chromate primer. In addition, paint such items in finished spaces with two coats of finish paint in a color to match adjacent surfaces or as otherwise directed by the Architect.

E. Clean and paint black ferrous metal items exposed outside the building such as piping, cooling tower beams, un-insulated pipe, and pipe supports with one coat of rust inhibiting primer and two coats of an asphaltic base aluminum paint. Clean and paint all piping installed outside the building that is to be insulated with one coat of rust inhibiting primer before installing insulation.

F. Do not paint nameplates on equipment.

G. Re-coat galvanizing broken during construction with cold galvanizing compound.

H. Paint all ductwork, piping, insulation, conduit, structural members or other appurtenances visible through ceiling grilles flat black, unless specifically noted otherwise.

3.07 SYSTEM STARTUP

A. See individual specifications sections for systems startup instructions for systems and equipment.

3.08 CLEANING

A. Flush new water piping systems until water runs clean. Mild chemical cleaning may be required. If so, flush all cleaning chemicals out of the piping system before recharging with water.
B. Remove all stickers, rust, stains, labels and temporary covers before final acceptance.
C. Clean the interior of all ducts, plenums and casings of all debris and blow free all particles of rubbish and dust before installing outlet faces.
D. Lubricate bearings that require lubrication in accordance with the manufacturer's recommendations.
E. Leave equipment rooms clean.
F. Provide temporary filters for any fans operated during construction. Change temporary filters regularly (minimum once per week) to prevent contamination of the equipment and duct systems. Install new and unused permanent filters one week prior to final inspection.
G. Cover ends of open ducts and pipes during construction except when working on such end prohibits covering, per SMACNA Duct Cleanliness Standards noted in Part 1. Cover with minimum 4 mil thick polyethylene taped, tied or wired in place.
H. See Section 01 7419 - Construction Waste Management and Disposal, for additional requirements.

3.09 CLOSEOUT ACTIVITIES

A. See Section 01 7800 - Closeout Submittals, for closeout submittals.
B. See Section 01 7900 - Demonstration and Training, for additional requirements.
C. Demonstration: Demonstrate operation of system to Owner's personnel.
    1. Use operation and maintenance data as reference during demonstration.
    2. Conduct walking tour of project.
    3. Briefly describe function, operation, and maintenance of each component.
    4. See individual specifications sections and drawings for additional training requirements.

3.10 MAINTENANCE

A. See Section 01 7000 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.
B. Provide a separate maintenance contract for the service and maintenance of all systems for 12 months from Date of Substantial Completion.

END OF SECTION 23 0500

SECTION 23 0517
SLEEVES AND SLEEVE SEALS FOR HVAC PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pipe sleeves.
B. Manufactured sleeve-seal systems.

1.02 RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping.
B. Section 09 9113 - Exterior Painting: Preparation and painting of exterior piping systems.
C. Section 09 9123 - Interior Painting: Preparation and painting of interior piping systems.

1.03 REFERENCE STANDARDS

A. ASTM C592 - Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type) 2022a.
B. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems 2013a (Reapproved 2017).

1.04 SUBMITTALS

A. Product Data: For each product used in a rated assembly.
B. See Section 01 3000 - Administrative Requirements, for submittal procedures.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store sleeve and sleeve seals in shipping containers, with labeling in place.
B. Provide temporary protective coating on cast iron and steel sleeves if shipped loose.

PART 2 PRODUCTS

2.01 PIPE SLEEVES

A. Manufacturers:
   1. Flexicraft Industries; Pipe Wall Sleeve: www.flexicraft.com/#sle.
B. Vertical Piping:
   1. Sleeve Length: 1 inch above finished floor.
   2. Provide sealant for watertight joint.
   3. Blocked Out Floor Openings: Provide 1-1/2 inch angle set in silicon adhesive around opening.
   4. Drilled Penetrations: Provide 1-1/2 inch angle ring or square set in silicone adhesive around penetration.
C. Pipe Passing Through Below Grade Exterior Walls:
   1. Zinc coated or cast iron pipe.
   2. Provide watertight space with link rubber or modular seal between sleeve and pipe on both pipe ends.

D. Pipe Passing Through Concrete Beam Flanges, except where Brass Pipe Sleeves are Specified:
   1. Galvanized steel pipe or black iron pipe with asphalt coating.
   2. Connect sleeve with floor plate except in mechanical rooms.
E. Penetrations in concrete beam flanges are permitted but are prohibited through ribs or beams without prior approval from the .
F. Clearances:
   1. Provide allowance for insulated piping.
   2. Wall, Floor, Floor, Partitions, and Beam Flanges: 1 inch greater than external; pipe diameter.
   3. All Rated Openings: Caulked tight with fire stopping material in compliance with ASTM E814 in accordance with Section 07 8400 to prevent the spread of fire, smoke, and gases.

2.02 MANUFACTURED SLEEVE-SEAL SYSTEMS

A. Manufacturers:
   1. Advance Products & Systems, LLC; Innerlynx: www.apsonline.com/#sle.
   2. Flexicraft Industries; PipeSeal: www.flexicraft.com/#sle.
B. Modular/Mechanical Seal:
   1. High-temperature-silicone interlocking links shaped to fit surface of pipe such that they continuously fill annular space between pipe and wall/casing opening. Include type and number required by manufacturer for pipe material and size.
   2. Designed to form a hydrostatic seal of minimum 20-psig.
   3. Provide watertight seal between pipe and wall/casing opening.
   4. Elastomer element size and material in accordance with manufacturer's recommendations.
   5. Glass reinforced plastic or Carbon Steel pressure end plates.
   6. Carbon Steel connecting Bolts and Nuts with corrosion-resistant coating, ASTM B633, of sufficient length to secure pressure plates to sealing elements in the manner prescribed by the manufacturer.

2.03 GROUT

A. Description: Nonshrink, recommended for interior and exterior sealing openings in nonfire-rated walls or floors.
B. Standard: ASTM C1107/C1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
C. Design Mix: 5000-psi, 28-day compressive strength.
D. Packaging: Premixed and factory packaged.

2.04 SILICONE SEALANTS

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

PART 3 EXECUTION

3.01 INSTALLATION

A. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.

B. Install piping to conserve building space, to not interfere with use of space and other work, to maintain required maintenance clearances for all equipment, and to ensure the lowest visual impact possible.

C. Install piping and pipe sleeves to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

D. Structural Considerations:
   1. Do not penetrate building structural members unless indicated on structural drawings.

E. Provide sleeves when penetrating footings, floors, walls, and partitions. Seal pipe including sleeve penetrations to achieve fire resistance equivalent to fire separation required.
   1. Underground Piping: Seal pipe sleeve watertight with mechanically expandable chloroprene inserts with bitumen sealed metal components.
   2. Aboveground Piping:
      a. Pack solid using mineral fiber in compliance with ASTM C592.
      b. Fill space with an elastomer caulk to a depth of 0.50 inch where penetrations occur between conditioned and unconditioned spaces.
   3. All Rated Openings: Caulk tight with fire stopping material in compliance with ASTM E814 in accordance with Section 07 8400 to prevent the spread of fire, smoke, and gases.
   4. Seal exterior wall sleeves watertight with mechanically expandable chloroprene inserts with mastic-sealed components.

F. Manufactured Sleeve-Seal Systems:
   1. Install manufactured sleeve-seal systems in sleeves located in grade slabs and exterior concrete walls at piping entrances into building.
   2. Provide sealing elements of the size, quantity, and type required for the piping and sleeve inner diameter or penetration diameter.
   3. Locate piping in center of sleeve or penetration.
   4. Install field assembled sleeve-seal system components in annular space between sleeve and piping.
   5. Tighten bolting for a water-tight seal.

6. Install in accordance with manufacturer's recommendations.

G. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

3.02 CLEANING

A. Upon completion of work, clean all parts of the installation.

B. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

C. See Section 01 7419 - Construction Waste Management and Disposal, for additional requirements.

END OF SECTION 23 0517

SECTION 23 0548
VIBRATION AND SEISMIC CONTROLS FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Vibration isolation requirements.
B. Seismic control requirements.
   1. Includes requirements for seismic qualification of equipment not specified in this section.
C. Vibration-isolated equipment support bases.
D. Vibration isolators.
E. Seismic restraint systems.
F. Vibration-isolated and/or seismically engineered roof curbs.

1.02 RELATED REQUIREMENTS

A. Section 01 4533 - Code-Required Special Inspections and Procedures.
B. Section 03 3000 - Cast-in-Place Concrete.
C. Section 05 5000 - Metal Fabrications: Materials and requirements for fabricated metal supports.
D. Section 21 0548 - Vibration and Seismic Controls for Fire Suppression Piping and Equipment.
E. Section 22 0548 - Vibration and Seismic Controls for Plumbing Piping and Equipment.
F. Section 23 0529 - Hangers and Supports for HVAC Piping and Equipment.

1.03 DEFINITIONS

A. HVAC Component: Where referenced in this section in regards to seismic controls, applies to any portion of the HVAC system subject to seismic evaluation in accordance with applicable codes, including distributed systems (e.g., ductwork, piping).
B. Seismic Restraint: Structural members or assemblies of members or manufactured elements specifically designed and applied for transmitting seismic forces between components and the seismic force-resisting system of the structure.

1.04 REFERENCE STANDARDS

A. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures Most Recent Edition Cited by Referring Code or Reference Standard.
B. ASCE 19 - Structural Applications of Steel Cables for Buildings 2016.
C. ASHRAE (HVACA) - ASHRAE Handbook - HVAC Applications Most Recent Edition Cited by Referring Code or Reference Standard.
D. FEMA 412 - Installing Seismic Restraints for Mechanical Equipment 2014.
E. FEMA 413 - Installing Seismic Restraints for Electrical Equipment 2004.
F. FEMA 414 - Installing Seismic Restraints for Duct and Pipe 2004.
G. FEMA E-74 - Reducing the Risks of Nonstructural Earthquake Damage 2012.

H. ICC (IBC) - International Building Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
I. ICC-ES AC156 - Acceptance Criteria for Seismic Certification by Shake-Table Testing of Nonstructural Components 2010, with Editorial Revision (2015).
J. MFMA-4 - Metal Framing Standards Publication 2004.
K. SMACNA (SRM) - Seismic Restraint Manual Guidelines for Mechanical Systems 2008.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate selection and arrangement of vibration isolation and/or seismic control components with the actual equipment to be installed.
   2. Coordinate the work with other trades to provide additional framing and materials required for installation.
   3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
   4. Seismic Controls:
      a. Coordinate the arrangement of seismic restraints with piping, conduit, equipment, and other potential conflicts installed under other sections or by others.
      b. Coordinate the work with other trades to accommodate relative positioning of essential and nonessential components in consideration of seismic interaction.
   5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
B. Sequencing:
   1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 03 3000.

1.06 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Design Documents: Prepare and submit all information required for plan review and permitting by authorities having jurisdiction, including but not limited to floor plans, details, and calculations.
C. Product Data: Provide manufacturer's standard catalog pages and data sheets for products, including materials, fabrication details, dimensions, and finishes.
   1. Vibration Isolators: Include rated load capacities and deflections; include information on color coding or other identification methods for spring element load capacities.
   2. Seismic Controls: Include seismic load capacities.
D. Shop Drawings - Vibration Isolation Systems:

1. Include dimensioned plan views and sections indicating proposed arrangement of vibration isolators; indicate equipment weights and static deflections.
2. Vibration-Isolated Equipment Support Bases: Include base weights, including concrete fill where applicable; indicate equipment mounting provisions.

E. Shop Drawings - Seismic Controls:
1. Include dimensioned plan views and sections indicating proposed HVAC component locations and distributed system routing, with locations and details of gravity supports and seismic restraints and associated attachments.
2. Identify anchor manufacturer, type, minimum embedment, minimum spacing, minimum member thickness, and minimum edge distance requirements.
3. Indicate proposed arrangement of distributed system trapeze support groupings.
4. Indicate proposed locations for distributed system flexible fittings and/or connections.
5. Indicate locations of seismic separations where applicable.

F. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

G. Evidence of qualifications for seismic controls designer.

H. Manufacturer’s detailed field testing and inspection procedures.

I. Field quality control test reports.

1.07 QUALITY ASSURANCE

A. Comply with applicable building code.

B. Seismic Controls Designer Qualifications: Registered professional engineer licensed in the State in which the Project is located and with minimum five years experience designing seismic restraints for nonstructural components.
1. Designer may be employed by the manufacturer of the seismic restraint products.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 VIBRATION ISOLATION REQUIREMENTS

A. Design and provide vibration isolation systems to reduce vibration transmission to supporting structure from vibration-producing HVAC equipment and/or HVAC connections to vibration-isolated equipment.

B. Comply with applicable general recommendations of ASHRAE (HVACA), where not in conflict with other specified requirements:

C. General Requirements:
   1. Select vibration isolators to provide required static deflection.
   2. Select vibration isolators for uniform deflection based on distributed operating weight of actual installed equipment.
   3. Select seismic type vibration isolators to comply with seismic design requirements, including conditions of equipment seismic certification where applicable.
   4. Select vibration-isolated equipment support bases and associated vibration isolators to provide minimum 2-inch operating clearance beneath base unless otherwise indicated.

D. Equipment Isolation:
   1. Equipment Type: Packaged Rooftop Units.
      a. Location: Outdoor.
      b. Approximate Weight: As indicated on mechanical drawing schedule..
      c. Mounting: Vibration-isolated structural steel base.
      d. Isolator Type (Nonseismic Application): Restrained spring isolators.
      e. Isolator Type (Seismic Application): Seismic type restrained spring isolators.

E. Piping Isolation:
   1. Provide vibration isolators for piping supports:
      a. Systems required by code to be seismically protected (e.g., natural gas piping).
      b. Located within 50 feet of connected vibration-isolated equipment and pressure-regulating valve (PRV) stations.
   2. Suspended Piping, Nonseismic Applications: Use resilient material isolator hangers, spring isolator hangers, or combination resilient material/spring isolator hangers.
   3. Suspended Piping, Seismic Applications: Use seismic type resilient material isolator hangers, seismic type spring isolator hangers, or seismic type combination resilient material/spring isolator hangers.
   4. Floor-Mounted Piping, Nonseismic Applications: Use open (unhoused) spring isolators.
   5. Floor-Mounted Piping, Seismic Applications: Use seismic type restrained spring isolators.
   6. Use modular seal or approved resilient material where vibration-isolated piping penetrates building elements (e.g., walls, floors) arranged to prevent vibration transmission to structure.

F. Thrust Restraint Applications:

1. Use thrust restraints to resist horizontal motion due to thrust for fan heads, suspended fans, and base-mounted and suspended air handling equipment operating at 2.0 inches wg or greater total static pressure.
2. Limit lateral movement to 0.25 inch or less unless otherwise indicated.

2.02 VIBRATION-ISOLATED EQUIPMENT SUPPORT BASES

A. Manufacturers:
   1. Vibration-Isolated Equipment Support Bases:
      a. Kinetics Noise Control, Inc; : www.kineticsnoise.com/#sle.
      b. Mason Industries; : www.mason-ind.com/#sle.
      c. Vibration Eliminator Company, Inc; : www.veco-nyc.com/#sle.
      d. Vibro-Acoustics Swegon North America; : https://vibro-acoustics.com/sle#
      e. Substitutions: See Section 01 6000 - Product Requirements.
   2. Source Limitations: Furnish vibration-isolated equipment support bases and associated components and accessories produced by the same manufacturer as the vibration isolators and obtained from a single supplier.

2.03 VIBRATION ISOLATORS

A. Manufacturers:
   1. Vibration Isolators:
      a. Kinetics Noise Control, Inc; [_____]: www.kineticsnoise.com/#sle.
      b. Mason Industries; [_____]: www.mason-ind.com/#sle.
      c. Vibration Eliminator Company, Inc; [_____]: www.veco-nyc.com/#sle.
      d. Vibro-Acoustics Swegon North America; : https://vibro-acoustics.com/sle#
      e. Substitutions: See Section 01 6000 - Product Requirements.
   2. Source Limitations: Furnish vibration-isolators and associated accessories produced by a single manufacturer and obtained from a single supplier.

B. General Requirements:
   1. Resilient Materials for Vibration Isolators: Oil, ozone, and oxidant resistant.
   2. Spring Elements for Spring Isolators:
      a. Color code or otherwise identify springs to indicate load capacity.
      b. Lateral Stability: Minimum lateral stiffness to vertical stiffness ratio of 0.8.
      c. Designed to operate in the linear portion of their load versus deflection curve over deflection range of not less than 50 percent above specified deflection.
      d. Designed to provide additional travel to solid of not less than 50 percent of rated deflection at rated load.
      e. Selected to provide designed deflection of not less than 75 percent of specified deflection.
      f. Selected to function without undue stress or overloading.
   3. Seismic Snubbing Elements for Seismic Isolators:

a. Air Gap: Between 0.125 inches and 0.25 inches unless otherwise indicated.
b. Points of Contact: Cushioned with resilient material, minimum 0.25 inch thick; capable of being visually inspected for damage and replaced.

2.04 SEISMIC RESTRAINT SYSTEMS

A. Manufacturers:
1. Seismic Restraint Systems:
a. Eaton Corporation; [_____]: www.eaton.com/#sle.
b. Kinetics Noise Control, Inc; [_____]: www.kineticsnoise.com/#sle.
c. Mason Industries; [_____]: www.mason-ind.com/#sle.
d. Substitutions: See Section 01 6000 - Product Requirements.
2. Source Limitations: Furnish seismic restraint system components and accessories produced by a single manufacturer and obtained from a single supplier.

B. Description: System components and accessories specifically designed for field assembly and attachment of seismic restraints.

C. Cable Restraints:
1. Comply with ASCE 19.
2. Cables: Pre-stretched, galvanized steel wire rope with certified break strength.
3. Cable Connections: Use only swaged end fittings. Cable clips and wedge type end fittings are not permitted in accordance with ASCE 19.
4. Use protective thimbles for cable loops where potential for cable damage exists.

D. Rigid Restraints: Use MFMA-4 steel channel (strut), steel angle, or steel pipe for structural element; suitable for both compressive and tensile design loads.

2.05 VIBRATION-ISOLATED AND/OR SEISMICALLY ENGINEERED ROOF CURBS

A. Manufacturers:
1. Vibration-Isolated and/or Seismically Engineered Roof Curbs:
a. Kinetics Noise Control, Inc; [_____]: www.kineticsnoise.com/#sle.
b. Mason Industries; [_____]: www.mason-ind.com/#sle.
c. Vibration Eliminator Company, Inc; [_____]: www.veco-nyc.com/#sle.
d. Substitutions: See Section 01 6000 - Product Requirements.
2. Source Limitations: Furnish vibration-isolated roof curbs and associated accessories produced by the same manufacturer as the vibration isolators and obtained from a single supplier.

B. Vibration Isolation Curbs:
1. Nonseismic Curb Rail:
a. Location: Between existing roof curb and rooftop equipment.
b. Construction: Aluminum.
c. Integral vibration isolation to comply with requirements of this section.
d. Weather exposed components consist of corrosion resistant materials.

2. Nonseismic Curb:
    a. Location: Between structure and rooftop equipment.
    b. Construction: Aluminum.
    c. Integral vibration isolation to comply with requirements of this section.
    d. Weather exposed components consist of corrosion resistant materials.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as shown on the drawings.
B. Verify that mounting surfaces are ready to receive vibration isolation and/or seismic control components and associated attachments.
C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 CODE-REQUIRED SPECIAL INSPECTIONS

A. Arrange work to accommodate tests and/or inspections performed by Special Inspection Agency employed by Owner or Architect in accordance with Section 01 4533 and statement of special inspections as required by applicable building code.
B. Frequency of Special Inspections: Where special inspections are designated as continuous or periodic, arrange work accordingly.
    1. Continuous Special Inspections: Special Inspection Agency to be present in the area where the work is being performed and observe the work at all times the work is in progress.
    2. Periodic Special Inspections: Special Inspection Agency to be present in the area where work is being performed and observe the work part-time or intermittently and at the completion of the work.
C. Seismic special inspections include, but are not limited to:
    1. Seismically Qualified Equipment: Verification that label, anchorage, and mounting comply with the certificate of compliance.
    2. Installation and anchorage of piping systems designed to carry hazardous materials and their associated mechanical units for Seismic Design Categories C, D, E, and F; periodic inspection.
    3. Installation and anchorage of ductwork designed to carry hazardous materials for Seismic Design Categories C, D, E and F; periodic inspection.
    4. Installation and anchorage of vibration isolation systems for Seismic Design Categories C, D, E, and F where the approved Contract Documents require a nominal clearance of 1/4 inch or less between equipment support frame and seismic restraint; periodic inspection.
    5. Verification of required clearances between HVAC equipment, distribution systems, and associated supports and fire protection sprinkler system drops and sprigs for Seismic Design Categories C, D, E, and F; periodic inspection.

D. Prior to starting work, Contractor to submit written statement of responsibility to authorities having jurisdiction and to Owner acknowledging awareness of special requirements contained in the statement of special inspections.
E. Special Inspection Agency services do not relieve Contractor from performing inspections and testing specified elsewhere.

3.03 INSTALLATION

A. Install products in accordance with manufacturer's instructions.
B. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.
C. Secure fasteners according to manufacturer's recommended torque settings.
D. Install flexible piping connections to provide sufficient slack for vibration isolation and/or seismic relative displacements as indicated or as required.
E. Vibration Isolation Systems:
    1. Vibration-Isolated Equipment Support Bases:
        a. Provide specified minimum clearance beneath base.
    2. Clean debris from beneath vibration-isolated equipment that could cause short-circuiting of isolation.
    3. Use elastomeric grommets for attachments where required to prevent short-circuiting of isolation.
    4. Adjust isolators to be free of isolation short circuits during normal operation.
    5. Do not overtighten fasteners such that resilient material isolator pads are compressed beyond manufacturer's maximum recommended deflection.

3.04 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.
B. Inspect vibration isolation and/or seismic control components for damage and defects.
C. Provide manufacturer representative or authorized technician services to assist with inspection and testing of vibration isolation systems and seismic controls. Submit a detailed copy of manufacturer recommended inspection, testing, and field report procedures.
D. Vibration Isolation Systems:
    1. Verify isolator static deflections.
    2. Verify vibration isolation performance during normal operation; investigate sources of isolation short circuits.
E. Correct deficiencies and replace damaged or defective vibration isolation and/or seismic control components.

END OF SECTION 23 0548

SECTION 23 0553
IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nameplates.
B. Tags.
C. Adhesive-backed duct markers.
D. Ceiling tacks.

1.02 RELATED REQUIREMENTS

A. Section 09 9123 - Interior Painting: Identification painting.

1.03 REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems 2020.
B. ASTM D709 - Standard Specification for Laminated Thermosetting Materials 2017.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.
B. Tag List: Submit table including all equipment to receive a permanent nameplate tag including the following information:

Unit Mark	Area or System Served	Tag Material	Tag Colors
-	-	-	-

C. Product Data: Provide manufacturers catalog literature for each product required.
D. Shop Drawing: Submit examples of each tag type showing all content required in this section.
E. Manufacturer's Installation Instructions: Indicate special procedures, and installation.

PART 2 PRODUCTS

2.01 IDENTIFICATION APPLICATIONS

A. Air Handling Units: Nameplates.
B. Air Terminal Units: Tags.
C. Automatic Controls: Tags. Key to control schematic.
D. Control Panels: Nameplates.
E. Dampers: Ceiling tacks, where located above lay-in ceiling.
F. Ductwork: Duct Markers.
G. Major Control Components: Nameplates.
H. Piping: Pipe markers.
I. Small-sized Equipment: Tags.
J. Thermostats: Nameplates.

2.02 NAMEPLATES

A. Manufacturers:

1. Advanced Graphic Engraving, LLC: www.advancedgraphicengraving.com/.
2. Brimar Industries, Inc: www.pipemarker.com/.
3. Craftmark Pipe Markers: www.craftmarkid.com/.
4. Kolbi Pipe Marker Co: www.kolbipipemarkers.com/.
5. Seton Identification Products, a Tricor Direct Company: www.seton.com/.
6. Substitutions: See Section 01 6000 - Product Requirements.

B. Letter Height: 1/4 inch.

2.03 TAGS

A. Manufacturers:
1. Advanced Graphic Engraving: www.advancedgraphicengraving.com/.
2. Brady Corporation: www.bradycorp.com/.
3. Brimar Industries, Inc: www.pipemarker.com/.
4. Craftmark Pipe Markers: www.craftmarkid.com/.
5. Kolbi Pipe Marker Co: www.kolbipipemarkers.com/.
6. Seton Identification Products, a Tricor Company: www.seton.com/.
7. Substitutions: See Section 01 6000 - Product Requirements.

B. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch diameter.

C. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.

2.04 ADHESIVE-BACKED DUCT MARKERS

A. Manufacturers:
1. Brimar Industries, Inc: www.pipemarker.com/.
2. Craftmark Pipe Markers: www.craftmarkid.com/.
3. Kolbi Pipe Marker Co: www.kolbipipemarkers.com/.
4. Substitutions: See Section 01 6000 - Product Requirements.

B. Material: High gloss acrylic adhesive-backed vinyl film 0.0032 inch; printed with UV and chemical resistant inks.

C. Style: Individual Label.

D. Color Table:

System Type:	Color
Supply Air	Blue/White
Return Air	Green/White
Exhaust Air	Green/White
100% Outside Air	Blue/White
Hazardous Exhaust Air	Yellow/White

2.05 CEILING TACKS

A. Manufacturers:
   1. Craftmark Pipe Markers: www.craftmarkid.com/.
   2. Kolbi Pipe Marker Co : www.kolbipipemarkers.com/.
   3. Substitutions: See Section 01 6000 - Product Requirements.
B. Description: Steel with 3/4 inch diameter color coded head.
C. Color code as follows:
   1. HVAC Equipment: Yellow.
   2. Fire Dampers and Smoke Dampers: Red.

PART 3 EXECUTION

3.01 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

3.02 INSTALLATION

A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.
B. Install tags with corrosion resistant chain.
C. Install plastic pipe markers in accordance with manufacturer's instructions.
D. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.
E. Identify service, flow direction, and pressure.
F. Install in clear view and align with axis of piping.
G. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.
H. Install ductwork with plastic nameplates. Include System Type (e.g. Supply Air), System Served (e.g., RTU-1), and Airflow Direction (with arrow). Locate identification at air handling unit or appliance, at each side of penetration of structure or enclosure, at each obstruction, and at every 25 feet.
I. Install dryer exhaust duct maximum equivalent length identification labels on **each dryer exhaust duct system, regardless of total maximum length.** See section 23 3501 - Dryer-Vent Exhaust Collection Systems.
J. Locate ceiling tacks to locate valves or dampers above lay-in panel ceilings. Locate in corner of panel closest to equipment.

END OF SECTION 23 0553

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SECTION 23 0593
TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Testing, adjustment, and balancing of air systems.
B. Measurement of final operating condition of HVAC systems.
C. Sound measurement of equipment operating conditions.
D. Commissioning activities.

1.02 RELATED REQUIREMENTS

A. Section 01 4000 - Quality Requirements: Employment of testing agency and payment for services.
B. Section 01 9113 - General Commissioning Requirements: Commissioning requirements that apply to all types of work.
C. Section 23 0800 - Commissioning of HVAC.
D. Section 25 0500 - Common Work Results for Integrated Automation.

1.03 REFERENCE STANDARDS

A. AABC (NSTSB) - AABC National Standards for Total System Balance, 7th Edition 2016.
B. ASHRAE Std 111 - Measurement, Testing, Adjusting, and Balancing of Building HVAC Systems 2008, with Errata (2019).
C. NEBB (TAB) - Procedural Standards for Testing Adjusting and Balancing of Environmental Systems 2015, with Errata (2017).
D. SMACNA (TAB) - HVAC Systems Testing, Adjusting and Balancing 2002.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. TAB Plan: Submit a written plan indicating the testing, adjusting, and balancing standard to be followed and the specific approach for each system and component.
    1. Submit to the Commissioning Authority.
    2. Submit six weeks prior to starting the testing, adjusting, and balancing work.
    3. Include certification that the plan developer has reviewed Contract Documents, the equipment and systems, and the control system with the Architect and other installers to sufficiently understand the design intent for each system.
    4. Include at least the following in the plan:
        a. List of all air flow, ~~water flow~~, sound level, system capacity and efficiency measurements to be performed and a description of specific test procedures, parameters, formulas to be used.
        b. Copy of field checkout sheets and logs to be used, listing each piece of equipment to be tested, adjusted and balanced with the data cells to be gathered for each.

c. Discussion of what notations and markings will be made on the duct and piping drawings during the process.
d. Final test report forms to be used.
e. Details of how TOTAL flow will be determined; for example:
    1) Air: Sum of terminal flows via control system calibrated readings or via hood readings of all terminals, supply (SA) and return air (RA) pitot traverse, SA or RA flow stations.
    2) ~~Water: Pump curves, circuit setter, flow station, ultrasonic, etc.~~
f. Confirmation of understanding of the outside air ventilation criteria under all conditions.
g. Method of verifying and setting minimum outside air flow rate will be verified and set and for what level (total building, zone, etc.).
h. Method of checking building static and exhaust fan and/or relief damper capacity.
i. Proposed selection points for sound measurements and sound measurement methods.
j. Time schedule for TAB work to be done in phases (by floor, etc.).
k. Time schedule for deferred or seasonal TAB work, if specified.
l. Exhaust fan balancing and capacity verifications, including any required room pressure differentials.
m. Interstitial cavity differential pressure measurements and calculations, if specified.
n. Procedures for field technician logs of discrepancies, deficient or uncompleted work by others, contract interpretation requests and lists of completed tests (scope and frequency).
o. Procedures for formal deficiency reports, including scope, frequency and distribution.

C. Field Logs: Submit at least twice a week to the Commissioning Authority.
D. Control System Coordination Reports: Communicate in writing to the controls installer all setpoint and parameter changes made or problems and discrepancies identified during TAB that affect, or could affect, the control system setup and operation.
E. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
    1. Submit to the the Commissioning Authority within two weeks after completion of testing, adjusting, and balancing.
    2. Revise TAB plan to reflect actual procedures and submit as part of final report.

3. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Architect and for inclusion in operating and maintenance manuals.
4. Include actual instrument list, with manufacturer name, serial number, and date of calibration.
5. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.
6. Units of Measure: Report data in both I-P (inch-pound) and SI (metric) units.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

A. Perform total system balance in accordance with one of the following:
   1. AABC (NSTSB), AABC National Standards for Total System Balance.
   2. ASHRAE Std 111, Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning, and Refrigeration Systems.
   3. SMACNA (TAB).
   4. Maintain at least one copy of the standard to be used at project site at all times.

B. Begin work after completion of systems to be tested, adjusted, or balanced and complete work prior to Substantial Completion of the project.

C. TAB Agency Qualifications:
   1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.
   2. Having minimum of three years documented experience.
   3. Certified by one of the following:
      a. AABC, Associated Air Balance Council: www.aabc.com/#sle; upon completion submit AABC National Performance Guaranty.
      b. NEBB, National Environmental Balancing Bureau: www.nebb.org/#sle.
      c. TABB, The Testing, Adjusting, and Balancing Bureau of National Energy Management Institute: www.tabbcertified.org/#sle.

D. TAB Supervisor and Technician Qualifications: Certified by same organization as TAB agency.

3.02 EXAMINATION

A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:
   1. Systems are started and operating in a safe and normal condition.
   2. Temperature control systems are installed complete and operable.
   3. Proper thermal overload protection is in place for electrical equipment.

4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
5. Duct systems are clean of debris.
6. Fans are rotating correctly.
7. Fire and volume dampers are in place and open.
8. Air coil fins are cleaned and combed.
9. Access doors are closed and duct end caps are in place.
10. Air outlets are installed and connected.
11. Duct system leakage is minimized.

B. Submit field reports. Report defects and deficiencies that will or could prevent proper system balance.

C. Beginning of work means acceptance of existing conditions.

3.03 PREPARATION

A. Hold a pre-balancing meeting at least one week prior to starting TAB work.
1. Require attendance by all installers whose work will be tested, adjusted, or balanced.

B. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to Architect to facilitate spot checks during testing.

3.04 ADJUSTMENT TOLERANCES

A. Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply systems and plus or minus 5 percent of design for return and exhaust systems.

B. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.

3.05 RECORDING AND ADJUSTING

A. Field Logs: Maintain written logs including:
1. Running log of events and issues.
2. Discrepancies, deficient or uncompleted work by others.
3. Contract interpretation requests.
4. Lists of completed tests.

B. Ensure recorded data represents actual measured or observed conditions.

C. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

D. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.

E. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

F. **After testing, adjusting and balancing is complete the agency shall visit the job two additional times: once during the heating season, and once during the cooling season, to make adjustments to provide uniform temperatures throughout the building. Schedule the adjustments trips during the months of December through February, when the outdoor temperature is below 40°F, for the heating season, and June through August, when the outdoor temperature is above 85°F for the cooling season. Obtain a signed statement from the Owner acknowledging the trips and subsequent adjustments. Submit a statement to the Architect.**

3.06 AIR SYSTEM PROCEDURE

A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities at site altitude.

B. Measure air quantities at air inlets and outlets.

C. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.

D. Use volume control devices to regulate air quantities only to the extent that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.

E. Vary total system air quantities by adjustment of fan speeds via Variable Frequency Drive (VFD) or Electronically Commutated Motor (ECM) adjustments. Provide drive changes required. Vary branch air quantities by damper regulation.

F. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.

G. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.

H. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.

I. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.

J. Where modulating dampers are provided, take measurements and balance at extreme conditions. Balance variable volume systems at maximum air flow rate, full cooling, and at minimum air flow rate, full heating.

K. Measure building static pressure and adjust supply, return, and exhaust air systems to provide required relationship between each to maintain approximately 0.05 inches positive static pressure near the building entries. Maintain any and all additional pressure relationships shown on the drawings.

L. For variable air volume system powered units set volume controller to air flow setting indicated. Confirm connections properly made and confirm proper operation for automatic variable air volume temperature control.

3.07 COMMISSIONING

A. See Sections 01 9113 - General Commissioning Requirements and 23 0800 for additional requirements.

B. Perform prerequisites prior to starting commissioning activities.

C. Fill out Prefunctional Checklists for:

1. Air side systems.
2. Water side systems.

D. Furnish to the Commissioning Authority, upon request, any data gathered but not shown in the final TAB report.

E. Re-check minimum outdoor air intake flows and maximum and intermediate total airflow rates for 25% percent of the air handlers plus a random sample equivalent to 10% percent of the final TAB report data as directed by Commissioning Authority.

1. Original TAB agency shall execute the re-checks, witnessed by the Commissioning Authority.
2. Use the same test instruments as used in the original TAB work.
3. Failure of more than 10 percent of the re-checked items of a given system shall result in the rejection of the system TAB report; rebalance the system, provide a new system TAB report, and repeat random re-checks.
4. For purposes of re-check, failure is defined as follows:
    a. Air Flow of Supply and Return: Deviation of more than 10 percent of instrument reading.
    b. Minimum Outside Air Flow: Deviation of more than 20 percent of instrument reading; for inlet vane or VFD OSA compensation system using linear proportional control, deviation of more than 30 percent at intermediate supply flow.
    c. Temperatures: Deviation of more than one degree F.
    d. Air and Water Pressures: Deviation of more than 10 percent of full scale of test instrument reading.
    e. Sound Pressures: Deviation of more than 3 decibels, with consideration for variations in background noise.
5. For purposes of re-check, a whole system is defined as one in which inaccuracies will have little or no impact on connected systems; for example, the air distribution system served by one air handler or the hydronic chilled water supply system served by a chiller or the condenser water system.

F. In the presence of the Commissioning Authority, verify that:

1. Final settings of all valves, splitters, dampers and other adjustment devices have been permanently marked.
2. The air system is being controlled to the lowest possible static pressure while still meeting design loads, less diversity; this shall include a review of TAB methods, established control setpoints, and physical verification of at least one leg from fan to diffuser having all balancing dampers wide open and that during full cooling of all terminal units taking off downstream of the static pressure sensor, the terminal unit on the critical leg has its damper 90 percent or more open.
3. The water system is being controlled to the lowest possible pressure while still meeting design loads, less diversity; this shall include a review of TAB methods, established control setpoints, and physical verification of at least one leg from the pump to the coil having all balancing valves wide open and that during full cooling the cooling coil valve of that leg is 90 percent or more open.

3.08 SCOPE

A. Test, adjust, and balance the following:
   1. Fire Pumps.
   2. Plumbing Pumps.
   3. Packaged Roof Top Heating/Cooling Units.
   4. Computer Room Air Conditioning Units.
   5. Air Handling Units.
   6. Fans.
   7. Air Filters.
   8. Air Terminal Units.
   9. Air Inlets and Outlets.

3.09 MINIMUM DATA TO BE REPORTED

A. Electric Motors:
   1. Manufacturer.
   2. Model/Frame.
   3. HP/BHP.
   4. Phase, voltage, amperage; nameplate, actual, no load.
   5. RPM.
   6. Service factor.

B. Pumps:
   1. Identification/number.
   2. Manufacturer.
   3. Size/model.
   4. Impeller.
   5. Service.

6. Design flow rate, pressure drop, BHP.
7. Actual flow rate, pressure drop, BHP.
8. Discharge pressure.
9. Suction pressure.
10. Total operating head pressure.
11. Shut off, discharge and suction pressures.
12. Shut off, total head pressure.

C. Cooling Coils:
1. Identification/number.
2. Location.
3. Service.
4. Manufacturer.
5. Air flow, design and actual.
6. Entering air DB temperature, design and actual.
7. Entering air WB temperature, design and actual.
8. Leaving air DB temperature, design and actual.
9. Leaving air WB temperature, design and actual.
10. Saturated suction temperature, design and actual.
11. Air pressure drop, design and actual.

D. Heating Coils:
1. Identification/number.
2. Location.
3. Service.
4. Manufacturer.
5. Air flow, design and actual.
6. Entering air temperature, design and actual.
7. Leaving air temperature, design and actual.
8. Air pressure drop, design and actual.

E. Electric Duct Heaters:
1. Manufacturer.
2. Identification/number.
3. Location.
4. Model number.
5. Design kW.
6. Number of stages.
7. Phase, voltage, amperage.
8. Test voltage (each phase).
9. Test amperage (each phase).

10. Air flow, specified and actual.
11. Temperature rise, specified and actual.

F. Air Moving Equipment:
1. Location.
2. Manufacturer.
3. Model number.
4. Serial number.
5. Arrangement/Class/Discharge.
6. Air flow, specified and actual.
7. Return air flow, specified and actual.
8. Outside air flow, specified and actual.
9. Total static pressure (total external), specified and actual.
10. Inlet pressure.
11. Discharge pressure.
12. Sheave Make/Size/Bore.
13. Number of Belts/Make/Size.
14. Fan RPM.

G. Return Air/Outside Air:
1. Identification/location.
2. Design air flow.
3. Actual air flow.
4. Design return air flow.
5. Actual return air flow.
6. Design outside air flow.
7. Actual outside air flow.
8. Return air temperature.
9. Outside air temperature.
10. Required mixed air temperature.
11. Actual mixed air temperature.
12. Design outside/return air ratio.
13. Actual outside/return air ratio.

H. Exhaust Fans:
1. Location.
2. Manufacturer.
3. Model number.
4. Serial number.
5. Air flow, specified and actual.
6. Total static pressure (total external), specified and actual.

7. Inlet pressure.
8. Discharge pressure.
9. Sheave Make/Size/Bore.
10. Number of Belts/Make/Size.
11. Fan RPM.

I. Duct Leak Tests:
1. Description of ductwork under test.
2. Duct design operating pressure.
3. Duct design test static pressure.
4. Duct capacity, air flow.
5. Maximum allowable leakage duct capacity times leak factor.
6. Test apparatus:
   a. Blower.
   b. Calibrated.
7. Test static pressure.
8. Test orifice differential pressure.
9. Leakage.

J. Terminal Unit Data:
1. Manufacturer.
2. Type, constant, variable, single, dual duct.
3. Identification/number.
4. Location.
5. Model number.
6. Size.
7. Minimum static pressure.
8. Minimum design air flow.
9. Maximum design air flow.
10. Maximum actual air flow.
11. Inlet static pressure.

K. Air Distribution Tests:
1. Air terminal number.
2. Room number/location.
3. Terminal type.
4. Terminal size.
5. Area factor.
6. Design velocity.
7. Design air flow.
8. Test (final) velocity.

9. Test (final) air flow.
10. Percent of design air flow.

L. Sound Level Reports:
1. Location.
2. Octave bands - equipment off.
3. Octave bands - equipment on.

END OF SECTION 23 0593

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SECTION 23 0713
DUCT INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Duct insulation.
B. Duct liner.
C. Insulation jackets.

1.02 SECTION DOES NOT INCLUDE

A. Double-walled ducts. See Section 23 3100 - HVAC Ducts and Casings for all double-walled duct construction, lining, and insulation details.

1.03 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.
B. Section 07 8400 - Firestopping.
C. Section 09 9113 - Exterior Painting: Painting insulation jackets.
D. Section 09 9123 - Interior Painting: Painting insulation jackets.
E. Section 22 0553 - Identification for Plumbing Piping and Equipment.
F. Section 23 0553 - Identification for HVAC Piping and Equipment.

1.04 REFERENCE STANDARDS

A. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2014.
B. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric) 2014.
C. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus 2021.
D. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form 2020a.
E. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications 2013 (Reapproved 2019).
F. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation 2014 (Reapproved 2019).
G. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel 2008 (Reapproved 2018).
H. ASTM C916 - Standard Specification for Adhesives for Duct Thermal Insulation 2020.
I. ASTM C1071 - Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material) 2019.
J. ASTM C1290 - Standard Specification for Flexible Fibrous Glass Blanket Insulation Used to Externally Insulate HVAC Ducts 2016 (Reapproved 2021).

K. ASTM C1410 - Standard Specification for Cellular Melamine Thermal and Sound-Absorbing Insulation 2017.
L. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2022.
M. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials 2022.
N. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi 2015, with Editorial Revision (2021).
O. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible 2021.
P. UL 441 - Standard for Gas Vents Current Edition, Including All Revisions.
Q. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials Current Edition, Including All Revisions.
R. UL-1738 - Standard for Venting Systems for Gas-Burning Appliances, Categories II, III, and IV Current Edition.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.
C. Shop Drawings: Provide shop drawings for all listed and labeled systems (e.g., dryer exhaust, combustion air).

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labelled with manufacturer's identification, including product density and thickness.
B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.07 FIELD CONDITIONS

A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.
B. Maintain temperature during and after installation for minimum period of 24 hours.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 GLASS FIBER, FLEXIBLE

A. Manufacturer:
1. CertainTeed Corporation; [_____]: www.certainteed.com/#sle.
2. Johns Manville; [_____]: www.jm.com/#sle.
3. JP Lamborn Co; Thermal Sleeve MT: www.jpflex.com/#sle.

4. Knauf Insulation; Atmosphere Duct Wrap: www.knaufinsulation.com/#sle.
5. Owens Corning Corporation; [_____]: www.ocbuildingspec.com/#sle.
6. Substitutions: See Section 01 6000 - Product Requirements.

B. Insulation: ASTM C553; flexible, noncombustible blanket.
1. Maximum Service Temperature: 1200 degrees F.
2. Maximum Water Vapor Absorption: 5.0 percent by weight.

C. Vapor Barrier Jacket:
1. Kraft paper with glass fiber yarn and bonded to aluminized film.
2. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E96/E96M.
3. Secure with pressure sensitive tape.

D. Vapor Barrier Tape:
1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.

E. Indoor Vapor Barrier Mastic:
1. Manufacturers:
a. Design Polymerics; DP 3040 Water Based, Zero VOC, Premium Quality, Low Perm, Vapor Barrier Coating: www.designpoly.com.com/#sle.
b. Substitutions: See Section 01 6000 - Product Requirements
2. Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.

F. Outdoor Vapor Barrier Mastic:
1. Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.

G. Tie Wire: Annealed steel, 16 gauge, 0.0508 inch diameter.

2.03 GLASS FIBER, RIGID

A. Manufacturer:
1. CertainTeed Corporation; [_____]: www.certainteed.com/#sle.
2. Johns Manville; [_____]: www.jm.com/#sle.
3. Knauf Insulation; [_____]: www.knaufinsulation.com/#sle.
4. Owens Corning Corporation; 700 Series FIBERGLAS Insulation: www.ocbuildingspec.com/#sle.
5. Substitutions: See Section 01 6000 - Product Requirements.

B. Insulation: ASTM C612; rigid, noncombustible blanket.
1. K Value: 0.24 at 75 degrees F, when tested in accordance with ASTM C518.
2. Maximum Service Temperature: 450 degrees F.
3. Maximum Water Vapor Absorption: 5.0 percent.
4. Maximum Density: 8.0 lb/cu ft.

C. Vapor Barrier Jacket:
1. Kraft paper with glass fiber yarn and bonded to aluminized film.

2. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E96/E96M.
3. Secure with pressure sensitive tape.

D. Vapor Barrier Tape:
1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.

E. Protective Coating:
1. Manufacturers:
a. Design Polymerics; DP 2510 Water Based, Low VOC, Duct Liner Protective Coating: www.designpoly.com.com/#sle.
b. Substitutions: See Section 01 6000 - Product Requirements

F. Indoor Vapor Barrier Finish:
1. Cloth: Untreated; 9 oz/sq yd weight, glass fabric.
2. Vinyl emulsion type acrylic, compatible with insulation, black color.

2.04 JACKETS

A. Aluminum Jacket: ASTM B209 (ASTM B209M).
1. Thickness: 0.040 inch sheet.
2. Finish: Smooth.
3. Joining: Longitudinal slip joints and 2 inch laps.
4. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner.
5. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum.
6. Metal Jacket Bands: 3/8 inch wide; 0.010 inch thick stainless steel.

2.05 DUCT LINER

A. Manufacturers:
1. Armacell LLC; AP Coilflex: www.armacell.us/#sle.
2. CertainTeed Corporation; [_____]: www.certainteed.com/#sle.
3. Ductmate Industries, Inc, a DMI Company; [_____]: www.ductmate.com/#sle.
4. Johns Manville; [_____]: www.jm.com/#sle.
5. Knauf Insulation; [_____]: www.knaufinsulation.com/#sle.
6. Owens Corning Corporation; QuietR Rotary Duct Insulation ; [_____]: www.ocbuildingspec.com/#sle.
7. Substitutions: See Section 01 6000 - Product Requirements.

B. Note: Choose the liner type - Elastomeric Foam or Glass Fiber.

C. Elastomeric Foam Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1, in sheet form.
1. Minimum Service Temperature: Minus 40 degrees F.
2. Maximum Service Temperature: 180 degrees F.

3. Fungal Resistance: No growth when tested according to ASTM G21.
4. Apparent Thermal Conductivity: Maximum of 0.28 at 75 degrees F.
5. Minimum Noise Reduction Coefficients:
   a. 1/2 inch Thickness: 0.30.
   b. 1 inch Thickness: 0.40.
   c. 1-1/2 inches Thickness: 0.50.
   d. 2 inch Thickness: 0.60.
6. Erosion Resistance: Does not show evidence of breaking away, flaking off, or delamination at velocities of 10,000 fpm per ASTM C1071.
7. Connection: Waterproof vapor barrier adhesive.

D. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation. Comply with ASTM C916.

E. Glass Fiber Insulation: Non-corrosive, incombustible glass fiber complying with ASTM C1071; flexible blanket, rigid board, and preformed round liner board; impregnated surface and edges coated with poly vinyl acetate polymer, acrylic polymer, or black composite.
1. Fungal Resistance: No growth when tested according to ASTM G21.
2. Apparent Thermal Conductivity: Maximum of 0.31 at 75 degrees F.
3. Service Temperature: Up to 250 degrees F.
4. Rated Velocity on Coated Air Side for Air Erosion: 5,000 fpm, minimum.
5. Minimum Noise Reduction Coefficients:
   a. 1/2 inch Thickness: 0.30.
   b. 1 inch Thickness: 0.45.
   c. 1-1/2 inches Thickness: 0.60.
   d. 2 inch Thickness: 0.70.

F. Adhesive: Waterproof, fire-retardant type, ASTM C916.
1. Manufacturers:
   a. Design Polymerics; DP 2502 Water Based, Low VOC, Duct Liner Adhesive: www.designpoly.com.com/#sle.
   b. Substitutions: See Section 01 6000 - Product Requirements

G. Liner Fasteners: Galvanized steel, self-adhesive pad with integral head.

2.06 SPECIAL APPLICATIONS

A. The following systems are required to use a listed and labeled duct and insulation system designed and manufactured for the specific installation:
1. Tybe B Gas Vents: Prefabricated system listed to UL 441 made with aluminum alloy inner liner, insulating air space, and galvanized steel or galvalume outer jacket. Vent shall be designed for maximum 480°F and negative pressures only.

2. Category II, III, and IV Gas Vents: Prefabricated system listed to UL-1738 made with AL29-4C stainless steel inner liner, 1" insulating air space, and 400 series stainless steel outer jacket. Vent shall be designed for maximum 550°F and positive pressure of 15" W.C.
3. Manufacturers:
   a. Mechanical Sales Co.; https://mechanicalsalesco.com/#sle
   b. Substitutions: See Section 01 6000 - Product Requirements
4. Grease Duct Systems: See Section 23 3100 - HVAC Ducts and Casings.

PART 3 EXECUTION

3.01 EXAMINATION

A. Test ductwork for design pressure prior to applying insulation materials.
B. Verify that surfaces are clean, foreign material removed, and dry.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.
B. Provide minimum R6 insulation for Supply duct, Return duct, and Outside Air duct in all locations unless specifically noted otherwise. Insulate Exhaust duct as indicated in these specifications and on drawings.
C. Insulated Ducts Conveying Air Below Ambient Temperature:
   1. Provide insulation with vapor barrier jackets.
   2. Finish with tape and vapor barrier jacket.
   3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
   4. Insulate entire system, including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.
D. Insulated Ducts Conveying Air Above Ambient Temperature:
   1. Provide with or without standard vapor barrier jacket.
   2. Insulate fittings and joints. Where service access is required, bevel and seal ends of insulation.
E. Exterior Applications: Minimum R8 insulation. Provide insulation with vapor barrier jacket. Cover with caulked aluminum jacket with seams located on bottom side of horizontal duct section heavy duty all-weather listed and rated aluminum jacketing system (3M VentureClad 1579GCW-E).. Rectangular and Oval Ducts shall have watershed design to prevent ponding on duct surface (flat-surface top installations on exterior are not permitted). See mechanical details on drawings.
F. External Duct Insulation Application:
   1. Install according to manufacturer's installation instructions for a watertight installation.
G. Duct and Plenum Liner Application:
   1. Adhere insulation with adhesive for 90 percent coverage.

2. Seal and smooth joints. Seal and coat transverse joints.
3. Seal liner surface penetrations with adhesive.
4. **Duct dimensions indicated are net inside dimensions required for air flow. Increase duct size to allow for insulation thickness.**

3.03 SCHEDULES

A. Combustion Air Duct: Listed and labeled combustion air system only.
B. Duct Connections to air handling equipment: Provide 2" acoustical lining for at least 15'-0" downstream of the discharge from the air handling unit, and at all locations shown or called out on the drawings.
C. Exhaust Ducts Within 10 ft of Exterior Openings: Insulate
D. Exhaust Ducts: Insulate upstream of energy recovery devices where located outside of building envelope.
E. Outside Air Ducts: Insulate where ambient temperature difference duct differs more than 10 degrees F from the airstream.
F. Supply Ducts: Insulate.
G. Return Ducts: Insulate.
H. Air Transfer Ducts: Provide 2" acoustical lining for entire length of duct for Air Transfer ducts serving sound-sensitive areas, provide no lining for industrial areas, and provide 1" acoustical lining for all other areas.
I. Ducts Exposed to Outdoors: Insulate with Weatherproof Jacket.
J. Ducts Exposed to potential damage or high traffic areas: Double-walled Construction.

END OF SECTION 23 0713

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SECTION 23 0719
HVAC PIPING INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Piping insulation.
B. Flexible removable and reusable blanket insulation.
C. Jackets and accessories.
D. Engineered wall outlet seals and refrigerant piping insulation protection.

1.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.
B. Section 07 8400 - Firestopping.
C. Section 09 9123 - Interior Painting: Painting insulation jacket.
D. Section 22 1005 - Plumbing Piping: Placement of hangers and hanger inserts.
E. Section 23 2300 - Refrigerant Piping: Placement of inserts.

1.03 REFERENCE STANDARDS

A. ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus 2019.
B. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2014.
C. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric) 2014.
D. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form 2020a.
E. ASTM D1056 - Standard Specification for Flexible Cellular Materials—Sponge or Expanded Rubber 2020.
F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2022.
G. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.
C. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

1.06 FIELD CONDITIONS

A. Maintain ambient conditions required by manufacturers of each product.

B. Maintain temperature before, during, and after installation for minimum of 24 hours.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Manufacturers:

1. Aeroflex USA, Inc; Aerocel ULP: www.aeroflexusa.com/#sle.
2. Armacell LLC; AP Armaflex: www.armacell.us/#sle.
3. K-Flex USA LLC; K-Flex Titan: www.kflexusa.com/#sle.
4. Substitutions: See Section 01 6000 - Product Requirements.

B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1; use molded tubular material wherever possible.

1. Minimum Service Temperature: Minus 40 degrees F.
2. Maximum Service Temperature: 180 degrees F.
3. Connection: Waterproof vapor barrier adhesive.

2.03 JACKETS

A. Aluminum Jacket: ASTM B209 (ASTM B209M) formed aluminum sheet.

1. Thickness: 0.040 inch sheet.
2. Finish: Smooth.
3. Joining: Longitudinal slip joints and 2 inch laps.
4. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner.
5. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum.

PART 3 EXECUTION

3.01 EXAMINATION

A. Test piping for design pressure, liquid tightness, and continuity prior to applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Exposed Piping: Locate insulation and cover seams in least visible locations.

C. Insulated Pipes Conveying Fluids Below Ambient Temperature:

1. Insulate entire system, including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.

D. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, refer to Section 07 8400.

E. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 10 feet above finished floor): Finish with aluminum jacket.

F. Exterior Applications: Provide vapor barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor barrier cement. Cover with aluminum jacket with seams located on bottom side of horizontal piping. Provide two coats of UV resistant finish for flexible elastomeric cellular insulation and cover with aluminum jacket.

END OF SECTION 23 0719

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SECTION 23 0800
COMMISSIONING OF HVAC

PART 1 GENERAL

1.01 SUMMARY

A. See Section 01 9113 - General Commissioning Requirements for overall objectives; comply with the requirements of Section 01 9113.

B. This section covers the Contractor's responsibilities for commissioning; each subcontractor or installer responsible for the installation of a particular system or equipment item to be commissioned is responsible for the commissioning activities relating to that system or equipment item.

C. The Commissioning Authority (CA) directs and coordinates all commissioning activities and provides Prefunctional Checklists and Functional Test Procedures for Contractor's use.

D. The entire HVAC system is to be commissioned, including commissioning activities for the following specific items:

1. Control system.
2. Major and minor equipment items.
3. Terminal units.
4. Sound control devices.
5. Other equipment and systems explicitly identified elsewhere in Contract Documents as requiring commissioning.

E. The Prefunctional Checklist and Functional Test requirements specified in this section are in addition to, not a substitute for, inspection or testing specified in other sections.

1.02 RELATED REQUIREMENTS

A. Section 01 7800 - Closeout Submittals: Scope and procedures for operation and maintenance manuals and project record documents.

B. Section 01 9113 - General Commissioning Requirements: Commissioning requirements that apply to all types of work.

C. Section 23 0923 - Direct-Digital Control System for HVAC.

D. Section 23 0993 - Sequence of Operations for HVAC Controls.

E. Section 23 0593 - Testing, Adjusting, and Balancing for HVAC.

1.03 REFERENCE STANDARDS

A. ASHRAE Guideline 1.1 - HVAC&R Technical Requirements for the Commissioning Process 2007, with Errata (2012).

1.04 SUBMITTALS

A. Updated Submittals: Keep the Commissioning Authority informed of all changes to control system documentation made during programming and setup; revise and resubmit when substantial changes are made.

B. Draft Prefunctional Checklists and Functional Test Procedures for Control System: Detailed written plan indicating the procedures to be followed to test, checkout and adjust the control system prior to full system Functional Testing; include at least the following for each type of equipment controlled:
   1. System name.
   2. List of devices.
   3. Step-by-step procedures for testing each controller after installation, including:
      a. Process of verifying proper hardware and wiring installation.
      b. Process of downloading programs to local controllers and verifying that they are addressed correctly.
      c. Process of performing operational checks of each controlled component.
      d. Plan and process for calibrating valve and damper actuators and all sensors.
      e. Description of the expected field adjustments for transmitters, controllers and control actuators should control responses fall outside of expected values.
   4. Copy of proposed log and field checkout sheets to be used to document the process; include space for initial and final read values during calibration of each point and space to specifically indicate when a sensor or controller has “passed” and is operating within the contract parameters.
   5. Description of the instrumentation required for testing.
   6. Indicate what tests on what systems should be completed prior to TAB using the control system for TAB work. Coordinate with the Commissioning Authority and TAB contractor for this determination.

C. Startup Reports, Prefunctional Checklists, and Trend Logs: Submit for approval of Commissioning Authority.

D. HVAC Control System O&M Manual Requirements. In addition to documentation specified elsewhere, compile and organize at minimum the following data on the control system:
   1. Specific step-by-step instructions on how to perform and apply all functions, features, modes, etc. mentioned in the controls training sections of this specification and other features of this system. Provide an index and clear table of contents. Include the detailed technical manual for programming and customizing control loops and algorithms.
   2. Full as-built set of control drawings.
   3. Full as-built sequence of operations for each piece of equipment.
   4. Full points list; in addition to the information on the original points list submittal, include a listing of all rooms with the following information for each room:
      a. Floor.

b. Room number.
c. Room name.
d. Air handler unit ID.
e. Reference drawing number.
f. Air terminal unit tag ID.
g. Heating and/or cooling valve tag ID.
h. Minimum air flow rate.
i. Maximum air flow rate.

5. Full print out of all schedules and set points after testing and acceptance of the system.
6. Full as-built print out of software program.
7. Electronic copy on disk of the entire program for this facility.
8. Marking of all system sensors and thermostats on the as-built floor plan and HVAC drawings with their control system designations.
9. Maintenance instructions, including sensor calibration requirements and methods by sensor type, etc.
10. Control equipment component submittals, parts lists, etc.
11. Warranty requirements.
12. Copies of all checkout tests and calibrations performed by the Contractor (not commissioning tests).
13. Organize and subdivide the manual with permanently labeled tabs for each of the following data in the given order:
    a. Sequences of operation.
    b. Control drawings.
    c. Points lists.
    d. Controller and/or module data.
    e. Thermostats and timers.
    f. Sensors and DP switches.
    g. Valves and valve actuators.
    h. Dampers and damper actuators.
    i. Program setups (software program printouts).

E. Project Record Documents: See Section 01 7800 for additional requirements.
1. Submit updated version of control system documentation, for inclusion with operation and maintenance data.
2. Show actual locations of all static and differential pressure sensors (air, water and building pressure) and air-flow stations on project record drawings.

F. Draft Training Plan: In addition to requirements specified in Section 01 7900, include:
1. Follow the recommendations of ASHRAE Guideline 1.1.

2. Control system manufacturer's recommended training.
3. Demonstration and instruction on function and overrides of any local packaged controls not controlled by the HVAC control system.

G. Training Manuals: See Section 01 7900 for additional requirements.
1. Provide three extra copies of the controls training manuals in a separate manual from the O&M manuals.

PART 2 PRODUCTS

2.01 TEST EQUIPMENT

A. Provide all standard testing equipment required to perform startup and initial checkout and required functional performance testing; unless otherwise noted such testing equipment will NOT become the property of Owner.

B. Equipment-Specific Tools: Where special testing equipment, tools and instruments are specific to a piece of equipment, are only available from the vendor, and are required in order to accomplish startup or Functional Testing, provide such equipment, tools, and instruments as part of the work at no extra cost to Owner; such equipment, tools, and instruments are to become the property of Owner.

PART 3 EXECUTION

3.01 PREPARATION

A. Cooperate with the Commissioning Authority in development of the Prefunctional Checklists and Functional Test Procedures.

B. Furnish additional information requested by the Commissioning Authority.

C. Prepare a preliminary schedule for HVAC pipe and duct system testing, flushing and cleaning, equipment start-up and testing, adjusting, and balancing start and completion for use by the Commissioning Authority; update the schedule as appropriate.

D. Notify the Commissioning Authority when pipe and duct system testing, flushing, cleaning, startup of each piece of equipment and testing, adjusting, and balancing will occur; when commissioning activities not yet performed or not yet scheduled will delay construction notify ahead of time and be proactive in seeing that the Commissioning Authority has the scheduling information needed to efficiently execute the commissioning process.

E. Put all HVAC equipment and systems into operation and continue operation during each working day of testing, adjusting, and balancing and commissioning, as required.

F. Provide test holes in ducts and plenums where directed to allow air measurements and air balancing; close with an approved plug.

G. Provide temperature and pressure taps in accordance with Contract Documents.

3.02 INSPECTING AND TESTING - GENERAL

A. Submit startup plans, startup reports, and Prefunctional Checklists for each item of equipment or other assembly to be commissioned.
B. Perform the Functional Tests directed by the Commissioning Authority for each item of equipment or other assembly to be commissioned.
C. Provide two-way radios for use during the testing.
D. Valve/Damper Stroke Setup and Check:
    1. For all valve/damper actuator positions checked, verify the actual position against the control system readout.
    2. Set pump/fan to normal operating mode.
    3. Command valve/damper closed; visually verify that valve/damper is closed and adjust output zero signal as required.
    4. Command valve/damper open; verify position is full open and adjust output signal as required.
    5. Command valve/damper to a few intermediate positions.
    6. If actual valve/damper position does not reasonably correspond, replace actuator or add pilot positioner (for pneumatics).
E. Deficiencies: Correct deficiencies and re-inspect or re-test, as applicable, at no extra cost to Owner.

3.03 TAB COORDINATION

A. TAB: Testing, adjusting, and balancing of HVAC.
B. Coordinate commissioning schedule with TAB schedule.
C. Review the TAB plan to determine the capabilities of the control system toward completing TAB.
D. Provide all necessary unique instruments and instruct the TAB technicians in their use; such as handheld control system interface for setting terminal unit boxes, etc.
E. Have all required Prefunctional Checklists, calibrations, startup and component Functional Tests of the system completed and approved by the Commissioning Authority prior to starting TAB.
F. Provide a qualified control system technician to operate the controls to assist the TAB technicians or provide sufficient training for the TAB technicians to operate the system without assistance.

3.04 CONTROL SYSTEM FUNCTIONAL TESTING

A. Prefunctional Checklists for control system components will require a signed and dated certification that all system programming is complete as required to accomplish the requirements of Contract Documents and the detailed Sequences of Operation documentation submittal.

B. Do not start Functional Testing until all controlled components have themselves been successfully Functionally Tested in accordance with Contract Documents.
C. Using a skilled technician who is familiar with this building, execute the Functional Testing of the control system as required by the Commissioning Authority.
D. Functional Testing of the control system constitutes demonstration and trend logging of control points monitored by the control system.
    1. The scope of trend logging is partially specified; trend log up to 50 percent more points than specified at no extra cost to Owner.
    2. Perform all trend logging specified in Prefunctional Checklists and Functional Test procedures.
E. Functionally Test integral or stand-alone controls in conjunction with the Functional Tests of the equipment they are attached to, including any interlocks with other equipment or systems; further testing during control system Functional Test is not required unless specifically indicated below.
F. Demonstrate the following to the Commissioning Authority during testing of controlled equipment; coordinate with commissioning of equipment.
    1. Setpoint changing features and functions.
    2. Sensor calibrations.
G. Demonstrate to the Commissioning Authority:
    1. That all specified functions and features are set up, debugged and fully operable.
    2. That scheduling features are fully functional and setup, including holidays.
    3. That all graphic screens and value readouts are completed.
    4. Correct date and time setting in central computer.
    5. That field panels read the same time as the central computer; sample 10 percent of field panels; if any of those fail, sample another 10 percent; if any of those fail test all remaining units at no extra cost to Owner.
    6. Functionality of field panels using local operator keypads and local ports (plug-ins) using portable computer/keypad; demonstrate 100 percent of panels and 10 percent of ports; if any ports fail, sample another 10 percent; if any of those fail, test all remaining units at no extra cost to Owner.
    7. Power failure and battery backup and power-up restart functions.
    8. Global commands features.
    9. Security and access codes.
    10. Occupant over-rides (manual, telephone, key, keypad, etc.).
    11. O&M schedules and alarms.
    12. Occupancy sensors and controls.
    13. Fire alarm interlocks and response.

14. That points that are monitored only, having no control function, are reporting properly to the control system.
15. All control strategies and sequences not tested during controlled equipment testing.

H. If the control system, integral control components, or related equipment do not respond to changing conditions and parameters appropriately as expected, as specified and according to acceptable operating practice, under any of the conditions, sequences, or modes tested, correct all systems, equipment, components, and software required at no additional cost to Owner.

3.05 OPERATION AND MAINTENANCE MANUALS

A. See Section 01 7800 for additional requirements.

B. Add design intent documentation furnished by Architect to manuals prior to submission to Owner.

C. Submit manuals related to items that were commissioned to Commissioning Authority for review; make changes recommended by Commissioning Authority.

D. Commissioning Authority will add commissioning records to manuals after submission to Owner.

3.06 DEMONSTRATION AND TRAINING

A. See Section 01 7900 for additional requirements.

B. Demonstrate operation and maintenance of HVAC system to Owner' personnel; if during any demonstration, the system fails to perform in accordance with the information included in the O&M manual, stop demonstration, repair or adjust, and repeat demonstration. Demonstrations may be combined with training sessions if appropriate.

C. These demonstrations are in addition to, and not a substitute for, Prefunctional Checklists and demonstrations to the Commissioning Authority during Functional Testing.

D. Provide classroom and hands-on training of Owner's designated personnel on operation and maintenance of the HVAC system, control system, and all equipment items indicated to be commissioned. **Training hours shall take place over at least two (2) sessions, not less than 180 days and not more than 365 days apart.** Provide the following minimum durations of training:

1. HVAC Control System: 18 hours.
2. Variable Speed Drives: 3 hours.
3. Air Terminal Units: 6 hours.
4. Packaged Rooftop Units: 18 hours.
5. Computer Room AC Units: 3 hours.
6. Split System AC or Heat Pumps: 3 hours.

7. Spot Unit Heaters: 1 hours.
8. Specialty Exhaust Fans: 3 hours.
9. Specialy Filters: 3 hours

E. TAB Review: Instruct Owner's personnel for minimum 18 hours, after completion of TAB, on the following:
   1. Review final TAB report, explaining the layout and meanings of each data type.
   2. Discuss any outstanding deficient items in control, ducting or design that may affect the proper delivery of air or water.
   3. Identify and discuss any terminal units, duct runs, diffusers, coils, fans and pumps that are close to or are not meeting their design capacity.
   4. Discuss any temporary settings and steps to finalize them for any areas that are not finished.
   5. Other salient information that may be useful for facility operations, relative to TAB.

F. HVAC Control System Training: Perform training in at least three phases:
   1. Phase 1 - Basic Control System: Provide minimum of 6 hours of actual training on the control system itself. Upon completion of training, each attendee, using appropriate documentation, should be able to perform elementary operations and describe general hardware architecture and functionality of the system.
      a. This training must be held on-site or at the manufacturer's facility.
   2. Phase 2 - Integrating with HVAC Systems: Provide minimum of 4 hours of on-site, hands-on training after completion of Functional Testing. Include instruction on:
      a. The specific hardware configuration of installed systems in this facility and specific instruction for operating the installed system, including interfaces with other systems, if any.
      b. Security levels, alarms, system start-up, shut-down, power outage and restart routines, changing setpoints and alarms and other typical changed parameters, overrides, freeze protection, manual operation of equipment, optional control strategies that can be considered, energy savings strategies and set points that if changed will adversely affect energy consumption, energy accounting, procedures for obtaining vendor assistance, etc.
      c. Trend logging and monitoring features (values, change of state, totalization, etc.), including setting up, executing, downloading, viewing both tabular and graphically and printing trends; provide practice in setting up trend logging and monitoring during training session.
      d. Every display screen, allowing time for questions.
      e. Point database entry and modifications.

3. Phase 3 - Post-Occupancy: Six months after occupancy conduct minimum of 8 hours of training. Tailor training session to questions and topics solicited beforehand from Owner. Also be prepared to address topics brought up and answer questions concerning operation of the system.

G. Provide the services of manufacturer representatives to assist instructors where necessary.

H. Provide the services of the HVAC controls instructor at other training sessions, when requested, to discuss the interaction of the controls system as it relates to the equipment being discussed.

END OF SECTION 23 0800

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SECTION 23 0913
INSTRUMENTATION AND CONTROL DEVICES FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Control panels.
B. Damper Operators:
C. Humidistats:
   1. Room humidistats.
D. Input/Output Sensors:
   1. Temperature sensors.
   2. Humidity sensors.
   3. Static pressure (air pressure) sensors.
   4. Equipment operation (current) sensors.
   5. Carbon dioxide sensors.
E. Thermostats:
   1. Room thermostat accessories.
   2. Outdoor reset thermostats.
F. Time clocks.

1.02 RELATED REQUIREMENTS

A. Section 23 0923 - Direct-Digital Control System for HVAC.
B. Section 23 0993 - Sequence of Operations for HVAC Controls.
C. Section 23 3300 - Air Duct Accessories: Installation of automatic dampers.
D. Section 26 0583 - Wiring Connections: Electrical characteristics and wiring connections.
E. Section 26 2726 - Wiring Devices: Elevation of exposed components.

1.03 REFERENCE STANDARDS

A. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.
B. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems 2021.
C. UL 94 - Tests for Flammability of Plastic Materials for Parts in Devices and Appliances Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide description and engineering data for each control system component. Include sizing as requested. Provide data for each system component and software module.

C. Shop Drawings: Indicate complete operating data, system drawings, wiring diagrams, and written detailed operational description of sequences. Submit schedule of valves indicating size, flow, and pressure drop for each valve. For automatic dampers indicate arrangement, velocities, and static pressure drops for each system.
D. Manufacturer's Instructions: Provide for all manufactured components.
E. Project Record Documents: Record actual locations of control components, including panels, thermostats, and sensors. Accurately record actual location of control components, including panels, thermostats, and sensors.
    1. Revise shop drawings to reflect actual installation and operating sequences.
F. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.
G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
    1. See Section 01 6000 - Product Requirements, for additional provisions.
    2. Extra Thermostats and Other Exposed Sensors: One of each type.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.01 EQUIPMENT - GENERAL

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

2.02 CONTROL PANELS

A. Unitized cabinet type for each system under automatic control with relays and controls mounted in cabinet and temperature indicators, pressure gauges, pilot lights, push buttons and switches flush on cabinet panel face.
B. NEMA 250, general purpose utility enclosures with enameled finished face panel.
C. Provide common keying for all panels.

2.03 DAMPER OPERATORS

A. General: Provide smooth proportional control with sufficient power for air velocities 20 percent greater than maximum design velocity and to provide tight seal against maximum system pressures. Provide spring return for two position control and for fail safe operation.
    1. Provide sufficient number of operators to achieve unrestricted movement throughout damper range.

2.04 HUMIDISTATS

A. Room Humidistats:
   1. Wall mounted, proportioning type.
   2. Throttling Range: Adjustable 2 percent relative humidity.
   3. Operating Range: 30 to 80 percent.

2.05 INPUT/OUTPUT SENSORS

A. Temperature Sensors:
   1. Use thermistor or RTD type temperature sensing elements with characteristics resistant to moisture, vibration, and other conditions consistent with the application without affecting accuracy and life expectancy.
   2. Performance Characteristics:
      a. Room Temperature Sensors with Integral Digital Display:
         1) Construct for low-profile mounting.
         2) Provide a four button keypad with the following capabilities:
            (a) Indication of space and outdoor temperatures.
            (b) Setpoint adjustment to accommodate room setpoint.
            (c) Manual occupancy override and indication of occupancy status.
            (d) Controller mode status.
            (e) Password enabled setpoint and override modes.

B. Humidity Sensors:
   1. Duct Mounted Sensor: Voltage type encased in a die-cast metal, weather-proof housing.
      a. Humidity:
         1) Accuracy 1 percent at 10 to 80 percent relative humidity at 77 degrees F, multi-point calibration, NIST traceable.
            (a) Plus/minus 1 percent at 20 to 40 percent RH in mA output mode; (multi-point calibration, NIST traceable).
         2) Scaling: 0 to 100 percent RH.
      b. Temperature Effect:
         1) Duct Mounted: Plus/minus 0.18 percent per degree F.
         2) Outdoor Mounted: 4 to 20mA version: (0.0013x%RHx(TdegreeC-25)).
   2. Wall Mounted Sensor: Voltage type encased in a plastic housing.

C. Static Pressure (Air Pressure) Sensors:
   1. Unidirectional with ranges not exceeding 150 percent of maximum expected input.
   2. Temperature compensate with typical thermal error or 0.06 percent of full scale in temperature range of 40 to 100 degrees F.
   3. Accuracy: One percent of full scale with repeatability 0.3 percent.

D. Equipment Operation (Current) Sensors:
   1. Status Inputs for Fans: Differential pressure switch with adjustable range of 0 to 5 inches wg.
   2. Status Inputs for Electric Motors: Current sensing relay with current transformers, adjustable and set to 175 percent of rated motor current.

E. Carbon Dioxide Sensors, Duct and Wall:
   1. General: Provide non-dispersive infrared (NDIR), diffusion sampling CO2 sensors with integral transducers and linear output.
   2. Air Temperature: Range of 32 to 122 degrees F.
   3. Relative Humidity: Range of 0 to 95 percent (non-condensing).
   4. Calibration Characteristics:
      a. Automatically compensating algorithm for sensor drift due to sensor degradation.
      b. Maximum Drift: 2 percent.
      c. User calibratable with a minimum calibration interval of 5 years.
   5. Construction:
      a. Sensor Chamber: Non-corrosive material for neutral effect on carbon dioxide sample.
      b. Provide duct mounted sensors with duct probe designed to protect sensing element from dust accumulation and mechanical damage.

2.06 THERMOSTATS

A. Room Thermostat Accessories:
   1. Insulating Bases: For thermostats located on exterior walls.

B. Outdoor Reset Thermostats:
   1. Remote bulb or bimetal rod and tube type, proportioning action with adjustable throttling range, adjustable setpoint.
   2. Scale range: Minus 10 to 70 degrees F.

2.07 TIME CLOCKS

A. Seven day programming switch timer with synchronous timing motor and seven day dial, continuously charged Ni-cad battery driven power failure 8 hour carry over and multiple switch trippers to control systems for minimum of two and maximum of eight signals per day with two normally open and two normally closed output switches.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.
B. Verify that systems are ready to receive work.
C. Beginning of installation means installer accepts existing conditions.

D. Sequence work to ensure installation of components is complementary to installation of similar components in other systems.
E. Coordinate installation of system components with installation of mechanical systems equipment such as air handling units and air terminal units.
F. Ensure installation of components is complementary to installation of similar components.
G. Coordinate installation of system components with installation of mechanical systems equipment such as air handling units and air terminal units.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.
B. Check and verify location of thermostats with plans and room details before installation. Locate 60 inches above floor. Align with lighting switches and any other adjacent wall-mounted devices (such as fire alarm strobes, etc.). See device mounting detail on architectural drawings. Refer to Section 26 2726 - Wiring Devices.
C. Mount outdoor reset thermostats and outdoor sensors indoors, with sensing elements outdoors with sun shield.
D. Mount control panels adjacent to associated equipment on vibration free walls or free standing angle iron supports. One cabinet may accommodate more than one system in same equipment room. Provide engraved plastic nameplates for instruments and controls inside cabinet and engraved plastic nameplates on cabinet face.
E. Install "hand/off/auto" selector switches to override automatic interlock controls when switch is in "hand" position.
F. Provide conduit and electrical wiring in accordance with Section 26 0583. Electrical material and installation shall be in accordance with appropriate requirements of Division 26.

END OF SECTION 23 0913

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SECTION 23 0923
DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

A. Section 23 0913 - Instrumentation and Control Devices for HVAC.
B. Section 23 0993 - Sequence of Operations for HVAC Controls.
C. Section 26 0583 - Wiring Connections: Electrical characteristics and wiring connections.

1.02 REFERENCE STANDARDS

A. ASHRAE Std 135 - A Data Communication Protocol for Building Automation and Control Networks 2020, with Errata and Amendments (2022).
B. ASHRAE Std 147 - Reducing the Release of Halogenated Refrigerants from Refrigerating and Air-Conditioning Equipment and Systems 2019, with Addendum (2021).
C. Bluetooth CS - Bluetooth Core Specification 2016, Addendum 2017.
D. CTA-709.1 - Control Network Protocol Specification 2019.
E. IEEE 802.11 - IEEE Standard for Information Technology--Telecommunications and Information Exchange between Systems - Local and Metropolitan Area Networks--Specific Requirements - Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications 2020, with Amendment (2021).
F. IEEE 802.15.4 - IEEE Standard for Low-Rate Wireless Networks 2020, with Amendment (2021).
G. MIL-STD-810 - Environmental Engineering Considerations and Laboratory Tests 2019h.
H. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
I. UL (DIR) - Online Certifications Directory Current Edition.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.
B. Product Data: Provide data for each system component and software module.
C. Shop Drawings:
    1. Indicate trunk cable schematic showing programmable control unit locations, and trunk data conductors.
    2. Indicate system graphics indicating monitored systems, data (connected and calculated) point addresses, and operator notations. Provide demonstration digital media containing graphics.

3. Show system configuration with peripheral devices, batteries, power supplies, diagrams, modems, and interconnections.
4. Indicate description and sequence of operation of operating, user, and application software.

D. Manufacturer's Instructions: Indicate manufacturer's installation instructions for all manufactured components.
E. Designer's Qualification Statement.
F. Manufacturer's Qualification Statement.
G. Installer's Qualification Statement.
H. Project Record Documents: Record actual locations of control components, including control units, thermostats, and sensors.
1. Revise shop drawings to reflect actual installation and operating sequences.
2. Include submittals data in final "Record Documents" form.
3. Startup Testing Report (See PART 3 - EXECUTION for startup testing details)
4. Performance Verification Testing Report (See PART 3 - EXECUTION for performance verification details)
I. Operation and Maintenance Data:
1. Include interconnection wiring diagrams complete field installed systems with identified and numbered, system components and devices.
2. Include keyboard illustrations and step-by-step procedures indexed for each operator function.
3. Include inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.
4. Include all other information common to the entire system. This shall include, but not be limited to, the following:
a. Product manuals for the key software tasks.
b. Operating the system.
c. Administrating the system.
d. Engineering the operator workstation.
e. Application programming.
f. Engineering the network.
g. Setting up the web server.
h. Report creation.
i. Graphics creation.
j. All other engineering tasks.
k. System Architecture Diagram.
l. List of recommended maintenance tasks associated with the system servers, operator workstations, data servers, web servers and web clients.

m. Define a task.
n. Recommend a frequency for the task.
o. Reference the product manual that includes instructions on executing the task.
p. Names, addresses, and telephone numbers of installing contractors and service representatives for equipment and control systems.
q. Licenses, guarantees, and warranty documents for equipment and systems.

5. Provide additional information common to the systems in a single building, including, but not limited to, the following:
   a. System architecture diagram for components within the building annotated with specific location information.
   b. As-built drawing for each control panel.
   c. As-built wiring design diagram for all components.
   d. Installation design details for each I/O device.
   e. As-built system flow diagram for each system.
   f. Sequence of control for each system.
   g. Binding map for the building.
   h. Product data sheet for each component.
   i. Installation data sheet for each component.

J. Software Submittals: All software revisions shall be as installed at the time of the system acceptance. Provide the following software submittals:
   1. Submit a copy of all software installed on the servers and workstations.
   2. Submit all licensing information for all software installed on the servers and workstations.
   3. Submit a copy of all software used to execute the project even if the software was not installed on the servers and workstations.
   4. Submit all licensing information for all of the software used to execute the project.
   5. All software revisions shall be as installed at the time of the system acceptance.
   6. Submit a copy of all firmware files that were downloaded to or pre-installed on any devices installed as part of this project. This does not apply to firmware that is permanently burned on a chip at the factory and can only be replaced by replacing the chip.
   7. Submit a copy of all application files that were created during the execution of the project.
   8. Submit a copy of all graphic page files created during the execution of the project.

K. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Perform work in accordance with NFPA 70.

B. Designer Qualifications: Perform design of system using manufacturer's software under direct supervision of a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

C. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum five years of documented experience.

D. Installer Qualifications: Company specializing in performing work of the type specified and with minimum five years of documented experience and approved by manufacturer.

1. Installer shall have a full service facility within 100 miles of the project that is staffed with engineers trained and certified by the manufacturer in the configuration, programming and service of the automation system. The installer's technicians shall be fully capable of providing instructions and routine emergency maintenance service on all system components.

E. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for purpose specified and indicated.

1.06 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Correct defective Work within a five year period after Substantial Completion.

C. Provide five year manufacturer's warranty for field programmable micro-processor based units.

1.07 PROTECTION OF SOFTWARE RIGHTS

A. The Owner shall retain permanent licenses to software for this project.

B. The Owner shall sign a copy of the manufacturer's standard software and firmware licensing agreement. Such license shall grant use of all programs and application software to the Owner as defined by the manufacturer's license agreement, but shall protect the manufacturer's rights to disclosure of Trade Secrets contained within such software. **The licensing agreement shall not preclude the use of the software by individuals under contract to the owner for commissioning, servicing or altering the system in the future.** Use of the software by individuals under contract to the owner shall be restricted to use on the owner's computers and only for the purpose of commissioning, servicing, or altering the installed system.

C. All project developed software, files and documentation shall become the property of the Owner. These include but are not limited to:

1. Server and workstation software

2. Application programming tools
3. Configuration tools
4. Network diagnostic tools
5. Addressing tools
6. Application files
7. Configuration files
8. Graphic files
9. Report files
10. Graphic symbol libraries
11. All documentation

PART 2 PRODUCTS

2.01 SYSTEM DESCRIPTION

A. The Building Automation System (BAS) shall consist of Network Server/Controllers (NSCs), a family of Standalone Digital Control Units (SDCUs), Administration and Programming Workstations (APWs), and Web-based Operator Workstations (WOWs). The BAS shall provide control, alarm detection, scheduling, reporting and information management for the entire facility, and Wide Area Network (WAN) if applicable.
   1. Modbus RTU/ASCII (and J-bus), Modbus TCP, BACnet MS/TP, BACnet IP, LonTalk FTT-10A, and WebServices shall be native to the NSCs. There shall not be a need to provide multiple NSCs to support all the network protocols, nor should there be a need to supply additional software to allow all three protocols to be natively supported.
   2. A sub-network of SDCUs using the BACnet MS/TP protocol shall connect the local, stand-alone controllers with Ethernet-level Network Server Controllers/IP Routers.
   3. All NSCs, Workstation(s) and Servers shall be capable of residing directly on the owner's Ethernet TCP/IP LAN/WAN with no required gateways. Furthermore, the NSC's, Workstation(s), and Server(s) shall be capable of using standard, commercially available, off-the-shelf Ethernet infrastructure components such as routers, switches and hubs. With this design the owner may utilize the investment of an existing or new enterprise network or structured cabling system. This also allows the option of the maintenance of the LAN/WAN to be performed by the owner's Information Systems Department as all devices utilize standard TCP/IP components.

B. System Expansion:

1. The BAS system shall be scalable and expandable at all levels of the system using the same software interface, and the same TCP/IP level and fieldbus level controllers. Systems that require replacement of either the workstation software or field controllers in order to expand the system shall not be acceptable.
2. Web-based operation shall be supported directly by the NSCs and require no additional software.
3. The system shall be capable of using graphical and/or line application programming language for the Network Server Controllers.
4. The system shall be able to operate normally and without restriction at multiple software version levels with the only requirement that each element of the hierarchy be at least as new a version as the newest version in the level below it. In other words, Enterprise Servers will be able to manage NSCs of different version provided that the Enterprise Server was the same or more recent version than the most recent NSC version.

C. Automatic temperature control field monitoring and control system using field programmable micro-processor based units.

D. Base system on distributed system of fully intelligent, stand-alone controllers, operating in a multi-tasking, multi-user environment on token passing network, with central and remote hardware, software, and interconnecting wire and conduit.

E. Include computer software and hardware, operator input/output devices, control units, local area networks (LAN), sensors, control devices, actuators.

F. Controls for variable air volume terminals, radiation, reheat coils, unit heaters, fan coils, and the like when directly connected to the control units. Individual terminal unit control is specified in Section 23 0913.

G. Provide control systems consisting of thermostats, control valves, dampers and operators, indicating devices, interface equipment and other apparatus and accessories required to operate mechanical systems, and to perform functions specified.

H. Include installation and calibration, supervision, adjustments, and fine tuning necessary for complete and fully operational system.

2.02 OPERATOR INTERFACE

A. User Access and Permissions:

1. The BMS system shall allow for creation of one account per user.
2. The BMS shall support Groups where User Accounts associated with the group can inherit group permissions.
3. The BMS shall be able to specify each user account / group accessibility to each object in the system.

4. This username/password combination shall be linked to a set of capabilities within the software, set and editable only by user with system administrator privileges. The sets of capabilities shall include: edit or View only, Acknowledge alarms, Enable/disable Program and change values.
5. The system shall allow the above capabilities to be applied independently to each and every class of object in the system.
6. The BMS shall support configurable reminder for “Days until password expires”.
7. The BMS shall support configurable password policy across:
    a. Minimum number of characters
    b. Minimum number of lowercase characters
    c. Minimum number of numeric characters
    d. Minimum number of special characters
    e. Number of consecutive unique passwords before reuse
    f. No more than three repeating identical characters
8. The BMS user account management shall support password policy with the following components:
    a. Mandatory change of password at first logon with default credentials
    b. Disabling of all imported user accounts by default
    c. Custom password complexity rules and its enforcement
    d. Custom password reuse and its enforcement
    e. Configurable black listing of passwords to limit the use of common known passwords (e.g. password)
    f. Password aging rules
9. The BMS shall be capable of enabling an anonymous access (guest account) to previously engineered views such as dashboards, graphics, etc. with configurable permissions and without username or password.
10. It shall be possible to configure the BMS system so that the guest account is used by default to simplify presentation of Kiosk Mode across multiple screens
11. The BMS shall provide time configurability to logout the user and to revert to a preconfigured presentation view, such as offered by the Guest account functionality.
12. The BMS shall provide configurability in managing access and permission levels based on location, IP addresses and address ranges, Schedule and Time of day and combination thereof.

B. System Security
    1. The BMS system supplier The BMS vendor shall be certified to Security Development Lifecycle process that is certified to IEC 62443-4-1 by a reputable third party independent lab.

2. The BMS system supplier shall be subjected to regular and verifiable best practice cyber security testing by the system supplier. Results of this testing shall be made available upon request prior to deployment of the system.
3. The BMS system supplier shall provide cyber security service incident escalation through help desk on a 7/24/365 basis.
4. The BMS shall support configuration for inactivity auto log-off of logged clients
5. The BMS system shall support Self-Signed Certificates, Default Certificates and/or Certification Authority (CA) certificates.
6. The BMS client communications (web access or rich client access) shall support TLS 1.2 encryption or higher
7. The BMS shall allow configuration in disabling all devices and software that support HTTP and require access via HTTPS.
8. The BMS must be able to Alarm or generate notification on failed access attempts
9. The BMS Servers shall support SNMP V3 monitoring of network performance and stack statistics for the purpose of managing denial of service attacks
10. The Integrated Control Platform shall support the feature to alarm on a predetermined period of time until the default password for each device is changed from the default factory setting.
11. The Integrated Control Platform shall support encrypted password authentication for all web services whether serving or consuming.
12. The BMS shall have the capability to use blacklisted and whitelisted IPs/MAC addresses to gate access
13. The BMS shall have the capability to differentiate, limit, or enable user access depending on Client's IP address/range (where) and time of day (when) the user is accessing the system.

C. Alarm Management
1. A minimum of 1000 alarm notification levels at the NSC, workstation, and webstation levels.
2. Each notification level will establish a unique set of parameters for controlling alarm display, distribution, acknowledgment, keyboard annunciation, and record keeping.
3. It shall be possible for the user to sort, filter and search on any available criteria such as priority, category, origin, alarm type, etc.
4. An active alarm viewer shall be included which can be customized for each user or user type to a hide or display any alarm attributes.
5. It shall be possible to present alarms with configurable colors based on priority, category, origin, alarm type, etc.

6. It shall be possible to linking files/documents/hyperlinks/navigation links/graphics link to an alarm for easy access upon occurrence
7. Automatic logging in the database of the alarm message, point name, point value, source device, timestamp of alarm, username and time of acknowledgement, username and time of alarm silence (soft acknowledgement).
8. Alarm notifications must support multiple distribution methods within one notification
9. On alarm, it shall be possible to notify via email to a preconfigured list of recipients . through a Simple Mail Transfer Protocol (SMTP) or secure email using Simple Mail Transfer Protocol Secure (SMTPS). No special software interfaces shall be required and no email client software must be running in order for email to be distributed. The email notification shall be able to be sent to an individual user or a user group.
10. On alarm, it shall be possible to notify via SNMP
11. On alarm, it shall be possible to notify via file (on disk) that would be consumable by other alarm management services
12. An operator shall have the capability to assign an alarm to another user of the system.
13. Individual alarms shall be able to be assigned to a user automatically via a preconfigured list of users and date/time. For example, a critical high temp alarm can be configured to be assigned to a Facilities Dept or to a Central Alarming workstation depending on time/date.
14. Playing an audible sound on alarm initiation or return to normal.
15. It shall be possible to assign a custom audio sound to each alarm / alarm-criteria (e.g., priority, category, origin, alarm type, etc.)
16. The active alarm viewer can be configured such that an operator must confirm that all of the steps in a check list have been accomplished prior to acknowledging the alarm.
17. The active alarm viewer shall, if filtered, show the quantity of visible and total number of alarms that are not equal to ‘normal’ and the quantity of disabled and hidden alarms.
18. The alarm viewer can be configured to auto hide alarms when triggered.
19. An operator shall have the capability to save and apply alarm favorites.
20. Alarms shall be configurable such that an operator must type in text in an alarm entry and/or pick from a drop-down list of user actions for certain alarms.
21. Alarms shall be configurable such that an operator must type in text in an alarm entry and/or pick from a drop-down list of causes for certain alarms. This ensures accountability (audit trail) for the response to critical alarms.

22. It shall be possible to configure user-actions via user/group permissions when responding to an alarm
23. All operator actions responding to an alarm must be audit trailed.

D. PC Based Work Station:
   1. The BAS system supplier shall furnish licenses for web connection to the BAS system. Web-based users shall have access to all system points and graphics, shall be able to receive and acknowledge alarms, and shall be able to control setpoints and other parameters. All engineering work, such as trends, reports, graphics, etc. that are accomplished from the WorkStation shall be available for viewing through the web browser interface without additional changes. The web-based interface must conform to the B-OWS BACnet device profile. There will be no need for any additional computer based hardware to support the web-based user interface.
   2. Resides on high speed network with building controllers.
   3. Connected to server for full access to all system information.
   4. Shall have a graphical, web-based operator interface that allows for instant access to any system through a standard browser.
   5. Allows for future expansion of both input/output points and processing/control functions.

E. Administration and Programming Workstation(s):
   1. The BAS system supplier shall include Operation software and architecture required. These workstations must be running the standard workstation software developed and tested by the manufacturer of the network server controllers and the standalone controllers. No third party front-end workstation software will be acceptable. Workstations must conform to the B-OWS BACnet device profile

F. Mobile Device Interface:
   1. The BAS system supplier shall include Operation software and architecture required to proivide a graphical, web-based operator interface that allows for instant access to any system through a a mobile device operating on the most current versions of both Apple iOS or Android.

G. Workstation, controllers, and control backbone to communicate using BACnet protocol and addressing.

H. BACnet protocol to comply with ASHRAE Std 135.

I. Hardware:
   1. Desktop:
      a. Computer(s) and display(s) to be provided by Owner, meeting DDC Control Manufacturer's minimum requirements..
      b. Quantity: 1.

c. Minimum RAM: 8GB.
d. Minimum Processing Speed: 3.0 GHz.
e. Minimum Hard Drive Memory: 20GB.
f. Drives: Solid State recommended..
g. Ports: USB 2.0 minimum..
h. Location(s): As directed by the Owner.
i. Network Connection:
    1) Ethernet interface card.
    2) Minimum Speed: 10/100MBPS.

2. Hand Held Device:
    a. Provide remote system access via iPAD or Smart Phone with browser agnostic connectivity, including controller point monitor and control access to the following data:
        1) Alarm.
        2) Summary.
        3) Schedule.
        4) Trend.
    b. Provide the capability to view in text list based format.
    c. Minimum Functionality:
        1) Set point adjustment.
        2) Alarm acknowledgement.
        3) Scheduling.

2.03 ENCLOSURES

A. For all I/O requiring field interface devices, these devices where practical will be mounted in a field interface panel (FIP). The Contractor shall provide an enclosure which protects the device(s) from dust, moisture, conceals integral wiring and moving parts.
B. FIPs shall contain power supplies for sensors, interface relays and contactors, and safety circuits.
C. The FIP enclosure shall be of steel construction with baked enamel finish; NEMA 1 rated with a hinged door and keyed lock. The enclosure will be sized for twenty percent spare mounting space. All locks will be keyed identically.
D. All wiring to and from the FIP will be to screw type terminals. Analog or communications wiring may use the FIP as a raceway without terminating. The use of wire nuts within the FIP is prohibited.
E. All outside mounted enclosures shall meet the NEMA-4 rating.
F. The wiring within all enclosures shall be run in plastic track. Wiring within controllers shall be wrapped and secured.

2.04 POWER SUPPLIES AND LINE FILTERING

A. Power Supplies:
   1. Provide UL listed control transformers with Class 2 current limiting type or over-current protection in both primary and secondary circuits for Class 2 service as required by the NEC.
   2. Limit connected loads to 80 percent of rated capacity.
   3. Match DC power supply to current output and voltage requirements.
   4. Unit to be full wave rectifier type with output ripple of 5.0 mV maximum peak to peak.
   5. Regulation to be 1 percent combined line and load with 100 microsecond response time for 50 percent load changes.
   6. Provide over-voltage and over-current protection to withstand a 150 percent current overload for 3 seconds minimum without trip-out or failure.
   7. Operational Ambient Conditions: 32 to 120 degrees F.
   8. EM/RF meets FCC Class B and VDE 0871 for Class B and MIL-STD-810 for shock and vibration.
   9. Line voltage units UL recognized and CSA approved.

B. Power Line Filtering:
   1. Provide external or internal transient voltage and surge suppression component for all workstations and controllers.
   2. Minimum surge protection attributes:
      a. Dielectric strength of 1000 volts minimum.
      b. Response time of 10 nanoseconds or less.
      c. Transverse mode noise attenuation of 65 dB or greater.
      d. Common mode noise attenuation of 150 dB or greater at 40 to 100 Hz.

2.05 CONTROLLER SOFTWARE

A. All applications reside and operate in the system controllers and editing of all applications occurs at the operator workstation.

B. Web-based Operator PC Requirements:
   1. Any user on the network can access the system, using the following software:
      a. Google Chrome 71 or higher
      b. Mozilla Firefox 64 or higher
      c. Microsoft Edge (EdgeHTML) 17 or higher
      d. Safari 11.4 or higher

C. System Security:
   1. User access secured via user passwords and user names.
   2. Passwords restrict user to the objects, applications, and system functions as assigned by the system manager.

3. User Log On/Log Off attempts are recorded.
4. Automatic Log Off occurs following the last keystroke after a user defined delay time.

D. User Interface:
1. FOR NEW SYSTEMS, NOT CONNECTING TO AN EXISTING ENTERPRISE SYSTEM: The following guidelines are used to convey the intent of the user interface. BAS system supplier may furnish an alternate proposed interface, provided that such interface meets or exceeds these guidelines in function and purpose.
2. The Navigation Pane shall comprise a Navigation Tree which defines a geographic hierarchy of the proposed BAS system. Navigation through the GUI shall be accomplished by clicking on appropriate level of a navigation tree (consisting of expandable and collapsible tree control like Microsoft's Explorer program), and/or by selecting dynamic links to other system graphics. Both the navigation tree and graphic pane defined under "Action Pane" below shall be displayed simultaneously, enabling the operator to select a specific system or equipment, and view the graphic corresponding to the highlighted position in the navigation tree. The navigation tree shall as a minimum provide the following views: Geographic, Network, Groups and Configuration.
   a. Geographic View shall display a logical geographic hierarchy of the system including cities, sites, buildings, building systems, floors, equipment and BACnet objects.
   b. Network View shall display the hierarchy of the actual BACnet IP Intranet network. This can include: Systems, Site, Networks, Routers, Half-Routers, Devices, Equipment and all the BACnet Objects in a device.
   c. Groups View shall display Scheduled Groups and custom reports.
   d. Configuration View shall display all the configuration categories (Operators, Schedule, Event, Reporting and Roles).
3. Action Pane:
   a. The Action Pane shall provide several functional views for each HVAC or mechanical/electrical subsystem specified. By clicking on a button, an operator shall be able to select the following system page, corresponding to the highlighted area/equipment in the navigation tree.

1) Graphics: Using animated gifs or other graphical format suitable for display in a web browser, graphics shall include aerial building/campus views, color building floor-plans, equipment drawings of each individual piece of equipment with live variable statuses, active graphic setpoint controls, web content, and other valid HTML elements. The data on each graphic page shall automatically refresh at a rate defined by the operator.
2) Properties: Shall include graphic controls and text for the following: Locking or overriding BACnet objects, demand strategies, and any other valid data required for setup. Changes made to the properties pages shall require the operator to depress a 'accept/cancel' button.
3) Schedules: Shall be used to create, modify/edit and view schedules based on the systems geographical hierarchy (using the navigation tree) and in compliance with "Hierarchical Schedules" below.
4) Events: Shall be used to view alarm event information geographically (using the navigation tree), acknowledge events, sort events by category, actions and verify reporting actions.
5) Trends: Shall be used to display associated trend and historical data, modify colors, date range, axis and scaling
6) Logic - Live Graphic Programs: Shall be used to display a 'live' graphic program of the control algorithm for the mechanical/electrical system selected in the navigation tree. All control outputs and inputs shall be displayed on the program giving real-time statuses for use in operator troubleshooting.

4. The following actions shall be accomplished by clicking appropriate buttons/menu in the graphic window: Log In/Out, Print and Hide/Show Navigation Pane.
5. Color Graphics:
   a. The Web Browser GUI shall make extensive use of color in the graphic pane to communicate information related to setpoints and comfort. Animated gif's, active setpoint graphic controls and valid web content (like local weather forecast) shall be used to enhance usability:
      1) Display Size: The GUI workstation software shall graphically display in at least 1024 by 768 pixels 24 bit True Color.
      2) General Graphic: General area maps shall show locations of controlled buildings in relation to local landmarks.

3) Color Floor Plans: Floor plan graphics shall show heating and cooling zones throughout the buildings in a range of colors, which provide a visual display of temperature relative to their respective setpoints (see "Zone Setpoint Adjustments" below). The colors shall be updated dynamically as a zone's actual comfort condition changes in real-time. Locations of space sensors shall also be shown for each zone. The intent of the specification is to enable the operator to readily assess problems at a glance.
4) Mechanical Components: Mechanical system graphics shall show the type of mechanical system components serving any zone through the use of a pictorial representation of components. Selected I/O points being controlled or monitored for each piece of equipment shall be displayed with the appropriate engineering units. Animation shall be used for rotation or moving mechanical components to enhance usability.
5) Minimum System Color Graphics: Color graphics shall be selected and displayed via a web browser for the following:
   (a) Each piece of equipment monitored or controlled including each terminal unit
   (b) Each building
   (c) Each floor and zone controlled

6. Zone Setpoint Adjustments: Color floor plans displayed via a web browser shall utilize a contiguous band of colors, each corresponding to actual zone temperatures relative to the desired heating and cooling setpoints. The ideal temperature shall be shown as a green color band. Temperatures slightly warmer than ideal shall be shown in yellow, and even warmer temperature band shall be shown in orange. Temperatures slightly cooler than ideal shall be light blue, and even cooler temperatures shall be shown as dark blue. All alarm colors shall be in red.
7. Hierarchical Schedules: Utilizing the Navigation Tree displayed in the web browser GUI, an operator (with password access) shall be able to define a Normal, Holiday or Override schedule for an individual piece of equipment or room, or choose to apply a hierarchical schedule to the entire system, site or floor area. All schedules that affect the system/area/equipment highlighted in the Navigation Tree shall be shown in a summary schedule table and graph. See "Object or Object Group Scheduling" below.

E. Object or Object Group Scheduling:
1. Weekly Schedules Based on Separate, Daily Schedules:

a. Include start, stop, optimal stop, and night economizer.
b. 10 events maximum per schedule.
c. Start/stop times adjustable for each group object.

2. Exception Schedules:
   a. Based on any day of the year.
   b. Defined up to one year in advance.
   c. Automatically discarded and replaced with standard schedule for that day of the week upon execution.
3. Holiday or Special Schedules:
   a. Capability to define up to 99 schedules.
   b. Repeated annually.
   c. Length of each period is operator defined.

F. Provide standard application for equipment coordination and grouping based on function and location to be used for scheduling and other applications.

G. Alarms:
1. Binary object is set to alarm based on the operator specified state.
2. Analog object to have high/low alarm limits.
3. All alarming is capable of being automatically and manually disabled.
4. Alarm Reporting:
   a. Operator determines action to be taken for alarm event.
   b. Alarms to be routed to appropriate workstation.
   c. Reporting Options:
      1) Start programs.
      2) Print.
      3) Logged.
      4) Custom messaging.
      5) Graphical displays.
      6) Dial out to workstation receivers via system protocol.

H. Maintenance Management: System monitors equipment status and generates maintenance messages based upon user-designated run-time limits.

I. Sequencing: Application software based upon specified sequences of operation in Section 23 0993.

J. PID Control Characteristics:
1. Direct or reverse action.
2. Anti-windup.
3. Calculated, time-varying, analog value, positions an output or stages a series of outputs.
4. User selectable controlled variable, set-point, and PED gains.

K. Staggered Start Application:
   1. Prevents all controlled equipment from simultaneously restarting after power outage.
   2. Order of equipment startup is user selectable.

L. Energy Calculations:
   1. Accumulated instantaneous power or flow rates are converted to energy use data.
   2. Algorithm calculates a rolling average and allows window of time to be user specified in minute intervals.
   3. Algorithm calculates a fixed window average with a digital input signal from a utility meter defining the start of the window period that in turn synchronizes the fixed-window average with that used by the power company.

M. Anti-Short Cycling:
   1. All binary output objects protected from short-cycling.
   2. Allows minimum on-time and off-time to be selected.

N. On-Off Control with Differential:
   1. Algorithm allows binary output to be cycled based on a controlled variable and set-point.
   2. Algorithm to be direct-acting or reverse-acting incorporating an adjustable differential.

O. Run-Time Totalization:
   1. Totalize run-times for all binary input objects.
   2. Provides operator with capability to assign high run-time alarm.

2.06 HVAC CONTROL PROGRAMS

A. General:
   1. Support Inch-pounds and SI (metric) units of measurement.
   2. Identify each HVAC Control system.

B. Optimal Run Time:
   1. Control start-up and shutdown times of HVAC equipment for both heating and cooling.
   2. Base on occupancy schedules, outside air temperature, seasonal requirements, and interior room mass temperature.
   3. Start-up systems by using outside air temperature, room mass temperatures, and adaptive model prediction for how long building takes to warm up or cool down under different conditions.
   4. Use outside air temperature to determine early shut down with ventilation override.

5. Analyze multiple building mass sensors to determine seasonal mode and worse case condition for each day.

C. Supply Air Reset:
   1. Monitor heating and cooling loads in building spaces, terminal reheat systems, both hot deck and cold deck temperatures on dual duct and multizone systems, single zone unit discharge temperatures.
   2. Adjust discharge temperatures to most energy efficient levels satisfying measured load by:
      a. Raising cooling temperatures to highest possible value.
      b. Reducing heating temperatures to lowest possible level.

D. Enthalpy Switchover:
   1. Calculate outside and return air enthalpy using measured temperature and relative humidity; determine energy expended and control outside and return air dampers.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Prior to delivery to the Project site, ensure that suitable storage space is available to store materials in a well-ventilated area protected from weather, moisture, soiling, extreme temperatures, humidity, and corrosive atmospheres. Materials shall be protected during delivery and storage and shall not exceed the manufacturer stated storage requirements. As a minimum, store indoors in clean, dry space with uniform temperature to prevent condensation. In addition, protect electronics from all forms of electrical and magnetic energy that could reasonably cause damage.

C. Deliver materials to the Project site in supplier’s or manufacturer’s original wrappings and containers, labeled with supplier’s or manufacturer’s name, material or product brand name, and equipment tag number or service name as identified within the Contract Documents.

D. Verify that conditioned power supply is available to the control units and to the operator work station. Verify that field end devices, wiring, and pneumatic tubing is installed prior to installation proceeding.

3.02 DEMOLITION

A. Remove controls which do not remain as part of the building automation system, all associated abandoned wiring and conduit, and all associated pneumatic tubing. Coordinate with Owner to determine any equipment which is to be removed that will remain the property of the Owner. All other equipment which is removed will be disposed of by .

3.03 COORDINATION

A. **The BAS system supplier shall furnish all Sensor Wells for installation by the Mechanical Contractor and/or others.**

B. Coordinate location of thermostats, humidistats, and other exposed control sensors with plans, furniture, and other room details before installation.

C. Coordinate equipment from other divisions including "Intrusion Detection," "Lighting Controls," "Motor Control Centers," "Panel boards," and "Fire Alarm" to achieve compatibility with equipment that interfaces with those systems.

D. Coordinate with Owner's IT department on locations for NSC's, Ethernet communication cabling and TCP/IP addresses.

E. The BAS system supplier shall provide field supervision to the designated contractor for the installation of the following:
   1. Automatic control dampers
   2. Blank-off plates for dampers that are smaller than duct size
   3. Sheet metal baffles plates to eliminate stratification

F. **The BAS system supplier shall furnish smoke detectors and wire to the building fire alarm system.** HVAC Contractor to mount devices. BAS system supplier to hardwire to fan shut down.

G. Coordinate requirements for auxiliary contact (pulse initiator) on the electric meter for central monitoring of kWh and KW with the Electrical Contractor. Electrical Contractor shall provide the pulse rate for remote readout to the BAS.

3.04 INSTALLATION

A. Install control units and other hardware in position on permanent walls where not subject to excessive vibration.

B. Install software in control units and in operator work station. Implement all features of programs to specified requirements and appropriate to sequence of operation. Refer to Section 23 0993.

C. Provide conduit and electrical wiring in accordance with Section 26 0583. Electrical material and installation shall be in accordance with appropriate requirements of Division 26.

D. Hardware and Wiring Installation:
   1. All controllers are to be mounted vertically and per the manufacturer's installation documentation.
   2. The 120VAC power wiring to each Ethernet or Remote Site controller shall be a dedicated run, with a separate breaker. Each run will include a separate hot, neutral and ground wire. The ground wire will terminate at the breaker panel ground. This circuit will not feed any other circuit or device.

3. A true earth ground must be available in the building. Do not use a corroded or galvanized pipe, or structural steel.
4. Wires are to be attached to the building proper at regular intervals such that wiring does not droop (not more than 0.50 inches of droop per 10'-0" length). Wires are not to be affixed to or supported by pipes, conduit, etc.
5. Conduit in finished areas will be concealed in ceiling cavity spaces, plenums, furred spaces and wall construction.
    a. Exception; metallic surface raceway may be used in finished areas on masonry walls **ONLY WHERE SPECIFICALLY INDICATED ON DRAWINGS OR IN THESE SPECIFICATIONS**. All surface raceway in finished areas must be color matched to the existing finish within the limitations of standard manufactured colors.
6. Conduit, in non-finished areas where possible, will be concealed in ceiling cavity spaces, plenums, furred spaces, and wall construction. Exposed conduit will run parallel to or at right angles to the building structure.
7. Wires are to be kept a minimum of three (3) inches from hot water, steam, or condensate piping.
8. Where sensor wires leave the conduit system, they are to be protected by a plastic insert.
9. Wire will not be allowed to run across telephone equipment areas.
10. Provide fire caulking at all rated penetrations.

E. Field Device Installation
1. Well-mounted sensors shall include thermal conducting compound within the well to ensure good heat transfer to the sensor.
2. Actuators shall be firmly mounted to give positive movement and linkage shall be adjusted to give smooth continuous movement throughout 100 percent of the stroke.
3. Relay outputs shall include transient suppression across all coils. Suppression devices shall limit transients to 150% of the rated coil voltage.
4. Water line mounted sensors shall be removable without shutting down the system in which they are installed.
5. For duct static pressure sensors, the high pressure port shall be connected to a metal static pressure probe inserted into the duct pointing upstream. The low pressure port shall be left open to the plenum area at the point that the high pressure port is tapped into the ductwork.
6. For building static pressure sensors, the high pressure port shall be inserted into the space via a metal tube. Pipe the low pressure port to the outside of the building.

7. Space humidity or temperature sensors will be mounted away from machinery generating heat, direct light and diffuser air streams.
8. Outdoor air sensors will be mounted on the north building face directly in the outside air. Install these sensors such that the effects of heat radiated from the building or sunlight is minimized.
9. Field enclosures shall be located immediately adjacent to the controller panel(s) to which they are being interfaced.

F. Software Installation:
1. The Contractor shall provide all labor necessary to install, initialize, start-up and debug all system software as described in this section. This includes any operating system software or other third party software necessary for successful operation of the system.

3.05 IDENTIFICATION

A. Identify all control wires with labeling tape or sleeves using words, letters, or numbers that can be exactly cross-referenced with as-built drawings.
B. All field enclosures, other than controllers, shall be identified with a Bakelite nameplate. The lettering shall be in white against a black or blue background.
C. Junction box covers must be marked to indicate that they are a part of the BAS system.
D. All I/O field devices (except space sensors) that are not mounted within FIP's shall be identified with name plates.
E. All I/O field devices inside FIP's shall be labeled.

3.06 TESTING AND STARTUP

A. Field Checkout:
1. Each I/O device (both field mounted as well as those located in FIPs) shall be inspected and verified for proper installation and functionality. A checkout sheet itemizing each device shall be filled out, dated and approved by the Contractor for submission to Owner or Owner's representative.
2. For wireless devices, the signal strength recorded during checkout shall also be reported.
3. A field checkout of all controllers and front end equipment (computers, printers, modems, etc.) shall be conducted to verify proper operation of both hardware and software. A checkout sheet itemizing each device and a description of the associated tests shall be prepared and submitted to Owner or Owner’s representative at the completion of the project.

B. Each point in the system shall be tested for both hardware and software functionality. In addition, each mechanical and electrical system under control of the BAS will be tested against the appropriate sequence of operation.

1. All application software will be verified and compared against the sequences of operation.
2. Control loops will be exercised by inducing a setpoint shift of at least 10% and observing whether the system successfully returns the process variable to setpoint. Record all test results and attach to the Test Results Sheet.
3. Test each alarm in the system and validate that the system generates the appropriate alarm message, that the message appears at all prescribed destinations (workstations or printers), and that any other related actions occur as defined (i.e. graphic panels are invoked, reports are generated, etc.). Submit a Test Results Sheet to the owner.
4. Perform an operational test of each unique graphic display and report to verify that the item exists, that the appearance and content are correct, and that any special features work as intended. Submit a Test Results Sheet to the owner.
5. Perform an operational test of each third party interface that has been included as part of the automation system. Verify that all points are properly polled, that alarms have been configured, and that any associated graphics and reports have been completed. If the interface involves a file transfer over Ethernet, test any logic that controls the transmission of the file, and verify the content of the specified information.

C. The BAS system supplier shall commission and set in operating condition all major equipment and systems, such as the chilled water, hot water and all air handling systems, in the presence of the equipment manufacturer's representatives, as applicable, and the Owner and Architect's representatives. If the vendor is providing an AFDD/CC system, use of the analytics shall be used to help commission the system.

D. Startup Testing shall be performed for each task on the startup test checklist, which shall be initialed by the technician and dated upon test was completion along with any recorded data such as voltages, offsets or tuning parameters. Any deviations from the submitted installation plan shall also be recorded. Required elements of the startup testing include, but are not limited to:

1. Measurement of voltage sources, primary and secondary
2. Verification of proper controller power wiring.
3. Verification of component inventory when compared to the submittals.
4. Verification of labeling on components and wiring.
5. Verification of connection integrity and quality (loose strands and tight connections).
6. Verification of bus topology, grounding of shields and installation of termination devices.
7. Verification of point checkout.

8. Each I/O device is landed per the submittals and functions per the sequence of control.
9. Analog sensors are properly scaled and a value is reported.
10. Binary sensors have the correct normal position and the state is correctly reported.
11. Analog outputs have the correct normal position and move full stroke when so commanded.
12. Binary outputs have the correct normal state and respond appropriately to energize/de-energize commands.
13. Documentation of analog sensor calibration (measured value, reported value and calculated offset).
14. Documentation of Loop tuning (sample rate, gain and integral time constant).

E. A performance verification test shall also be completed for the operator interaction with the system. Test elements shall be written to require the verification of all operator interaction tasks including, but not limited to the following:
1. Graphics navigation.
2. Trend data collection and presentation.
3. Alarm handling, acknowledgement and routing.
4. Time schedule editing.
5. Application parameter adjustment.
6. Manual control.
7. Report execution.
8. Automatic backups.
9. Web Client access.
10. Mobile Device Client access.

3.07 MANUFACTURER'S FIELD SERVICES

A. Allow sufficient time for start-up and commissioning prior to placing control systems in permanent operation. The BAS system supplier shall commission and set in operating condition all major equipment and systems in the presence of the equipment manufacturer’s representatives, as applicable, and the Owner and Architect’s representatives. If the vendor is providing an AFDD/CC system, use of the analytics shall be used to help commission the system.

B. See 23 0500 - Common Work Results for Mechanical for additional startup and training requirements.

END OF SECTION 23 0923

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SECTION 23 0934
VARIABLE-FREQUENCY MOTOR CONTROLLERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Variable-frequency motor controllers for low-voltage (600 V and less) AC motor applications.

1.02 RELATED REQUIREMENTS

A. Section 23 0529 - Hangers and Supports for HVAC Piping and Equipment.
B. Section 23 0553 - Identification for HVAC Piping and Equipment: Identification products and requirements.
C. Section 26 0526 - Grounding and Bonding for Electrical Systems.
D. Section 26 2813 - Fuses.
E. Section 28 4600 - Fire Detection and Alarm: For interface with variable-frequency motor controllers.

1.03 REFERENCE STANDARDS

A. IEC 60529 - Degrees of Protection Provided by Enclosures (IP Code) 2013 (Corrigendum 2019).
B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.
C. NEMA ICS 6 - Industrial Control and Systems: Enclosures 1993 (Reaffirmed 2016).
D. NEMA ICS 7 - Industrial Control and Systems: Adjustable-Speed Drives 2020.
E. NEMA ICS 7.1 - Safety Standards for Construction and Guide for Selection, Installation, and Operation of Adjustable-Speed Drive Systems 2014.
F. NEMA ICS 7.2 - Application Guide for AC Adjustable Speed Drive Systems 2021.
G. NEMA ICS 61800-2 - Adjustable Speed Electrical Power Drive Systems, Part 2: General Requirements-Rating Specifications for Low Voltage Adjustable Frequency AC Power Drive Systems 2005.
H. NEMA MG 1 - Motors and Generators 2021.
I. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems 2021.
J. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
K. UL 508A - Industrial Control Panels Current Edition, Including All Revisions.
L. UL 61800-5-1 - Standard for Adjustable Speed Electrical Power Drive Systems - Part 5-1: Safety Requirements – Electrical, Thermal, and Energy Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate work to provide motor controllers suitable for use with actual motors to be installed.
2. Coordinate work to provide controllers and associated wiring suitable for interface with control devices to be installed.
3. Coordinate arrangement with dimensions and clearance requirements of actual equipment to be installed.
4. Verify with manufacturer that conductor terminations are suitable for use with conductors to be installed.
5. Notify Architect of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for motor controllers, enclosures, overcurrent protective devices, and other installed components and accessories. Also include signed page from electrical contractor for confirming voltage and phase of motor feed.

C. Shop Drawings: Indicate dimensions, voltage, controller sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
   1. Include dimensioned plan and elevation views of controllers and adjacent equipment with required clearances indicated.
   2. Identify mounting conditions required for equipment seismic qualification.

D. Manufacturer's equipment seismic qualification certification.

E. Field quality control test reports.

F. Operation and Maintenance Data: Include detailed information on system operation, equipment programming and setup, replacement parts, and recommended maintenance procedures and intervals.

G. Project Record Documents: Record actual installed locations of controllers and final equipment settings.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain copy of each referenced document that prescribes execution requirements at project site.

C. Installer Qualifications: Company with minimum three years documented experience with variable-frequency motor control systems of similar size, type, and complexity; manufacturer's authorized installer.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store in clean, dry space. Maintain factory wrapping or provide additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

B. Handle carefully in accordance with manufacturer's written instructions to avoid damage to internal components, enclosure, and finish.

1.08 FIELD CONDITIONS

A. Maintain field conditions within required service conditions during and after installation.

1.09 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide minimum 18 month manufacturer warranty covering repair or replacement due to defective materials or workmanship.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Source Limitations: Furnish variable-frequency motor controllers and associated components produced by a single manufacturer and obtained from a single supplier.

2.02 VARIABLE-FREQUENCY MOTOR CONTROLLERS

A. Provide variable-frequency motor control system consisting of required controller assemblies, operator interfaces, control power transformers, instrumentation and control wiring, sensors, accessories, system programming, etc. as necessary for complete operating system.

B. Provide products listed, classified, and labeled as suitable for purpose intended.

C. Controller Assemblies: Comply with NEMA ICS 7, NEMA ICS 7.1, and NEMA ICS 61800-2; list and label as complying with UL 61800-5-1 or UL 508A as applicable.

D. Provide controllers selected for actual installed motors and coupled mechanical loads in accordance with NEMA ICS 7.2, NEMA MG 1 Part 30, and recommendations of manufacturers of both controller and load, where not in conflict with specified requirements; considerations include, but are not limited to:

1. Motor type (e.g., induction, reluctance, and permanent magnet); consider NEMA MG 1 design letter or inverter duty rating for induction motors.
2. Motor load type (e.g., constant torque, variable torque, and constant horsepower); consider duty cycle, impact loads, and high inertia loads.
3. Motor nameplate data.
4. Requirements for speed control range, speed regulation, and braking.
5. Motor suitability for bypass starting method, where applicable.

E. Devices on Load Side of Controller: Suitable for application across full controller output frequency range.

F. Operating Requirements:
   1. Input Voltage Tolerance: Plus/minus 10 percent of nominal.
   2. Input Frequency Tolerance: Plus/minus 5 percent of nominal.
   3. Efficiency: Minimum of 96 percent at full speed and load.
   4. Input Displacement Power Factor: Minimum of 0.96 throughout speed and load range.
   5. Overload Rating:
      a. Variable Torque Loads: Minimum of 110 percent of nominal for 60 seconds.
      b. Constant Torque Loads: Minimum of 150 percent of nominal for 60 seconds.

G. Power Conversion System: Microprocessor-based, pulse width modulation type consisting of rectifier/converter, DC bus/link, and inverter.
   1. Rectifier/Converter: Diode-based, 6-pulse type unless otherwise indicated.

H. Control System:
   1. Provide microprocessor-based control system for automatic control, monitoring, and protection of motors. Include sensors, wiring, and connections necessary for functions and status/alarm indications specified.
   2. Provide integral operator interface for controller programming, display of status/alarm indications, fault reset, and local control functions including motor run/stop, motor forward/reverse selection, motor speed increase/decrease, and local/remote control selection.
   3. Control Functions:
      a. Control Method: Selectable vector and scalar/volts per hertz unless otherwise indicated.
         1) Scalar/Volts per Hertz Control: Provide IR compensation for improved low-speed torque.
         2) Vector Control: Provide selectable autotuning function.
      b. Adjustable acceleration and deceleration time; linear and S-curve ramps; selectable coast to stop.
      c. Selectable braking control; DC injection or flux braking.
      d. Adjustable minimum/maximum speed limits.
      e. Adjustable pulse width modulation switching carrier frequency.
      f. Adjustable motor slip compensation.
      g. Selectable autorestart after noncritical fault; programmable number of time delay between restart attempts.
      h. Safety Interlock: Provide permissive run safety interlock capability where indicated or required; upon activation of designated input, stop and prevent operation of motor; operational in both drive and bypass modes where applicable.

4. Status Indications:
    a. Motor run/stop status.
    b. Motor forward/reverse status.
    c. Local/remote control status.
    d. Output voltage.
    e. Output current.
    f. Output frequency.
    g. DC bus voltage.
    h. Motor speed.
    i. Energy.
5. Protective Functions/Alarm Indications:
    a. Overcurrent.
    b. Motor overload.
    c. Undervoltage.
    d. Overvoltage.
    e. Controller overtemperature.
    f. Input/output phase loss.
    g. Output short circuit protection.
    h. Output ground fault protection.
6. Inputs:
    a. Digital Input(s): Three.
    b. Analog Input(s): Two.
7. Outputs:
    a. Analog Output(s): One.
    b. Relay Output(s): Two.
8. Communications: Compatible with connected systems. Provide accessories necessary for proper interface.
    a. Ethernet Communications: Support for Modbus TCP protocol.
    b. Remote Monitoring Capabilities:
        1) Motor run/stop status.
        2) Hand-off-auto status.
        3) Fault information.
        4) Discrete input/output status.
        5) Analog input/output values.
    c. Remote Control Capabilities:
        1) Motor run/stop command.
        2) Hand-off-auto selection.
        3) Speed adjustment.

4) Fault reset.

9. Features:
    a. Password-protected security access.
    b. Event log.
    c. Remote monitoring and programming capability via mobile device application.

I. Power Conditioning/Filtering:
1. Provide DC link choke or input/line reactor for each controller unless otherwise indicated or required.
2. Reactor Impedance: 3 percent, unless otherwise indicated or required.

J. Packaged Controllers: Controllers factory-mounted in separate enclosure with externally operable disconnect and specified accessories.
1. Disconnects: Circuit breaker or disconnect switch type.
    a. Disconnect Switches: Fusible type or nonfusible type with separate input fuses.
    b. Provide externally operable handle with means for locking in OFF position. Provide safety interlock to prevent opening cover with disconnect in ON position with capability of overriding interlock for testing purposes.
    c. Provide auxiliary interlock for disconnection of external control power sources where applicable.
2. Provide door-mounted remote operator interface.

K. Service Conditions:
1. Provide controllers and associated components suitable for operation under following service conditions without derating:
    a. Altitude: Less than 3,300 feet.
    b. Ambient Temperature: Between 32 degrees F and 104 degrees F.
2. Provide controllers and associated components suitable for operation at indicated ratings under service conditions at installed location.

L. Short Circuit Current Rating:
1. Provide controllers with listed short circuit current rating not less than available fault current at installed location as indicated on drawings.
2. Provide line/input reactors where specified by manufacturer for required short circuit current rating.

M. Conductor Terminations: Suitable for use with conductors to be installed.

N. Enclosures:
1. Comply with NEMA ICS 6.
2. NEMA 250 Environment Type or Equivalent IEC 60529 Rating: Unless otherwise indicated, as specified for following installation locations:

3. Finish: Manufacturer's standard unless otherwise indicated.
4. Cooling: Forced air or natural convection as determined by manufacturer.

O. Interface with Other Work:
1. Provide products compatible with other systems requiring interface with controllers.
2. Interface with building automation system as specified in Section 23 0923 - Direct-Digital Control System for HVAC.
3. Interface with fire alarm control system as specified in Section 28 4600.
a. Capable of affecting operation of selected HVAC equipment for selected fire alarm system events.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.
B. Verify that ratings of controllers are consistent with indicated requirements.
C. Verify that mounting surfaces are ready to accept controllers.
D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.
B. Install in accordance with NEMA ICS 7.1 and manufacturer's instructions.
C. Do not exceed manufacturer's recommended maximum cable length between controller and motor.
D. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
E. Provide required support and attachment in accordance with Section 23 0529.
F. Install controllers plumb and level.
G. Provide grounding and bonding in accordance with Section 26 0526.
H. Install field-installed devices, components, and accessories.
I. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.
J. Set field-adjustable settings of controllers and associated components according to installed motor requirements, in accordance with recommendations of manufacturers of controller and load.

3.03 FIELD QUALITY CONTROL

A. Provide services of manufacturer's authorized representative to observe installation and assist in inspection and testing. Include manufacturer's reports with submittals.
B. Inspect and test in accordance with NETA ATS, except Section 4.
C. Perform inspections and tests listed in NETA ATS, Section 7.17. Insulation-resistance test on control wiring listed as optional is not required.

D. Test for proper interface with other systems.
E. Correct deficiencies and replace damaged or defective controllers or associated components.

3.04 CLEANING

A. Clean dirt and debris from controller enclosures and components according to manufacturer's instructions.
B. Repair scratched or marred exterior surfaces to match original factory finish.

3.05 CLOSEOUT ACTIVITIES

A. See Section 01 7800 - Closeout Submittals, for closeout submittals.
B. See Section 01 7900 - Demonstration and Training, for additional requirements.
C. Demonstration: Demonstrate proper operation of controllers to Owner, and correct deficiencies or make adjustments as directed.
D. Training: Train Owner's personnel on operation, adjustment, and maintenance of controllers and associated devices.
    1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
    2. Provide minimum of two hours of training.
    3. Instructor: Manufacturer's authorized representative.
    4. Location: At project site.

3.06 PROTECTION

A. Protect installed controllers from subsequent construction operations.

3.07 MAINTENANCE

A. See Section 01 7000 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.

END OF SECTION 23 0934

SECTION 23 0993
SEQUENCE OF OPERATIONS FOR HVAC CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This section defines the manner and method by which controls function. Requirements for each type of control system operation are specified. Equipment, devices, and system components required for control systems are specified in other sections.

B. Sequence of operation for:

1.02 RELATED REQUIREMENTS

A. Section 01 9113 - General Commissioning Requirements: Commissioning requirements that apply to all types of work.

B. Section 23 0913 - Instrumentation and Control Devices for HVAC.

C. Section 23 0923 - Direct-Digital Control System for HVAC.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Sequence of Operation Documentation: Submit written sequence of operation for entire HVAC system and each piece of equipment.

1. Preface: 1 or 2 paragraph overview narrative of the system describing its purpose, components and function.
2. State each sequence in small segments and give each segment a unique number for referencing in Functional Test procedures; provide a complete description regardless of the completeness and clarity of the sequences specified in Contract Documents.
3. Include at least the following sequences:
   a. Start-up.
   b. Warm-up mode.
   c. Normal operating mode.
   d. Unoccupied mode.
   e. Shutdown.
   f. Capacity control sequences and equipment staging.
   g. Temperature and pressure control, such as setbacks, setups, resets, etc.
   h. Detailed sequences for all control strategies, such as economizer control, optimum start/stop, staging, optimization, demand limiting, etc.
   i. Effects of power or equipment failure with all standby component functions.
   j. Sequences for all alarms and emergency shut downs.
   k. Seasonal operational differences and recommendations.
   l. Interactions and interlocks with other systems.

4. Include initial and recommended values for all adjustable settings, setpoints and parameters that are typically set or adjusted by operating staff; and any other control settings or fixed values, delays, etc. that will be useful during testing and operating the equipment.
5. For packaged controlled equipment, include manufacturer's furnished sequence of operation amplified as required to describe the relationship between the packaged controls and the control system, indicating which points are adjustable control points and which points are only monitored.
6. Include schedules, if known.

C. Control System Diagrams: Submit graphic schematic of the control system showing each control component and each component controlled, monitored, or enabled.
1. Label with settings, adjustable range of control and limits.
2. Include flow diagrams for each control system, graphically depicting control logic.
3. Include the system and component layout of all equipment that the control system monitors, enables or controls, even if the equipment is primarily controlled by packaged or integral controls.
4. Include draft copies of graphic displays indicating mechanical system components, control system components, and controlled function status and value.
5. Include all monitoring, control and virtual points specified in elsewhere.
6. Include a key to all abbreviations.

D. Points List: Submit list of all control points indicating at least the following for each point.
1. Name of controlled system.
2. Point abbreviation.
3. Point description; such as dry bulb temperature, airflow, etc.
4. Display unit.
5. Control point or setpoint (Yes / No); i.e. a point that controls equipment and can have its setpoint changed.
6. Monitoring point (Yes / No); i.e. a point that does not control or contribute to the control of equipment but is used for operation, maintenance, or performance verification.
7. Intermediate point (Yes / No); i.e. a point whose value is used to make a calculation which then controls equipment, such as space temperatures that are averaged to a virtual point to control reset.
8. Calculated point (Yes / No); i.e. a “virtual” point generated from calculations of other point values.

E. Designer's Qualification Statement.

F. Project Record Documents: Record actual locations of components and setpoints of controls, including changes to sequences made after submission of shop drawings.

1.04 QUALITY ASSURANCE

A. Design system under direct supervision of a Professional Engineer experienced in design of this work and licensed at the State in which the Project is located.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

END OF SECTION 23 0993

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SECTION 23 2300
REFRIGERANT PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Piping.
B. Refrigerant.
C. Moisture and liquid indicators.
D. Valves.
E. Strainers.
F. Filter-driers.
G. Solenoid valves.
H. Flexible connections.
I. Engineered wall seals and insulation protection.
J. Engineered roof penetration protection.
K. Exterior penetration accessories.

1.02 RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping.
B. Section 08 3100 - Access Doors and Panels.
C. Section 09 9123 - Interior Painting.
D. Section 23 0719 - HVAC Piping Insulation.
E. Section 26 0583 - Wiring Connections: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

A. AHRI 760 (I-P) - Performance Rating of Solenoid Valves for Use with Volatile Refrigerants 2014.
B. AHRI 761 (SI) - Performance Rating of Solenoid Valves for Use with Volatile Refrigerants 2014.
C. ASHRAE Std 15 - Safety Standard for Refrigeration Systems 2019, with All Amendments and Errata.
D. ASHRAE Std 34 - Designation and Safety Classification of Refrigerants 2019.
E. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators 2021.
F. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings 2021.
G. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes 2018.
H. ASME B31.5 - Refrigeration Piping and Heat Transfer Components 2020.
I. ASME B31.9 - Building Services Piping 2020.

J. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.
K. ASTM B280 - Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service 2020.
L. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2022.
M. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers 1992, with Editorial Revision (2018).
N. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi 2015, with Editorial Revision (2021).
O. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding 2019.
P. AWS D1.1/D1.1M - Structural Welding Code - Steel 2020, with Errata (2022).
Q. ICC (IMC)-2018 - International Mechanical Code 2018.
R. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation 2018, with Amendment (2019).
S. UL 207 - Standard for Refrigerant-Containing Components and Accessories, Nonelectrical Current Edition, Including All Revisions.
T. UL 429 - Electrically Operated Valves Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.
B. Product Data: Provide general assembly of specialties, including manufacturers catalogue information. Provide manufacturers catalog data including load capacity.
C. Shop Drawings: Indicate schematic layout of system, including equipment, critical dimensions, piping, exterior piping protective cover systems, and sizes.
D. Design Data: Submit design data indicating pipe sizing. Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers.
E. Manufacturer's Installation Instructions: Indicate support, connection requirements, and isolation for servicing.
F. Submit welders certification of compliance with ASME BPVC-IX.
G. Installer's Qualification Statement.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the type of work specified in this section, with minimum 5 years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store piping and specialties in shipping containers with labeling in place.

B. Protect piping and specialties from entry of contaminating material by **leaving end caps and plugs in place until installation. The use of adhesive tape to cap piping is PROHIBITED, and use of this or other similar methods that do not use plugs or end caps specifically designed for pipe capping duty shall constitute grounds for requiring cleaning of all piping connected to the improperly capped pipe or joint at Contractor's expense.**

C. Dehydrate and charge components such as piping and receivers, seal prior to shipment, until connected into system.

PART 2 PRODUCTS

2.01 SYSTEM DESCRIPTION

A. Where more than one piping system material is specified ensure system components are compatible and joined to ensure the integrity of the system is not jeopardized. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

B. Provide pipe hangers and supports in accordance with ASME B31.5 unless indicated otherwise.

C. Liquid Indicators:
   1. Use line size liquid indicators in main liquid line leaving condenser.
   2. If receiver is provided, install in liquid line leaving receiver.
   3. Use line size on leaving side of liquid solenoid valves.

D. Valves:
   1. Use service valves on suction and discharge of compressors.
   2. Use gauge taps at compressor inlet and outlet.
   3. Use gauge taps at hot gas bypass regulators, inlet and outlet.
   4. Use check valves on compressor discharge.
   5. Use check valves on condenser liquid lines on multiple condenser systems.

E. Refrigerant Charging (Packed Angle) Valve: Use in liquid line between receiver shut-off valve and expansion valve.

F. Strainers:
   1. Use line size strainer upstream of each automatic valve.
   2. Where multiple expansion valves with integral strainers are used, use single main liquid line strainer.
   3. On steel piping systems, use strainer in suction line.
   4. Use shut-off valve on each side of strainer.

G. Pressure Relief Valves: Use on ASME receivers and pipe to outdoors.

H. Filter-Driers:
   1. Use a filter-drier immediately ahead of liquid-line controls, such as thermostatic expansion valves, solenoid valves, and moisture indicators.

2. Use a filter-drier on suction line just ahead of compressor.
3. Use sealed filter-driers in lines smaller than 1/2 inch outside diameter.
4. Use sealed filter-driers in systems utilizing hermetic compressors.
5. Use replaceable core filter-driers in lines of 1/2 inch outside diameter or greater.
6. Use replaceable core liquid-line filter-driers in systems utilizing receivers.
7. Use filter-driers for each solenoid valve.

I. Solenoid Valves:
1. Use in liquid line of systems operating with single pump-out or pump-down compressor control.
2. Use in liquid line of single or multiple evaporator systems.
3. Use in oil bleeder lines from flooded evaporators to stop flow of oil and refrigerant into the suction line when system shuts down.

J. Flexible Connectors: Utilize at or near compressors where piping configuration does not absorb vibration.

2.02 REGULATORY REQUIREMENTS

A. Comply with ASME B31.9 for installation of piping system.
B. Welding Materials and Procedures: Comply with ASME BPVC-IX and applicable state labor regulations.
C. Welders Certification: In accordance with ASME BPVC-IX.

2.03 PIPING

A. Copper Tube: ASTM B280, H58 hard drawn.
1. Fittings: ASME B16.22 wrought copper.
2. Joints: Braze, AWS A5.8M/A5.8 BCuP silver/phosphorus/copper alloy.
3. Mechanical Press Sealed Fittings: Double pressed type complying with UL 207 and ICC (IMC)-2018.
a. Manufacturers:
1) RLS, LLC; RLS Cu (Copper): www.rlspressfittings.com/#sle.
2) Parker Hannifin/Refrigeration and Air Conditioning; Zoomlock (Copper): https://zoomlock.co.uk/sle#
3) Substitutions: See Section 01 6000 - Product Requirements.

B. Pipe Supports and Anchors:
1. Provide hangers and supports that comply with MSS SP-58. See Section 23 0529 - Hangers and Supports for HVAC Piping and Equipment for additional requirements.
2. Rooftop Supports for Low-Slope Roofs: Steel pedestals with bases that rest on top of roofing membrane, not requiring any attachment to the roof structure and not penetrating the roofing assembly, with support fixtures as specified; and as follows:

a. Bases: High density, UV tolerant, polypropylene or reinforced PVC.
b. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
c. Steel Components: Stainless steel, or carbon steel hot-dip galvanized after fabrication in accordance with ASTM A123/A123M.
d. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports; corrosion resistant material.
e. Height: Provide minimum clearance of 6 inches under pipe to top of roofing.
f. Manufacturers:
    1) PHP Systems/Design: www.phpsd.com/#sle.
    2) Portals Plus; Pedestal Plus: www.portalsplus.com/#sle.
    3) Miro Industries, Inc.; : https://www.miroind.com/sle#
    4) Substitutions: See Section 01 6000 - Product Requirements.

2.04 REFRIGERANT

2.05 MOISTURE AND LIQUID INDICATORS

A. Indicators: Single port type, UL listed, with copper or brass body, flared or soldered ends, sight glass, color coded paper moisture indicator with removable element cartridge and plastic cap; for maximum temperature of 200 degrees F and maximum working pressure of 500 psi.

2.06 VALVES

A. Manufacturers:
    1. Hansen Technologies Corporation: www.hantech.com/#sle.
    2. Henry Technologies: www.henrytech.com/#sle.
    3. Flomatic Valves: www.flomatic.com/#sle.
    4. Substitutions: See Section 01 6000 - Product Requirements.
B. Ball Valves:
    1. Two piece bolted forged brass body with teflon ball seals and copper tube extensions, brass bonnet and seal cap, chrome plated ball, stem with neoprene ring stem seals; for maximum working pressure of 500 psi and maximum temperature of 300 degrees F.
C. Service Valves:
    1. Forged brass body with copper stubs, brass caps, removable valve core, integral ball check valve, flared or soldered ends, for maximum pressure of 500 psi.

2.07 STRAINERS

A. Manufacturers:
    1. Hansen Technologies Corporation: www.hantech.com/#sle.
    2. Parker Hannifin/Refrigeration and Air Conditioning: www.parker.com/#sle.

3. Sporlan, a Division of Parker Hannifin: www.parker.com/#sle.
4. Substitutions: See Section 01 6000 - Product Requirements.

B. Straight Line or Angle Line Type:
1. Brass or steel shell, steel cap and flange, and replaceable cartridge, with screen of stainless steel wire or monel reinforced with brass; for maximum working pressure of 430 psi.

2.08 FILTER-DRIERS

A. Manufacturers:
1. Flow Controls Division of Emerson Electric: www.emersonflowcontrols.com/#sle.
2. Parker Hannifin/Refrigeration and Air Conditioning: www.parker.com/#sle.
3. Sporlan, a Division of Parker Hannifin: www.parker.com/#sle.
4. Substitutions: See Section 01 6000 - Product Requirements.

B. Cores: Molded or loose-fill molecular sieve desiccant compatible with refrigerant, activated alumina, activated charcoal, and filtration to 40 microns, with secondary filtration to 20 microns; of construction that will not pass into refrigerant lines.

C. Construction: UL listed.
1. Replaceable Core Type: Steel shell with removable cap.
2. Sealed Type: Copper shell.
3. Connections: As specified for applicable pipe type.

2.09 SOLENOID VALVES

A. Manufacturers:
1. Flow Controls Division of Emerson Electric: www.emersonflowcontrols.com/#sle.
2. Parker Hannifin/Refrigeration and Air Conditioning: www.parker.com/#sle.
3. Sporlan, a Division of Parker Hannifin: www.parker.com/#sle.
4. Substitutions: See Section 01 6000 - Product Requirements.

B. Valve: AHRI 760 I-P, pilot operated, copper, brass or steel body and internal parts, synthetic seat, stainless steel stem and plunger assembly (permitting manual operation in case of coil failure), integral strainer, with flared, soldered, or threaded ends; for maximum working pressure of 500 psi.

C. Coil Assembly: UL 429 UL listed, replaceable with molded electromagnetic coil, moisture and fungus proof, with surge protector and color coded lead wires, integral junction box with pilot light.

2.10 FLEXIBLE CONNECTORS

A. Manufacturers:
1. Substitutions: See Section 01 6000 - Product Requirements.

B. Corrugated stainless steel hose with single layer of stainless steel exterior braiding and dielectric connection fittings compatible with refrigerant type or listed and rated for use with other materials in system, minimum 9 inches long with copper tube ends; for maximum working pressure of 500 psi.

2.11 ENGINEERED WALL SEALS AND INSULATION PROTECTION

A. Manufacturers:
   1. Airex Manufacturing, Inc; Titan: www.airexmfg.com/#sle.
   2. Rooftop Penetration Housings LLC; Wall Vault: https://roofpenetrationhousings.com/sle#
   3. Substitutions: See Section 01 6000 - Product Requirements.

2.12 ENGINEERED ROOF PENETRATION PROTECTION

A. Manufacturers:
   1. Rooftop Penetration Housings LLC; : https://roofpenetrationhousings.com/sle#
   2. SBC Flashings; : https://sbcflashings.com/product/ac-line-shack/
   3. Substitutions: See Section 01 6000 - Product Requirements.

B. Basis of Design: Rooftop Penetration Housings LLC
   1. Rooftop penetration housing: Roof Vault

2.13 EXTERIOR PENETRATION ACCESSORIES

A. Flashing Panels for Exterior Wall Penetrations: Premanufactured components and accessories as required to preserve integrity of building envelope; suitable for conduits and facade materials to be installed.
   1. Manufacturers:
      a. Quickflash Weatherproofing Products, Inc: www.quickflashproducts.com/#sle.
      b. Substitutions: See Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.01 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.02 INSTALLATION

A. Install refrigeration systems and specialties in accordance with manufacturer's instructions. Where these specifications and the manufacturer's instructions differ, use the more stringent method, except where doing so would negatively affect system operation.

B. **BRAZING ACTIVITIES: Flood refrigerant piping systems with nitrogen for the duration of all brazing activities.** Cut sample joints selected by the Engineer and/or the Contracting Officer of Record to inspect for carbon buildup or improper brazing techniques. **Piping found to have excessive scale or carbon buildup due to neglecting nitrogen purge must be replaced in its entirety.** Provide sample cuts for not less than three (3) locations, and not more than 2% of the fittings in the system, as directed.
   1. **Mechanical Press-Sealed Fittings installed in accordance with the manufacturer's instructions are exempt from this requirement.** Only brazed/welded piping and fittings require sample cuts.

C. Route piping in orderly manner, with plumbing parallel to building structure, and maintain gradient.

D. Install piping to conserve building space and avoid interference with use of space.

E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

F. Pipe Hangers and Supports:
   1. Install in accordance with ASME B31.5.
   2. Support horizontal piping as indicated.
   3. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
   4. Place hangers within 12 inches of each horizontal elbow.

G. Arrange piping to return oil to compressor. Provide traps and loops in piping, and provide double risers as required. Slope horizontal piping 0.40 percent in direction of flow.

H. Provide clearance for installation of insulation and access to valves and fittings.

I. Provide access to concealed valves and fittings.

J. Where pipe support members are welded to structural building frame, brush clean, and apply one coat of zinc rich primer to welding.

K. Prepare unfinished pipe, fittings, supports, and accessories ready for finish painting. See Section 09 9123.

L. Follow ASHRAE Std 15 procedures for charging and purging of systems and for disposal of refrigerant.

M. Provide replaceable cartridge filter-driers, with isolation valves and valved bypass.

N. Install flexible connectors at right angles to axial movement of compressor, parallel to crankshaft.

O. Fully charge completed system with refrigerant after testing.

P. Provide electrical connection to solenoid valves. See Section 26 0583.

3.03 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Test refrigeration system in accordance with ASME B31.5.

C. Pressure test system with dry nitrogen to 200 psi. Perform final tests at 27 inches vacuum and 200 psi using halide torch. Test to no leakage.

3.04 SCHEDULES

A. Hanger Spacing for Copper Tubing.

1. 1/2 inch, 5/8 inch, and 7/8 inch OD: Maximum span, 5 feet; minimum rod size, 1/4 inch.
2. 1-1/8 inch OD: Maximum span, 6 feet; minimum rod size, 1/4 inch.
3. 1-3/8 inch OD: Maximum span, 7 feet; minimum rod size, 3/8 inch.
4. 1-5/8 inch OD: Maximum span, 8 feet; minimum rod size, 3/8 inch.

END OF SECTION 23 2300

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SECTION 23 3100
HVAC DUCTS AND CASINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal ducts.

1.02 RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping.
B. Section 09 9113 - Exterior Painting: Weld priming, weather resistant, paint or coating.
C. Section 09 9123 - Interior Painting: Weld priming, paint or coating.
D. Section 23 0130.51 - HVAC Air-Distribution System Cleaning: Post install duct cleaning.
E. Section 23 0713 - Duct Insulation: External insulation and duct liner.
F. Section 23 3300 - Air Duct Accessories.
G. Section 23 3319 - Duct Silencers.
H. Section 23 3600 - Air Terminal Units.
I. Section 23 3700 - Air Outlets and Inlets: Fabric air distribution devices.

1.03 REFERENCE STANDARDS

A. ASHRAE (FUND) - ASHRAE Handbook - Fundamentals Most Recent Edition Cited by Referring Code or Reference Standard.
B. ASHRAE Std 126 - Method of Testing HVAC Air Ducts 2020.
C. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2019.
D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.
E. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2015.
F. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable 2021a.
G. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength 2018a.
H. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2022.
I. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements 2009 (Reapproved 2016).
J. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials 2020.
K. ICC-ES AC01 - Acceptance Criteria for Expansion Anchors in Masonry Elements 2015.

L. ICC-ES AC106 - Acceptance Criteria for Predrilled Fasteners (Screw Anchors) in Masonry Elements 2015.
M. ICC-ES AC193 - Acceptance Criteria for Mechanical Anchors in Concrete Elements 2015.
N. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems 2021.
O. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible 2021.
P. SMACNA (FGD) - Fibrous Glass Duct Construction Standards 2021.
Q. SMACNA (LEAK) - HVAC Air Duct Leakage Test Manual 2012.
R. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.
B. Product Data: Provide data for duct materials.
C. Shop Drawings: Indicate duct fittings, particulars such as gauges, sizes, welds, and configuration prior to start of work for medium pressure class and higher systems.
D. Project Record Documents: Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience, and approved by manufacturer. See Owner
B. Installer Qualifications: Company specializing in performing the type of work specified in this section, with minimum three years of documented experience.

1.06 FIELD CONDITIONS

A. Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.
B. Maintain temperatures within acceptable range during and after installation of duct sealants.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Provide UL Class 1 ductwork, fittings, hangers, supports, and appurtenances in accordance with NFPA 90A and SMACNA (DCS) guidelines unless stated otherwise.
B. Provide metal duct unless otherwise indicated. Fibrous glass duct can be substituted at the Contractor's option.
C. Acoustical Treatment: Provide sound-absorbing liners and sectional silencers for metal-based ducts in compliance with Section 23 3319.
D. Duct Shape and Material in accordance with Allowed Static Pressure Range:

E. Duct Sealing and Leakage in accordance with Static Pressure Class:

--- Medium Pressure service ranges from 3 to 6 in-wc. ---

--- High Pressure service ranges from 6 to 10 in-wc. ---

F. Duct Fabrication Requirements:
   1. Duct and Fitting Fabrication and Support: SMACNA (DCS) including specifics for continuously welded round and oval duct fittings.
   2. Use reinforced and sealed sheet-metal materials at recommended gauges for indicated operating pressures or pressure class.
   3. Construct tee's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows must be used, provide air foil turning vanes of perforated metal with glass fiber insulation.
   4. Provide turning vanes of perforated metal with glass fiber insulation when acoustical lining is indicated.
   5. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.
   6. Provide turning vanes of perforated metal with glass fiber insulation when an acoustical lining is required.
   7. Where ducts are connected to exterior wall louvers and duct outlet is smaller than louver frame, provide blank-out panels sealing louver area around duct. Use same material as duct, painted black on exterior side; seal to louver frame and duct.

G. Central Exhaust: 2 inch w.g. pressure class, galvanized steel.

H. Contaminated or Hazardous Exhaust: 2 inch w.g. pressure class, galvanized steel.

2.02 METAL DUCTS

A. Material Requirements:
   1. Galvanized Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G60/Z180 coating.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install, support, and seal ducts in accordance with SMACNA (DCS).

B. During construction, provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering the ductwork system.

C. Fibrous Glass Ducts: Install per SMACNA (FGD). Obtain manufacturer's inspection and acceptance of fabrication and installation at the beginning of the installation.

D. Flexible Ducts: Connect to metal ducts with adhesive, draw bands, and foil tape.

E. Duct sizes indicated are inside precise dimensions. For lined ducts, maintain sizes inside lining.
F. Provide openings in ductwork as indicated to accommodate thermometers and controllers. Provide pilot tube openings as indicated for testing of systems, complete with metal can with spring device or screw to insure against air leakage. For openings, insulate ductwork and install insulation material inside a metal ring.
G. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.
H. Use double nuts and lock washers on threaded rod supports.
I. Connect terminal units to supply ducts directly or with one foot maximum length of flexible neoprene glass fabric duct. Do not use flexible duct to change direction.
J. Connect diffusers to low pressure ducts directly or with 5 feet maximum length of flexible duct held in place with strap or clamp.

3.02 CLEANING

A. See Section 01 7419 - Construction Waste Management and Disposal for additional requirements.
B. Clean thoroughly each duct system as indicated within Section 23 0130.51.
C. Clean duct systems with high power vacuum machines. Protect equipment that could be harmed by excessive dirt with filters or bypass during cleaning. Provide adequate access to the ductwork for cleaning purposes.

END OF SECTION 23 3100

SECTION 23 3300
AIR DUCT ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Air turning devices/extractors.
B. Backdraft dampers - metal.
C. Backdraft dampers - fabric.
D. Combination fire and smoke dampers.
E. Duct access doors.
F. Duct test holes.
G. Fire dampers.
H. Flexible duct connectors.
I. Smoke dampers.
J. Volume control dampers.
K. Miscellaneous products:
    1. Internal strut end plugs.
    2. Duct opening closure film.

1.02 RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping.
B. Section 23 3100 - HVAC Ducts and Casings.
C. Section 23 3600 - Air Terminal Units: Pressure regulating damper assemblies.
D. Section 25 3513 - Integrated Automation Actuators and Operators: Damper operators.
E. Section 25 3516 - Integrated Automation Sensors and Transmitters: Damper position switch.
F. Section 25 3523 - Integrated Automation Control Dampers: Product furnishing.
G. Section 26 0583 - Wiring Connections: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

A. AMCA 500-D - Laboratory Methods of Testing Dampers for Rating 2018.
B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2022.
C. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems 2021.
D. NFPA 92 - Standard for Smoke Control Systems 2021.
E. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible 2021.
F. UL 33 - Safety Heat Responsive Links for Fire-Protection Service Current Edition, Including All Revisions.

G. UL 94 - Tests for Flammability of Plastic Materials for Parts in Devices and Appliances Current Edition, Including All Revisions.
H. UL 263 - Standard for Fire Tests of Building Construction and Materials Current Edition, Including All Revisions.
I. UL 555 - Standard for Fire Dampers Current Edition, Including All Revisions.
J. UL 2043 - Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide for shop fabricated assemblies including volume control dampers. Include electrical characteristics and connection requirements.
C. Manufacturer's Installation Instructions: Provide instructions for fire dampers.
D. Project Record Drawings: Record actual locations of access doors and test holes.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.
B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect dampers from damage to operating linkages and blades.

PART 2 PRODUCTS

2.01 AIR TURNING DEVICES/EXTRACTORS

A. Manufacturers:
   1. Krueger-HVAC, Division of Air System Components; [_____]: www.krueger-hvac.com/#sle.
   2. Ruskin Company; [_____]: www.ruskin.com/#sle.
   3. Titus HVAC, a brand of Johnson Controls; [_____]: www.titus-hvac.com/#sle.
   4. Substitutions: See Section 01 6000 - Product Requirements.
B. Multi-blade device with blades aligned in short dimension; steel construction; with individually adjustable blades, mounting straps.

2.02 BACKDRAFT DAMPERS - METAL

A. Manufacturers:
   1. Louvers & Dampers, Inc, a brand of Mestek, Inc; [_____]: www.louvers-dampers.com/#sle.
   2. Nailor Industries, Inc; [_____]: www.nailor.com/#sle.
   3. Ruskin Company; [_____]: www.ruskin.com/#sle.
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. Multi-Blade, Parallel Action Gravity Balanced Backdraft Dampers: Galvanized steel, with center pivoted blades of maximum 6 inch width, with felt or flexible vinyl sealed edges, linked together in rattle-free manner with 90 degree stop, steel ball bearings, and plated steel pivot pin; adjustment device with gravity counterbalance to permit setting for varying differential static pressure.

2.03 BACKDRAFT DAMPERS - FABRIC

A. Fabric Backdraft Dampers: Factory-fabricated.
   1. Blades: Neoprene coated fabric material.
   2. Birdscreen: 1/2 inch nominal mesh of galvanized steel or aluminum.
   3. Maximum Velocity: 1000 fpm (5 mps) face velocity.

2.04 COMBINATION FIRE AND SMOKE DAMPERS

2.05 DUCT ACCESS DOORS

A. Manufacturers:
   1. Ductmate Industries, Inc, a DMI Company; [_____]: www.ductmate.com/#sle.
   2. Nailor Industries, Inc; [_____]: www.nailor.com/#sle.
   3. Ruskin Company; [_____]: www.ruskin.com/#sle.
   4. SEMCO LLC; [_____]: www.semcohvac.com/#sle.
   5. Substitutions: See Section 01 6000 - Product Requirements.

B. Fabricate in accordance with SMACNA (DCS) and as indicated.

2.06 DUCT TEST HOLES

A. Permanent Test Holes: Factory fabricated, air tight flanged fittings with screw cap. Provide extended neck fittings to clear insulation.
   1. Manufacturers:
      a. Carlisle HVAC Products; Dynair Test Port with Red Cap with O-Ring Seal: www.carlislehvac.com/#sle.
      b. Substitutions: See Section 01 6000 - Product Requirements.

2.07 FIRE DAMPERS

A. Manufacturers:
   1. Louvers & Dampers, Inc, a brand of Mestek, Inc; [_____]: www.louvers-dampers.com/#sle.
   2. Nailor Industries, Inc; [_____]: www.nailor.com/#sle.
   3. Pottorff; [_____]: www.pottorff.com/#sle.
   4. Ruskin Company; [_____]: www.ruskin.com/#sle.
   5. Substitutions: See Section 01 6000 - Product Requirements.

B. Fabricate in accordance with NFPA 90A and UL 555, and as indicated.

C. Horizontal Dampers: Galvanized steel, 22 gauge, 0.0299 inch frame, stainless steel closure spring, and lightweight, heat retardant non-asbestos fabric blanket.

D. Curtain Type Dampers: Galvanized steel with interlocking blades. Provide stainless steel closure springs and latches for horizontal installations. Configure with blades out of air stream except for 1.0 inch pressure class ducts up to 12 inches in height.

E. Fusible Links: UL 33, separate at 160 degrees F with adjustable link straps for combination fire/balancing dampers.

2.08 FLEXIBLE DUCT CONNECTORS

A. Manufacturers:
   1. Carlisle HVAC Products; Dynair Connector Plus G90 Steel Offset Seam Neoprene Fabric: www.carlislehvac.com/#sle.
   2. Ductmate Industries, Inc, a DMI Company; [_____]: www.ductmate.com/#sle.
   3. Elgen Manufacturing Company, Inc; [_____]: www.elgenmfg.com/#sle.
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. Fabricate in accordance with SMACNA (DCS) and as indicated.

C. Flexible Duct Connections: Fabric crimped into metal edging strip.
   1. Fabric: UL listed fire-retardant neoprene coated woven glass fiber fabric to NFPA 90A, minimum density 30 oz per sq yd.
      a. Net Fabric Width: Approximately 2 inches wide.
      b. Metal: 3 inches wide, metal thickness and type to match connecting duct material.

D. Maximum Installed Length: 14 inch.

2.09 SMOKE DAMPERS

2.10 VOLUME CONTROL DAMPERS

A. Manufacturers:
   1. AireTechnologies, Inc, a DMI Company; [_____]: www.airetechnologies.com/#sle.
   2. Nailor Industries, Inc; [_____]: www.nailor.com/#sle.
   3. NCA, a brand of Metal Industries Inc; [_____]: www.ncamfg.com/#sle.
   4. Ruskin Company; [_____]: www.ruskin.com/#sle.
   5. Substitutions: See Section 01 6000 - Product Requirements.

B. Fabricate in accordance with SMACNA (DCS) and as indicated.

C. Splitter Dampers:
   1. Material: Same gauge as duct to 24 inches size in either direction, and two gauges heavier for sizes over 24 inches.
   2. Blade: Fabricate of single thickness sheet metal to streamline shape, secured with continuous hinge or rod.
   3. Operator: Minimum 1/4 inch diameter rod in self aligning, universal joint action, flanged bushing with set screw.

D. Single Blade Dampers:

1. Fabricate for duct sizes up to 6 by 30 inch.
2. Blade: 24 gauge, 0.0239 inch, minimum.

E. Multi-Blade Damper: Fabricate of opposed blade pattern with maximum blade sizes 8 by 72 inch. Assemble center and edge crimped blades in prime coated or galvanized channel frame with suitable hardware.
1. Blade: 18 gauge, 0.0478 inch, minimum.

F. End Bearings: Except in round ducts 12 inches and smaller, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon, thermoplastic elastomer, or sintered bronze bearings.
1. Manufacturers:
a. Carlisle HVAC Products; Dynair End Bearing Leak Resistant Sets: www.carlislehvac.com/#sle.
b. Elgen Manufacturing Company, Inc; [____]: www.elgenmfg.com/#sle.
c. Substitutions: See Section 01 6000 - Product Requirements.

G. Quadrants:
1. Provide locking, indicating quadrant regulators on single and multi-blade dampers.
2. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.
3. Where rod lengths exceed 30 inches provide regulator at both ends.
4. Manufacturers:
a. Carlisle HVAC Products; Dynair Double Shear Rattle Free Quadrants 1/2 inch: www.carlislehvac.com/#sle.
b. Substitutions: See Section 01 6000 - Product Requirements.

2.11 MISCELLANEOUS PRODUCTS

A. Internal Strut End Plugs: Combination end-mounting and sealing plugs for metal conduit used as internal reinforcement struts for metal ducts; plug crimped inside conduit with outside gasketed washer seal.
1. Manufacturers:
a. Carlisle HVAC Products; Dynair Internal Duct Reinforcement - Conduplugs: www.carlislehvac.com/#sle.
b. Substitutions: See Section 01 6000 - Product Requirements.

B. Duct Opening Closure Film: Mold-resistant, self-adhesive film to keep debris out of ducts during construction.
1. Thickness: 2 mils.
2. High tack water based adhesive.
3. UV stable light blue color.
4. Elongation Before Break: 325 percent, minimum.

5. Manufacturers:
    a. Carlisle HVAC Products; Dynair Duct Protection Film: www.carlislehvac.com/#sle.
    b. Substitutions: See Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.01 PREPARATION

A. Verify that electric power is available and of the correct characteristics.

3.02 INSTALLATION

A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA (DCS). Refer to Section 23 3100 for duct construction and pressure class.
B. Provide backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.
C. Provide duct test holes where indicated and required for testing and balancing purposes.
D. Provide fire dampers, combination fire and smoke dampers, and smoke dampers at locations indicated, where ducts and outlets pass through fire rated components, and where required by Authorities Having Jurisdiction. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.
E. Install smoke dampers and combination smoke and fire dampers in accordance with NFPA 92.
F. Demonstrate re-setting of fire dampers to Owner's representative.
G. At fans and motorized equipment associated with ducts, provide flexible duct connections immediately adjacent to the equipment.
H. At equipment supported by vibration isolators, provide flexible duct connections immediately adjacent to the equipment.
I. Provide balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Install minimum 2 duct widths from duct take-off.
J. Use splitter dampers only where indicated.
K. Provide balancing dampers on high velocity systems at all brancheswhere indicated. Refer to Section 23 3600 - Air Terminal Units.
L. Provide balancing dampers on duct take-off to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly or shown on the drawings.

END OF SECTION 23 3300

SECTION 23 3416
CENTRIFUGAL HVAC FANS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Backward inclined centrifugal fans.
B. Airfoil wheel centrifugal fans.
C. Bearings and drives.
D. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 23 0513 - Common Motor Requirements for HVAC Equipment.
B. Section 23 3300 - Air Duct Accessories: Backdraft dampers.
C. Section 26 0583 - Wiring Connections: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

A. ABMA STD 9 - Load Ratings and Fatigue Life for Ball Bearings 2015 (Reaffirmed 2020).
B. ABMA STD 11 - Load Ratings and Fatigue Life for Roller Bearings 2014 (Reaffirmed 2020).
C. AMCA (DIR) - (Directory of) Products Licensed Under AMCA International Certified Ratings Program 2015.
D. AMCA 99 - Standards Handbook 2016.
E. AMCA 210 - Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating 2016.
F. AMCA 300 - Reverberant Room Method for Sound Testing of Fans 2014.
G. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data 2014.
H. NEMA MG 1 - Motors and Generators 2021.
I. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible 2021.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide data on centrifugal fans and accessories including fan curves with specified operating point clearly plotted, power, RPM, sound power levels for both fan inlet and outlet at rated capacity, and electrical characteristics and connection requirements.
C. Manufacturer's Instructions: Include complete installation instructions.
D. Maintenance Data: Include instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect motors, shafts, and bearings from weather and construction dust.

1.07 FIELD CONDITIONS

A. Permanent fans may not be used for ventilation during construction.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Loren Cook Company: www.lorencook.com/#sle.

B. Greenheck Fan Corporation; https://www.greenheck.com/sle#

C. Twin City Fan & Blower: www.tcf.com/#sle.

D. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PERFORMANCE REQUIREMENTS

A. Performance Ratings: Determined in accordance with AMCA 210 and bearing the AMCA Certified Rating Seal.

B. Sound Ratings: AMCA 301, tested to AMCA 300, and bear AMCA Certified Sound Rating Seal.

C. Fabrication: Comply with AMCA 99.

D. Performance Base: Project-Specific elevation conditions.

2.03 BEARINGS AND DRIVES

A. Bearings: Heavy duty pillow block type, selfgreasing ball bearings, with ABMA STD 9 life at 50,000 hours.

B. Drives: As specified in the fan schedule drawings. If no drive is specified, provide Variable Frequency Drive (VFD) or Electronically-Commutated Motor (ECM) to effectuate speed control for the fan motor. **Do not use belt drives unless specifically called out on the drawings.**

2.04 ACCESSORIES

A. Inlet/Outlet Screens: Galvanized steel welded grid.

B. Access Doors: Shaped to fit scroll, with quick opening latches and gaskets.

C. Scroll Drain: 1/2 inch steel pipe coupling welded to low point of fan scroll.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install flexible connections between fan inlet and discharge ductwork; refer to Section 23 3300. Ensure metal bands of connectors are parallel with minimum one inch flex between ductwork and fan while running.

C. Provide backdraft dampers on discharge of exhaust fans and as indicated; refer to Section 23 3300.

END OF SECTION 23 3416

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SECTION 23 3439
HIGH-VOLUME, LOW-SPEED PROPELLER FANS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. High-volume, low-speed propeller fans.

1.02 RELATED REQUIREMENTS

A. Section 23 0513 - Common Motor Requirements for HVAC Equipment.
B. Section 23 0548 - Vibration and Seismic Controls for HVAC.
C. Section 26 0583 - Wiring Connections: Electrical characteristics and wiring connection.

1.03 REFERENCE STANDARDS

A. AMCA 99 - Standards Handbook 2016.
B. AMCA 204 - Balance Quality and Vibration Levels for Fans 2020.
C. NEMA MG 1 - Motors and Generators 2021.
D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.
E. UL 507 - Electric Fans Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.
B. Product Data: Provide data on fans and accessories including fan curves with specified operating point clearly plotted, power, RPM, sound power levels at rated capacity, and electrical characteristics and connection requirements.
C. Manufacturer's Instructions: Indicate installation instructions.
D. Maintenance Data: Include instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

1.05 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
B. Correct defective Work within a five year period after Date of Substantial Completion.
C. Provide five year manufacturer warranty for parts and labor.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. UL Compliance: UL listed and labeled, designed, manufactured, and tested in accordance with UL 507.
B. Static and Dynamically Balanced: Comply with AMCA 204.
C. Fabrication: Comply with AMCA 99.
D. Electrical Components: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

2.02 HIGH-VOLUME, LOW-SPEED PROPELLER FANS

A. Manufacturers:
   1. Greenheck Fan Corporation; https://www.greenheck.com/sle#

2. Macroair; https://macroairfans.com/sle#
3. Hunter Fan International; Titan: www.hunterfan.com/#sle.
4. Substitutions: See Section 01 6000 - Product Requirements.

B. Direct Drive Fan:
1. Statically and dynamically balanced.
2. Motors:
a. Totally enclosed fan cooled (TEFC).
b. Heavy duty ball bearing type.
c. Mount on vibration isolators or resilient cradle mounts, out-of-airstream.
d. Fully accessible for maintenance.

C. Shafts and Bearings:
1. Fan Shaft:
a. Ground and polished steel with anti-corrosive coating.
b. First critical speed at least 25 percent over maximum cataloged operating speed.
2. Bearings:
a. Permanently sealed or pillow block type.
b. Minimum L10 life in excess of 100,000 hours (equivalent to L50 average life of 500,000 hours), at maximum cataloged operating speed.
c. 100 percent factory tested.

D. Disconnect Switches:
1. Factory mounted and wired.
2. Environment Type per NEMA 250: As indicated on the drawings.
3. Finish for Painted Steel Enclosures: Provide manufacturer's standard unless otherwise indicated.
4. Positive electrical shutoff.
5. Wired from fan motor to junction box installed within motor compartment.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.
B. Secure fan with stainless steel lag screws to structure.
C. Ceiling-mounted Fans:
1. Install fans with resilient mountings and flexible electrical leads. See Section 23 0548.

END OF SECTION 23 3439

SECTION 23 3600
AIR TERMINAL UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Single-duct terminal units.
   1. Single-duct, variable-volume units.

1.02 RELATED REQUIREMENTS

A. Section 23 0548 - Vibration and Seismic Controls for HVAC.
B. Section 23 0913 - Instrumentation and Control Devices for HVAC: Thermostats and actuators.
C. Section 23 0993 - Sequence of Operations for HVAC Controls.
D. Section 23 3100 - HVAC Ducts and Casings.
E. Section 23 3300 - Air Duct Accessories.
F. Section 23 3700 - Air Outlets and Inlets.
G. Section 25 1400 - Integrated Automation Local Control Units: HVAC controllers.

1.03 REFERENCE STANDARDS

A. AHRI 410 - Forced-Circulation Air-Cooling and Air-Heating Coils 2001, with Addenda (2011).
B. AHRI 880 (I-P) - Performance Rating of Air Terminals 2017.
C. ASTM A492 - Standard Specification for Stainless Steel Rope Wire 1995 (Reapproved 2019).
D. ASTM A603 - Standard Specification for Metallic-Coated Steel Structural Wire Rope 2019.
E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2022.
F. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.
G. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
H. SMACNA (SRM) - Seismic Restraint Manual Guidelines for Mechanical Systems 2008.
I. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors current edition, including all revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data indicating configuration, general assembly, and materials used in fabrication. Include catalog performance ratings that indicate air flow, static pressure, and NC designation. Include electrical characteristics and connection requirements.
C. Certificates: Certify that coils are tested and rated in accordance with AHRI 410.
D. Manufacturer's Installation Instructions: Indicate support and hanging details, installation instructions, recommendations, and service clearances required.
E. Project Record Documents: Record actual locations of units and locations of access doors required for access of valving.
F. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts lists. Include directions for resetting constant-volume regulators.
G. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.06 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
B. Provide five year manufacturer warranty for air terminal units.

PART 2 PRODUCTS

2.01 SINGLE-DUCT, VARIABLE-VOLUME UNITS

A. Manufacturers:
1. Carrier, a part of UTC Building and Industrial Systems, a unit of United Technologies Corp.; [_____]: www.commercial.carrier.com/#sle.
2. Johnson Controls, Inc; [_____]: www.johnsoncontrols.com/#sle.
3. Metalaire, a brand of Metal Industries Inc; [_____]: www.metalaire.com/#sle.
4. Price Industries, Inc; [_____]: www.priceindustries.com/#sle.
5. Substitutions: See Section 01 6000 - Product Requirements.
B. Basis of Design: As scheduled on drawings.
C. General:
1. Factory-assembled, AHRI 880 (I-P) rated and bearing the AHRI seal, air volume control terminal with damper assembly, flow sensor, externally mounted volume controller, duct collars, and all required features.
2. Control box bearing identification, including but not necessarily limited to nominal cfm, maximum and minimum factory-set airflow limits, coil type and coil (right or left hand) connection, where applicable.
D. Unit Casing:
1. Minimum 22 gauge, 0.0299 inch galvanized steel.
2. Air Inlet Collar: Provide round, suitable for standard flexible duct sizes.
3. Unit Discharge: Rectangular, with slip-and-drive connections.

4. Acceptable Liners:
    a. 3/4 inch thick polyurethane foam adhesive complying with UL 181 erosion requirements in accordance with ASHRAE Std 62.1, and having a maximum smoke developed index of 50 for both insulation and adhesive, when tested in accordance with ASTM E84.
    b. Liner not to contain pentabrominated diphenyl ether (CAS #32534-81-9) or octabrominated diphenyl ether.

E. Sound Attenuator:
1. Provide if required to meet scheduled acoustical performance requirements.
2. Construction to consist of a continuous extension of the casing and liner as required to achieve required attenuation.
3. At 2000 fpm inlet velocity, the minimum operating pressure with attenuator added not to exceed 0.14 inch wg.

F. Damper Assembly:
1. Heavy-gauge, galvanized steel or extruded aluminum construction with solid steel, nickel-plated shaft pivoting on HDPE, self-lubricating bearings.
2. Provide integral position indicator or alternative method for indicating damper position over full range of 90 degrees.
3. Incorporate low leak damper blades for tight airflow shutoff.

G. Electric Heating Coil:
1. Listed and provided by the terminal unit manufacturer.
2. Coil Casing: 20 gauge, 0.0359 inch galvanized steel.
3. Heating Elements: Nickel chrome, supported by ceramic insulators.
4. Integral Control Panel: NEMA 250, Type 2 enclosure with hinged access door for access to all controls and safety devices.
5. Furnish a primary automatic reset thermal cutout and differential pressure airflow switch for proof of airflow.
6. Provide the following additional components, mounted and/or wired within the control enclosure:
    a. Fused or non-fused door interlocking disconnect switch.
    b. Mercury contactors.
    c. Fuse block.
7. Factory wired, including all limit switches and steps of control as indicated on the equipment schedule, with the SSR (solid-state relay) proportional heat control.
8. Provide SCR (Silicon Controlled Rectifier) controller as scheduled.

H. Electrical Requirements:
1. Single-point power connection.
2. Equipment wiring to comply with requirements of NFPA 70.

I. Controls:
1. DDC (Direct-Digital Controls):
a. Basis of Design: as scheduled on drawings.
1) The unit level controller to include the following:
(a) 24 VAC power terminal or RJ-12 Power connection.
(b) T-Stat Port for thermostat connection.
(c) Service Port for Price Linker diagnostic equipment.
(d) Damper actuator.
(e) Fan output connection.
(f) LED indication for troubleshooting.
(g) Three binary staged heating outputs.
(h) Binary cooling output.
(i) S.A.T. sensor input.
(j) Contact closure input.
(k) Four analog outputs.
b. Include a factory-installed, unit-mounted, direct-digital controller.
c. Bi-directional Damper Actuator: 24 volt, powered closed, spring return open.
d. Microprocessor-Based Controller: Air volume controller, pressure-independent with electronic airflow transducers, factory-calibrated maximum and minimum CFM's.
1) Occupied and unoccupied operating mode.
2) Remote reset of temperature or CFM set points.
3) Proportional, plus integral control of room temperature.
4) Monitoring and adjusting with portable terminal.
e. Room Sensor:
1) Compatible with temperature controls specified.
2) Wall-mounted, system powered, with temperature set-point adjustment including connection access for portable operator terminal.
f. See Section 25 1400.
2. Control Sequence:
a. Suitable for operation with duct pressures between 0.25 and 3.0 inch wg inlet static pressure.
b. Include factory-mounted and piped, 5-micron filter; and adjustable, velocity-resetting, high-limit control with amplifying relay.
c. See Section 23 0993.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that conditions are suitable for installation.

B. Verify that field measurements are as indicated on drawings.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.
B. Install the inlets of air terminal units and air flow sensors a minimum of four duct diameters from elbows, transitions, and duct takeoffs.
C. Provide ceiling access doors or locate units above easily removable ceiling components.
D. Support units individually from structure with wire rope complying with ASTM A492 and ASTM A603 in accordance with SMACNA (SRM). See Section 23 0548.
E. Do not support from ductwork.
F. Connect to ductwork in accordance with Section 23 3100.
G. Provide minimum of 10 ft of 1 inch thick lined ductwork downstream of units.
H. Verify that electric power is available and of the correct characteristics.

3.03 ADJUSTING

A. Reset volume with damper operator attached to assembly allowing flow range modulation from 100 percent of design flow to zero percent full flow. Set units with heating coils for minimum 50 percent full flow.

3.04 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.
B. Provide manufacturer's field representative to test, inspect, instruct, and observe field-assembled components and equipment installation, including connections and to assist in field testing. Report results in writing.
    1. Operational Test:
        a. After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
        b. Test and adjust controls and safeties.
        c. Replace damaged and malfunctioning controls and other equipment.
        d. Remove and replace malfunctioning units and retest as specified above.

3.05 CLEANING

A. See Section 01 7419 - Construction Waste Management and Disposal, for additional requirements.

3.06 CLOSEOUT ACTIVITIES

A. See Section 01 7800 - Closeout Submittals, for closeout submittals.
B. See Section 01 7900 - Demonstration and Training, for additional requirements.

END OF SECTION 23 3600

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SECTION 23 3700
AIR OUTLETS AND INLETS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Diffusers:
   1. Perforated ceiling diffusers.
   2. Rectangular ceiling diffusers.
   3. Round ceiling diffusers.
   4. Slot ceiling diffusers.

B. Registers/grilles:
   1. Ceiling-mounted, egg crate exhaust and return register/grilles.
   2. Ceiling-mounted, exhaust and return register/grilles.
   3. Ceiling-mounted, linear exhaust and return register/grilles.
   4. Ceiling-mounted, supply register/grilles.
   5. Wall-mounted, supply register/grilles.
   6. Wall-mounted, exhaust and return register/grilles.

C. Fabric air distribution devices.

D. Door grilles.

E. Louvers:
   1. Combination louvers.

1.02 RELATED REQUIREMENTS

A. Section 09 9123 - Interior Painting: Painting of ducts visible behind outlets and inlets.

1.03 REFERENCE STANDARDS

A. AHRI 880 (I-P) - Performance Rating of Air Terminals 2017.

B. AMCA 500-L - Laboratory Methods of Testing Louvers for Rating 2012 (Reapproved 2015).

C. AMCA 511 - Certified Ratings Program Product Rating Manual for Air Control Devices 2021.

D. AMCA 550 - Test Method for High Velocity Wind Driven Rain Resistant Louvers 2015, with Editorial Revision (2018).

E. ASHRAE Std 70 - Method of Testing the Performance of Air Outlets and Air Inlets 2006 (Reaffirmed 2021).

F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2022.

G. FLA (PAD) - Florida Building Code Online - Product Approval Directory Current Edition.

H. Miami (APD) - Approved Products Directory; Miami-Dade County Current Edition.

I. UL 2518 - Standard for Safety Air Dispersion Systems Current Edition, Including All Revisions.

J. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials Current Edition, Including All Revisions.
K. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems 2021.
L. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems 2021.
M. SMACNA (ASMM) - Architectural Sheet Metal Manual 2012.
N. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible 2021.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.
B. Product Data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.
C. Project Record Documents: Record actual locations of air outlets and inlets.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Metalaire, a brand of Metal Industries Inc; [_____]: www.metalaire.com/#sle.
B. Price Industries; [_____]: www.price-hvac.com/#sle.
C. Ruskin Company; [_____]: www.ruskin.com/#sle.
D. Titus, a brand of Air Distribution Technologies; [_____]: www.titus-hvac.com/#sle.
E. Substitutions: See Section 01 6000 - Product Requirements.

2.02 ROUND CEILING DIFFUSERS

A. Type: Round, adjustable pattern, stamped or spun, multi-core diffuser to discharge air in 360 degree pattern, with sectorizing baffles where indicated. Diffuser collar shall project not more than 1 inch above ceiling. In plaster ceilings, provide plaster ring and ceiling plaque.
B. Fabrication: Steel with baked enamel finish.
C. Color: As selected by Architect from manufacturer's full range.

2.03 RECTANGULAR CEILING DIFFUSERS

A. Type: Provide square and rectangular, adjustable pattern diffuser to discharge air in 360 degree pattern with sectorizing baffles where indicated.
B. Connections: Round.
C. Frame: Provide surface mount type.
D. Fabrication: Steel with baked enamel finish.
E. Color: As selected by Architect from manufacturer's full range.

2.04 PERFORATED FACE CEILING DIFFUSERS

A. Type: Perforated face with fully adjustable pattern and removable face.
B. Frame: Surface mount type.

C. Fabrication: Steel with steel frame and baked enamel finish.
D. Color: As selected by Architect from manufacturer's full range.

2.05 CEILING SLOT DIFFUSERS

A. Type: Continuous slot in size and quantity as scheduled on drawings, with adjustable vanes for left, right, or vertical discharge. Adjacent diffusers shall have removable end pieces to be installed for continous slot appearance.
B. Fabrication: Aluminum extrusions with factory clear lacquer finish.
C. Color: To be selected by Architect from manufacturer's full range.
D. Frame: 1-1/4 inch margin with concealed mounting and gasket, mitered end border. Use open-end construction for adjacent slot diffusers for continuous slot appearance.
E. Plenum: Integral, galvanized steel, insulated.
F. Accessories: Face-adjustable cable for damper control where required, to avoid access panels in hard ceilings.

2.06 CEILING EGG CRATE EXHAUST AND RETURN GRILLES

A. Type: Egg crate style face consisting of 1/2 by 1/2 by 1/2 inch, 1/2 by 1/2 by 1 inch, and 1 by 1 by 1 inch grid core.
B. Fabrication: Grid core consists of aluminum with mill aluminum finish.
C. Color: To be selected by Architect from manufacturer's full range.
D. Frame: Channel lay-in frame for suspended grid ceilings.
E. Accessories: Provide 45 degree angled eggcrate or other similar provisions for visual blocking such as angled louver, 90 degree duct elbow, etc. where scheduled on drawings.

2.07 WALL SUPPLY REGISTERS/GRILLES

A. Type: Streamlined and individually adjustable blades, 3/4 inch minimum depth, 3/4 inch maximum spacing with spring or other device to set blades, vertical face, single deflection.
B. Frame: 1-1/4 inch margin with countersunk screw mounting and gasket.
C. Fabrication: Steel with 20 gauge, 0.0359 inch minimum frames and 22 gauge, 0.0299 inch minimum blades, steel and aluminum with 20 gauge, 0.0359 inch minimum frame, or aluminum extrusions, with factory baked enamel finish.
D. Color: To be selected by Architect from manufacturer's full range.

2.08 WALL EXHAUST AND RETURN REGISTERS/GRILLES

A. Type: Streamlined blades, 3/4 inch minimum depth, 3/4 inch maximum spacing, with spring or other device to set blades, vertical face.
B. Frame: 1-1/4 inch margin with countersunk screw mounting.
C. Fabrication: Steel frames and blades, with factory baked enamel finish.
D. Color: To be selected by Architect from manufacturer's full range.

2.09 FABRIC AIR DISTRIBUTION DEVICES

A. General Requirements:
   1. Diffuser material to comply with ASTM E84, UL 723, UL 2518, NFPA 90A, and NFPA 90B.

2.10 DOOR GRILLES

A. Type: V-shaped louvers of 20 gauge, 0.0359 inch thick steel, 1 inch deep on 1/2 inch centers.
B. Frame: 20 gauge, 0.0359 inch steel with auxiliary frame to give finished appearance on both sides of door, with factory prime coat finish.

2.11 LOUVERS

A. Manufacturers:
   1. NCA, a brand of Metal Industries Inc; [_____]: www.ncamfg.com/#sle.
   2. Ruskin Company; [_____]: www.ruskin.com/#sle.
   3. Greenheck Fan Corporation: https://www.greenheck.com/sle#
   4. Substitutions: See Section 01 6000 - Product Requirements.
B. Type: 4 inch deep frame with drainable blades on 45 degree slope with center baffle and return bend, heavy channel frame, 1/2 inch square pvc-coated stainless steel mesh screen over intake or exhaust end.
C. Fabrication: 16 gage, 0.0598 inch (1.52 mm) thick galvanized steel thick galvanized steel welded assembly, with factory Kynar 500 prime coat finish.
D. Color: As indicated on the drawings.

2.12 COMBINATION LOUVERS

A. Damper-combined, drainable louver:
B. Size: As indicated on the drawings.
C. Material: Extruded galvanized steel.
D. Linkage: Concealed in frame.
E. Custom Features: Include architectural finish.
F. Insulation: Water-resistant sound absorbing material.
G. Hurricane Zone Approved: FLA (PAD) and Miami (APD) listed using impact resistant aluminum material.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.
B. Check location of outlets and inlets and make necessary adjustments in position to comply with architectural features, symmetry, and lighting arrangement.
C. Install diffusers to ductwork with air tight connection.

D. Provide balancing dampers on duct take-off to diffusers, and grilles and registers, despite whether dampers are specified as part of the diffuser, or grille and register assembly.

E. Paint ductwork visible behind air outlets and inlets matte black. Refer to Section 09 9123.

END OF SECTION 23 3700

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SECTION 23 3813
COMMERCIAL-KITCHEN HOODS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Cooking hoods.

1.02 REFERENCE STANDARDS

A. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2015.

B. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations 2021.

C. NSF 2 - Food Equipment 2021.

D. SMACNA (KVS) - Kitchen Ventilation Systems and Food Service Equipment Fabrication and Installation Guidelines 2001.

E. UL 710 - Standard for Exhaust Hoods for Commercial Cooking Equipment Current Edition, Including All Revisions.

F. UL 1046 - Standard for Grease Filters for Exhaust Ducts Current Edition, Including All Revisions.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:

1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Installation instructions, adjusting and balancing methods.
4. Specimen warranty.

C. Shop Drawings: For each custom fabricated unit, provide drawings showing details of construction, dimensions, and interfaces with adjacent construction.

D. Operation and Maintenance Data.

E. Warranty: Submit manufacturer's warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. At least five years experience in the design and manufacture of products of similar type to those specified.
2. For grease extracting hoods, able to provide test data showing performance of hoods to be provided.
3. Having at least one factory-authorized service agency located within 50 miles of project site.

4. Able to provide service to project site within 24 hours after receiving a service call.

1.05 DELIVERY, STORAGE, AND HANDLING

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

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Grease Extracting Hoods:
   1. Ansul, a brand of Tyco Fire Protection Products; PIRANHA: www.ansul.com/#sle.
   2. Captiveaire: https://www.captiveaire.com/#sle
   3. Grease Master: www.greasemaster.com/#sle.
   4. Greenheck Fan Corporation: www.greenheck.com/#sle.
   5. Substitutions: See Section 01 6000 - Product Requirements.

2.02 HOOD CONSTRUCTION

A. Provide products that comply with NFPA 96, the requirements and recommendations of SMACNA (KVS), and the requirements of the Authorities Having Jurisdiction.

B. Cooking Hoods: Provide Type I hoods, with all external joints and seams continuously welded, liquid-tight, and all internal joints, seams, and attachments sealed liquid-tight and grease-tight.
   1. Provide fire extinguishing system for all cooking hoods.
   2. Provide complete assemblies listed and labeled by UL under UL 710 for its intended use.
   3. Provide hoods and exhaust ducts rated for zero clearance to combustible construction.
   4. Provide complete assemblies certified and labeled by NSF under NSF 2.

C. Construction: Materials, inside and out, are stainless steel complying with ASTM A666, Type 304, stretcher leveled; unless otherwise indicated.
   1. Sheet Thickness: 18 gauge, 0.048 inch, minimum.
   2. Fabrication: Fabricate each individual hood in one piece, with all welds ground and finished to match (inside and out); fabricate flat surfaces exposed to view as double-pan formed panels with internal stiffener members.
   3. Finish on Surfaces Exposed to View: No.4 (brushed directional); provide stainless steel faces on all sides exposed to view.
   4. Finish on Concealed Surfaces: No.4 or No.2B (dull, matte).
   5. Duct Collars: For exhaust and make-up air openings, provide duct collar welded to hood unit; minimum of 8 inches extension from top or back face of unit, with minimum one inch 90 degree flange, unless otherwise indicated.
   6. Access Panels: Provide removable or hinged access panels sufficient for maintenance and replacement of operating components inside unit.

7. Electrical: Run electrical wiring in conduit or raceways, factory pre-wired, with single connection point per hood.
8. Supports: Stainless steel mounting brackets, struts, and threaded hanger rods.
    a. Hanger Rods: 3/8 inch diameter, minimum.
    b. Hanger Spacing: 48 inches on center, maximum.
    c. Attachment to Structure: Mechanical fittings or inserts, stainless steel.
9. Accessory Panels: Where indicated, provide filler and closure panels of same construction as hoods, to close spaces between hoods and adjacent construction; mount with panel face flush with face of hood.
    a. Where top of ceiling hung hood is lower than the finished ceiling, provide panels to close space between top of hood and ceiling.
    b. Where back of hood must be set away from wall, provide filler panels to close space between hood and wall.

2.03 HOOD ACCESSORIES

A. Fire Extinguishing Systems:
1. Manufacturers:
    a. Amerex: www.amerex-fire.com/#sle.
    b. Ansul, a Tyco Business: www.ansul.com/#sle.
    c. Grease Master: www.greasemaster.com/#sle.
    d. Substitutions: See Section 01 6000 - Product Requirements.
2. Fire extinguishing system to comply with NFPA 96.
3. Exposed Piping Under Hood: Stainless steel or chrome plated.
4. Exposed Piping Outside Hood: Not permitted.
5. Nozzles: Stainless steel or chrome plated brass.
6. Electrical Components: Provide all components required for properly operating system, including but not limited to wiring, raceways, contactors, circuit breakers, switches and solenoids.
7. Fire Alarm System: Provide connection point for building fire alarm system capable of signaling system readiness and to generate signal when system is actuated.
8. Manual Actuators: Wall-mounted pull stations; provide one near each hood and one near exit door.

B. Controls:
1. Fans: Provide manual push button controls for starting and stopping fans and labeled indicator lights showing fan status.
2. Fans: Provide controls for fan operation by time clock, programmable by the week, capable of maintaining time cycle after operation of manual push buttons.

3. Cooking Equipment: Provide manual shutoff and reset button located where indicated; combine with fire extinguishing actuation.
4. Fire Extinguishing System: Provide automatic actuation complying with NFPA 96; provide local and remote manual actuating stations clearly labeled "Hood Fire Protection"; upon actuation of fire extinguishing system, automatically:
   a. Shut off fans serving that hood.
   b. Shut off fuel source to equipment under hood; actuate solenoid gas valves provided as part of gas piping work.
   c. Shut off electric power to equipment under hood; actuate contactors or switches provided as part of electrical work.
   d. Signal building fire alarm system; normally-open contacts.

C. Control Panels: Factory assembled and pre-wired, ready for utility connections.
1. UL listed for use with specific hood.
2. Provide a single control panel combining all control functions for a particular hood, unless otherwise indicated.
3. Provide a single control panel for each group of hoods served by a single exhaust fan.
4. Enclosures: Flush-mounted; stainless steel, to match hood.
5. Provide indicator lights on control panel door showing status of fans and power supply.

D. Lights Inside Hoods: Fluorescent and incandescent in quantity and locations indicated, in UL listed vapor-proof fixtures, pre-wired to junction box on top of hood.
1. Locate switch for operating lights in locations indicated.

E. Grease Filters: Stainless steel, washable, complying with , UL listed and labeled.

F. Exhaust Ducts: 18 gauge, 0.048 inch stainless steel sheet, ; with external seams welded continuously, liquid-tight; see drawings for extent, location, and size of exhaust ducts.
1. Where ducts penetrate ceilings or walls, provide stainless steel angle flange trim with welded corners, 16 gauge, 0.06 inch minimum thickness.
2. Where ducts penetrate hood body, provide stainless steel angle flange trim with welded corners and seal joints liquid-tight.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that overhead supports are installed in correct locations.

B. Do not begin installation until substrates have been properly prepared.

C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions and NFPA 96.

B. Install hoods level and plumb, securely fastened, with seismic restraints as specified, and free of vibration during normal operation.

C. Weld hood duct collars to ductwork, liquid-tight.

D. Connect to utilities.

3.04 SYSTEM STARTUP

A. Obtain the services of the manufacturer's representative experienced in the installation, adjustment, and operation of the equipment to supervise the starting and adjusting of equipment.

B. Prepare equipment for startup, start and operate equipment for sufficient period to verify proper operation; correct equipment not operating correctly.

C. Demonstrate operation to Owner's designated personnel.

D. Demonstrate operation to authorities having jurisdiction if required by them; comply with their requirements for demonstration.

E. Report deficiencies in writing to Architect.

3.05 CLOSEOUT ACTIVITIES

A. See Section 01 7800 - Closeout Submittals, for closeout submittals.

B. Conduct training of Owner's designated personnel in the operation and maintenance of equipment.

C. Perform at least 2 hours of training, for minimum of 2 people, at project site.

D. Arrange training sessions with Owner at least 2 weeks in advance.

E. Have operation and maintenance data on hand for training sessions.

3.06 CLEANING

A. Clean surfaces of equipment.

3.07 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION 23 3813

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SECTION 23 4000
HVAC AIR CLEANING DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Activated carbon filters.
B. Disposable panel filters.
C. High efficiency particulate air (HEPA) filters.
D. Filter frames and housings.
E. Filter gauges.

1.02 RELATED REQUIREMENTS

A. Section 01 5000 - Temporary Facilities and Controls: Filters for temporary heating and ventilating.
B. Section 26 0583 - Wiring Connections: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

A. AHRI 850 (I-P) - Performance Rating of Commercial and Industrial Air Filter Equipment 2013.
B. AHRI 851 (SI) - Performance Rating of Commercial and Industrial Air Filter Equipment 2013.
C. ASHRAE Std 52.2 - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size 2017, with Addendum (2022).
D. MIL-STD-282 - Filter Units, Protective Clothing, Gas-Mask Components, and Related Products: Performance-Test Methods 2015b.
E. UL 586 - High Efficiency, Particulate, Air Filter Units Current Edition, Including All Revisions.
F. UL 900 - Standard for Air Filter Units Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.
B. Product Data: Provide data on filter media, filter performance data, filter assembly and filter frames, dimensions, motor locations and electrical characteristics and connection requirements.
C. Shop Drawings: Indicate filter assembly and filter frames, dimensions, motor locations, and electrical characteristics and connection requirements.
D. Manufacturer's Installation Instructions: Indicate assembly and change-out procedures.
E. Operation and Maintenance Data: Include instructions for operation, changing, and periodic cleaning.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Extra Filters: One set of each type and size.

1.05 QUALITY ASSURANCE

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.01 FILTER MANUFACTURERS

A. American Filtration Inc; [_____]: www.americanfiltration.com/#sle.
B. AAF International/American Air Filter; [_____]: www.aafintl.com/#sle.
C. The Camfil Group; [_____]: www.camfilfarr.com/#sle.
D. Basis of Design: Filters For Industry; https://filtersforindustry.com/sle#
E. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PERFORMANCE REQUIREMENTS

A. Comply with the rating requirements in AHRI 851 (SI).

2.03 ACTIVATED CARBON FILTERS

A. Assembly: Galvanized steel unit incorporating extruded aluminum tracks to accommodate filter servicing trays in deep V arrangement arranged for upstream servicing with disposable panel pre-filter.
B. Media:
   1. Activated Carbon Density: 34 lb/cu ft, pelletized or granular to 6 by 10 Tyler mesh screen.
   2. Carbon Tetrachloride Activity: Minimum 60 percent; in thin bed.
   3. Trays: Nominal size 24 by 24 by 5/8 inches thick.
   4. Carbon: 1.42 cu ft per 1000 CFM nominal air flow capacity.
C. Rating: 500 FPM face velocity, 0.45 inch WG resistance.

2.04 DISPOSABLE PANEL FILTERS

A. Manufacturers:
   1. Filters For Industry: TriplePlay Filter Media; https://filtersforindustry.com/.
   2. Substitutions: See Section 01 6000 - Product Requirements.
B. Media: UL 900 Class 2, fiber blanket, factory sprayed with flameproof, non-drip, non-volatile adhesive.
   1. Thickness: 1 inch.
C. Performance Rating:
   1. Face Velocity: 500 FPM.
   2. Initial Resistance: 0.15 inch WG.
   3. Recommended Final Resistance: 0.50 inches WG.

4. Minimum Efficiency Reporting Value (MERV) Rating: 13, unless scheduled otherwise on drawings.

D. Holding Frames: 20 gauge, 0.0359 inch minimum galvanized steel frame with expanded metal grid on outlet side and steel rod grid on inlet side, hinged with pull and retaining handles.

2.05 HIGH EFFICIENCY PARTICULATE AIR (HEPA) FILTERS

A. Media: UL 586, pleated, water-resistant glass fiber with separators of aluminum:
   1. Face Gasket: Neoprene expanded rubber.

B. Minimum Efficiency Reporting Value (MERV): 17, when tested in accordance with ASHRAE Std 52.2.

C. Performance Rating:
   1. MIL-STD-282 Test 0.3 Micron Dioctyl Phthalate Smoke (DOP) Efficiency: 99.97 percent.

2.06 FILTER FRAMES AND HOUSINGS

A. Manufacturers:
   1. Substitutions: See Section 01 6000 - Product Requirements.

B. General: Fabricate filter frames and supporting structures of 16 gauge, 0.0598 inch galvanized steel or extruded aluminum T-section construction with necessary gasketing between frames and walls.

C. Standard Sizes: Provide for interchangeability of filter media of other manufacturers; for panel filters, size for 24 by 24 inches [_____] filter media, minimum 2 inches thick; for extended surface and high efficiency particulate air filters, provide for upstream mounting of panel filters.

D. Side Servicing Housings: Flanged for insertion into ductwork, of reinforced 16 gauge, 0.0598 inch galvanized steel; access doors with continuous gasketing and positive locking devices on both sides; extruded aluminum tracks or channels for primary secondary filters with positive sealing gaskets. Access panels to have thumb-actuated cam latches.

2.07 FILTER GAUGES

A. Manufacturers:
   1. Dwyer Instruments, Inc; [_____]: www.dwyer-inst.com/#sle.
   2. H.O. Trerice Co; [_____]: www.trerice.com/#sle.
   3. Weiss Instruments; [_____]: www.weissinstruments.com/#sle.
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. Direct Reading Dial: 3-1/2 inch diameter diaphragm actuated dial in metal case, vent valves, black figures on white background, front recalibration adjustment, range 0-0.5 inch WG, 2 percent of full scale accuracy.

C. Accessories: Static pressure tips with integral compression fittings, 1/4 inch aluminum tubing, 2-way or 3-way vent valves.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install air cleaning devices in accordance with manufacturer's instructions.

B. Prevent passage of unfiltered air around filters with felt, rubber, or neoprene gaskets.

C. Install filter gauge static pressure tips upstream and downstream of filters. Mount filter gauges on outside of filter housing or filter plenum, in accessible position. Adjust and level.

D. Do not operate fan system until filters (temporary or permanent) are in place. Replace temporary filters used during construction and testing, with clean set.

E. Provide filter gauges on filter banks, installed with separate static pressure tips upstream and downstream of filters.

END OF SECTION 23 4000

SECTION 23 5100
BREECHINGS, CHIMNEYS, AND STACKS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Manufactured breechings.
B. Draft regulators.
C. Type B double wall gas vents.
D. Refractory lined metal stacks.
E. Double wall metal stacks.
F. Induced draft fans.
G. Stationary auxiliary power generator engine exhaust piping.

1.02 RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping.
B. Section 23 0513 - Common Motor Requirements for HVAC Equipment: Induced draft fan motor.
C. Section 25 1400 - Integrated Automation Local Control Units.
D. Section 23 0719 - HVAC Piping Insulation.
E. Section 26 0583 - Wiring Connections: Electrical characteristics and wiring connections.
F. Section 26 3213 - Engine Generators: Exhaust silencer.

1.03 REFERENCE STANDARDS

A. ANSI Z21.66 - American National Standard for Automatic Damper Devices for Use with Gas-Fired Appliances 2015 (Reaffirmed 2020).
B. ANSI Z223.1 - National Fuel Gas Code 2021.
C. ASME B16.5 - Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard 2020.
D. ASME B16.21 - Nonmetallic Flat Gaskets for Pipe Flanges 2021.
E. ASME B31.9 - Building Services Piping 2020.
F. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless 2020.
G. ASTM A181/A181M - Standard Specification for Carbon Steel Forgings, for General-Purpose Piping 2022.
H. ASTM A193/A193M - Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications 2020.
I. ASTM A194/A194M - Standard Specification for Carbon Steel, Alloy Steel, and Stainless Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both 2022.

J. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service 2019.
K. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.
L. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength 2018a.
M. ASTM C401 - Standard Classification of Alumina and Alumina-Silicate Castable Refractories 2012 (Reapproved 2018).
N. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation 2018, with Amendment (2019).
O. NFPA 54 - National Fuel Gas Code 2021.
P. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
Q. NFPA 82 - Standard on Incinerators and Waste and Linen Handling Systems and Equipment 2019.
R. NFPA 211 - Standard for Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances 2019.
S. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible 2021.
T. UL 103 - Factory-Built Chimneys for Residential Type and Building Heating Appliances Current Edition, Including All Revisions.
U. UL 127 - Standard for Factory-Built Fireplaces Current Edition, Including All Revisions.
V. UL 378 - Standard for Draft Equipment Current Edition, Including All Revisions.
W. UL 441 - Standard for Gas Vents Current Edition, Including All Revisions.
X. UL 641 - Type L Low Temperature Venting Systems Current Edition, Including All Revisions.
Y. UL 705 - Power Ventilators Current Edition, Including All Revisions.
Z. UL 959 - Medium Heat Appliance Factory Built Chimneys Current Edition, Including All Revisions.
AA. UL-1738 - Standard for Venting Systems for Gas-Burning Appliances, Categories II, III, and IV Current Edition.

1.04 DEFINITIONS

A. Breeching: Vent connector.
B. Chimney: Primarily vertical shaft enclosing at least one vent for conducting flue gases outdoors.
C. Smoke Pipe: Round, single wall vent connector.

D. Vent: That portion of a venting system designed to convey flue gases directly outdoors from a vent connector or from an appliance when a vent connector is not used.
E. Vent Connector: That part of a venting system that conducts the flue gases from the flue collar of an appliance to a chimney or vent, and may include a draft control device.

1.05 DESIGN REQUIREMENTS

A. Factory built vents and chimneys used for venting natural draft appliances to comply with NFPA 211 and be UL listed and labeled.

1.06 ADMINISTRATIVE REQUIREMENTS

A. Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner.

1.07 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.
B. Product Data: Provide data indicating factory built chimneys, including dimensional details of components and flue caps, dimensions and weights, electrical characteristics and connection requirements.
C. Manufacturer-provided ASHRAE flue sizing calculations or certificate or vent equivalent feet, demonstrating that vent inner diameter is in complete compliance with appliance manufacturer's installation instructions.
D. Shop Drawings: Indicate general construction, dimensions, weights, support and layout of breechings. Submit layout drawings indicating plan view and elevations.
E. Manufacturer's Instructions: Include installation instructions, and indicate assembly, support details, and connection requirements.
F. Manufacturer's qualification statement.
G. Installer's Qualification Statement, to include manufacturer's certification or written statement of approval.
H. Warranties:
    1. Include twenty-five (25) year functional failure warranty from the manufacturer.

1.08 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.
B. Installer Qualifications: Company specializing in performing the type of work specified in this section with minimum 3 years documented experience, and approved by manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Centrotherm North America; : https://www.centrotherm.us.com/Home.aspx/sle#
B. DuraVent; : www.duravent.com/#sle.
C. Enervex, Inc; : www.enervex.com/#sle
D. Heatfab; : http://www.heatfab.com//sle#
E. Jeremias Exhaust Systems; : https://jeremiasinc.com/sle#
F. Security Chimneys International; : www.securitychimneys.com/#sle.
G. Selkirk Corporation; Model IPS: www.selkirkcommercial.com/#sle.
H. US Draft Co, a division of RM Manifold Group, Inc; : www.usdraftco.com/#sle.
I. Van-Packer; : https://vpstack.com/sle#
J. Z-Flex U.S. Inc: www.z-flex.com/#sle.
K. Substitutions: See Section 01 6000 - Product Requirements.

2.02 BREECHINGS, CHIMNEYS, AND STACKS - GENERAL REQUIREMENTS

A. Regulatory Requirements:
    1. Comply with applicable codes for installation of natural gas burning appliances and equipment.
    2. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

2.03 MANUFACTURED BREECHINGS - PRESSURE STACK, NON-CATEGORIZED, FORCED DRAFT

A. Provide factory-built, modular connector and manifold system, tested to UL 103 with positive pressure rating.
B. Assembly to be UL listed for use with building equipment in compliance with NFPA 211.
C. Fabricate with 1 inch minimum air space between walls and construct inner liner of 304, 316L, or 444 stainless steel and outer jacket of 304 stainless steel.
    1. Protect aluminized steel surfaces exposed to the elements with a minimum of one base coat of primer and one finish coat of corrosion resistant paint suitable for outer jacket skin temperatures of the application.
D. Design, fabricate, and install gas-tight preventing products of combustion leaking into the building.
    1. Securely connect inner joints and seal with factory supplied overlapping V-bands and appropriate sealant in accordance with manufacturer's instructions.
    2. System design to compensate for all flue gas induced thermal expansion.

2.04 DRAFT REGULATORS

A. General Requirement: Comply with NFPA 54 and ANSI Z223.1.
B. Remote Monitoring:
    1. Provide hardwired interface to local controller, see Section 25 1400.

C. Draft Regulator, Individual Appliance:
   1. Controller: Pressure modulating using external bidirectional static pressure sensor rated for minus 1 to 1 in-wc service.
   2. Regulator: 316 stainless steel single-blade butterfly damper (SBD) with edge seal, graphite bearings, and external 2-second stroke fast-acting modulating actuator.
   3. Chimney or Gas Vent Size: As indicated on drawings, or per manufacturer requirements.
   4. Service Temperature: 500 degrees F, maximum.
   5. Accessories: Provide encapsulated relay, gas-flow switch, and tubing with fittings.

D. Draft Regulator, Manifolded Appliances:
   1. Controller: Pressure modulating using external bidirectional static pressure sensor rated for minus 1 to 1 in-wc service.
   2. Regulator: 316 stainless steel opposed blade damper (OBD) with graphite bearings, and external 2-second stroke fast-acting modulating actuator.
   3. Manifold Duct Size: As indicated on drawings, or per manufacturer requirements.
   4. Service Temperature: 500 degrees F, maximum
   5. Accessories: Provide flanged-collar fittings, gas-flow switch, and tubing.

E. Draft Inducer, Individual Appliance Vent:
   1. Controller: Pressure modulating using external bidirectional static pressure sensor rated for minus 1 to 1 in-wc service.
   2. Inline Regulator:
      a. Duct-mounted inline stainless steel fan with inverter duty TEFC, or Electronically-Commutated TEAO motor.
   3. Standard Regulator:
      a. Surface-mounted aluminum fan with inverter duty TEFC, or Electronically-Commutated TEAO motor.
   4. Chimney Regulator:
      a. Vertical or sidewall mounted stainless steel fan with inverter duty TEFC, or Electronically-Commutated TEAO motor.
   5. Fan Assembly: Comply with UL 378 and UL 705 listings and ratings.
   6. Maximum Service Temperature: 575 degrees F continuous duty and 750 degrees F intermittent duty.
   7. Accessories: Provide encapsulated relay, gas-flow switch, and tubing with fittings.

2.05 TYPE B DOUBLE WALL GAS VENTS

A. Fabrication: Inner pipe of sheet aluminum, and outer pipe of galvanized sheet steel, tested in compliance with UL 441.

B. Electrically Actuated Vent Dampers: Same size as draft hood collar, constructed of stainless steel or galvanized steel, with corrosion-resistant components, in compliance with ANSI Z21.66.

C. Barometric Vent Dampers: Same size as draft hood collar, constructed of stainless steel or galvanized steel, with corrosion-resistant components, in compliance with ANSI Z21.66. **Contractor shall provide calculations for each barometric vent damper to demonstrate proof of no positive vent draft in system, or shall use electrically actuated vent dampers.**

2.06 REFRACTORY LINED METAL STACKS

A. Fabricate jacket for size 36 inches and smaller of 24 gauge, 0.0239 inch galvanized steel with grooved seam joint, or 26 gauge, 0.0179 inch aluminized steel with riveted seams. For sizes 39 inches and larger fabricate of 11 gauge, 0.1196 inch galvanized steel with welded seam joint.

B. Weld heavy gauge stack sections together in factory. Factory apply heat resistant paint to each stack section and accessory with primer and finish paint. Touch-up or refinish in field.

C. Refractory lining to be a minimum 2 inch thick, proprietary material ASTM C401 Class [__] tested to UL 959 and UL listed to withstand 2000 degrees F without fusion, have maximum acid extraction of 0.2 percent, have minimum of 3200 psi cold crush strength, and be positively bonded to steel jacket, jointed with mortar.

D. Accessories, UL labeled:
   1. Anchor Lugs: Acid resistant coated cast iron.
   2. Clean Out Section: Welded to base of stack, with gasket, and bolt tightened inspection plate.
   3. Branching Sections: Construct with welded joints, lined with refractory, finished with smooth transition and no exposed metal on inside.
   4. Spark Screen: Type 304 stainless steel, 16 gauge, 0.0508 inch diameter wire, 1/2 by 1/2 inch mesh, with rolled angle and draw band.
   5. Drawbands: 8 inch wide, same material as jacket, fastened with nuts and bolts.
   6. Roof Penetration: Factory fabricated thimble, flashing and storm collar.

2.07 CATEGORY IV PLASTIC GAS VENTS

A. Provide prefabricated single-wall system listed to UL-1738 Gas Vent for Category II and IV Appliances. Complete vent system from appliance outlet to termination point, including accessories, shall be provided by one manufacturer, except where noted.

B. Accessories, UL Labeled:
   1. Appliance flue connector
   2. Boot tees
   3. Drain caps or inline drains

4. Stack Supports
5. Roof flashings
6. Termination.

2.08 SINGLE WALL METAL STACKS

A. Provide single wall metal stacks, tested to UL 1738 and UL listed with positive pressure rating, for use with building heating equipment, in compliance with NFPA 54.

B. Fabricate with AL29-4C stainless steel, or UL-1738/Code-Approved Stainless Steel.
   1. Protect aluminized steel surfaces exposed to the elements with a minimum of one base coat of primer and one finish coat of corrosion resistant paint suitable for outer jacket skin temperatures of the application.

C. Accessories, UL labeled:
   1. Ventilated Roof Thimble: Consists of roof penetration, vent flashing with spacers and storm collar.
   2. Stack Cap: Consists of conical rainshield with inverted cone for partial rain protection with low flow resistance.

2.09 DOUBLE WALL METAL STACKS

A. Provide double wall metal stacks, tested to UL-1738 and UL listed with positive pressure rating, for use with building heating equipment, in compliance with NFPA 54.

B. Fabricate with 1 inch minimum air space between walls and construct outer jacket of 304 stainless steel and inner liner of AL29-4C stainless steel, or UL-1738/Code-Approved Stainless Steel.
   1. Protect aluminized steel surfaces exposed to the elements with a minimum of one base coat of primer and one finish coat of corrosion resistant paint suitable for outer jacket skin temperatures of the application.

C. Accessories, UL labeled:
   1. Ventilated Roof Thimble: Consists of roof penetration, vent flashing with spacers and storm collar.
   2. Stack Cap: Consists of conical rainshield with inverted cone for partial rain protection with low flow resistance.

2.10 INDUCED DRAFT FANS

A. Mechanical Draft Induction Type:
   1. Fan: Forward curved venturi type, tested to UL 378, with shaded pole, sleeve bearing motor, or split capacitor type motor.

B. Induced Draft Type:
   1. Fabrication: Forward curved fan and scroll of mild steel with direct drive shaded pole motor with ball bearings, internal cooling fan, stainless steel shaft, and internal centrifugal switch, tested to UL 378.

C. Electrical Characteristics:

1. Motor: See Section 23 0513
2. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70.
3. Disconnect Switch: Factory mount disconnect switch in control panel.

2.11 STATIONARY AUXILIARY POWER GENERATOR ENGINE EXHAUST PIPING

A. Steel Pipe: ASTM A53/A53M, Schedule 40.
   1. Fittings:
      a. Buttweld in compliance with ASTM A234/A234M.
      b. Wall thickness and material same as adjoining pipe.
      c. Built-up miter welded fittings are acceptable where miter angles of each individual section do not exceed 22.5 degrees total and not more than 11.25 degrees relative to the axis of the pipe at any one cut.
   2. Flanges:
      a. Class 150, slip-on, forged steel welding flanges in accordance with ASME B16.5.
      b. Material in accordance with ASTM A181/A181M, Grade I.
      c. Provide for connections to engines, exhaust silencers, and flexible connections.
   3. Gaskets:
      a. High temperature asbestos-free material suitable for the service.
      b. ASME B16.21 composition ring, 0.0625 inch thick.
   4. Bolts: Alloy-steel, complying with ASTM A193/A193M, Grade B7, and of sufficient strength for full bearing on nuts, projecting not more than two full threads beyond the nut.
   5. Nuts: Alloy-steel, complying with ASTM A194/A194M, Grade 7.
   6. Provide stainless steel counterbalance type rain caps at exhaust pipe termination points.

B. Flexible joints:
   1. Provide flanged, multiple, corrugated, stainless steel (multi-ply) expansion joints with liners, between exhaust manifold and exhaust piping to absorb thermal expansion and vibration.
   2. Suitable for operation at 200 degrees F above normal exhaust gas temperature at 100 percent load, 10,000 cycles minimum.
   3. Design and construct for diesel engine exhaust application.

C. Hangers and Supports: Provide hangers and supports that comply with MSS SP-58.

D. Piping Sleeves:

1. Outside Walls Below and Above Grade, Floor, or Roof Slabs: Standard weight zinc coated pipe.
2. Partitions: Zinc coated sheet steel having nominal weight of not less than 0.90 lb per square foot.
3. Piping Insulation: Provide insulation in accordance with Section 23 0719.

PART 3 EXECUTION

3.01 INSTALLATION

A. **Install in accordance with manufacturer's instructions and NFPA 54. Where these standards differ, use the more stringent requirement.**

B. Install breechings with minimum of joints. Align accurately at connections, with internal surfaces smooth.

C. Support breechings from building structure, rigidly with suitable ties, braces, hangers and anchors to hold to shape and prevent buckling. Support vertical breechings, chimneys, and stacks at 12 foot spacing, to adjacent structural surfaces, or at floor penetrations. Refer to SMACNA (DCS) for equivalent duct support configuration and size.

D. Pitch breechings with positive slope up from fuel-fired equipment to chimney or stack.

E. Coordinate installation of dampers, and induced draft fans. See Section 26 0583.

F. For Type B double wall gas vents, maintain UL listed minimum clearances from combustibles. Assemble pipe and accessories as required for complete installation.

G. Assemble and install stack sections in accordance with NFPA 82, industry practices, and in compliance with UL listing. Join sections with acid-resistant joint cement. Connect base section to foundation using anchor lugs.

H. Level and plumb chimney and stacks.

I. Engine Exhaust:
   1. Install engine exhaust piping in accordance with MSS SP-58 and ASME B31.9.
   2. Install exhaust silencer provided in accordance with Section 26 3213.
   3. Provide sleeves with sufficient length to pass through entire thickness of walls, floors, roofs, partitions, or slabs.
   4. Extend sleeves in floor slabs 2 inches above finished floor.
   5. Firmly pack insulation between pipe and sleeve and caulk both ends with plastic waterproof cement.
   6. Space Between Pipe Insulation and Sleeve: Not less than 0.25 inch thick.

END OF SECTION 23 5100

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SECTION 23 8126.13
SMALL-CAPACITY SPLIT-SYSTEM AIR CONDITIONERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Air cooled condensing units.
B. Controls.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Mounting pad for outdoor unit.
B. Section 22 1005 - Plumbing Piping: Includes indoor coil condensate drain.
C. Section 22 3000 - Plumbing Equipment: Cooling condensate removal pumps.
D. Section 23 0913 - Instrumentation and Control Devices for HVAC: Thermostats, humidistats, time clocks.
E. Section 23 2300 - Refrigerant Piping: Refrigerant Piping, and Protective Lineset Covers

1.03 REFERENCE STANDARDS

A. AHRI 210/240 - Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment 2023.
B. AHRI 520 - Performance Rating of Positive Displacement Condensing Units 2004.
C. ASHRAE Std 15 - Safety Standard for Refrigeration Systems 2019, with All Amendments and Errata.
D. ASHRAE Std 23.1 - Methods for Performance Testing Positive Displacement Refrigerant Compressors and Condensing Units that Operate at Subcritical Pressures of the Refrigerant 2019.
E. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems 2021.
F. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems 2021.
G. UL 207 - Standard for Refrigerant-Containing Components and Accessories, Nonelectrical Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide rated capacities, weights, accessories, electrical nameplate data, and wiring diagrams.
C. Design Data: Indicate refrigerant pipe sizing.
D. Manufacturer's Instructions: Indicate rigging, assembly, and installation instructions.
E. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listing.

F. Warranty: Submit manufacturers warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.
G. Project Record Documents: Record actual locations of components and connections.
H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
    1. See Section 01 6000 - Product Requirements, for additional provisions.
    2. Extra Filters: One for each unit.

1.05 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
B. Provide ten year manufacturers warranty for heat exchangers.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Carrier Corporation: www.carrier.com/#sle.
B. LG Air Conditioning Technologies; https://www.lghvac.com/
C. Daikin Applied: https://www.daikinapplied.com/
D. Mitsubishi Electric; https://www.mitsubishicomfort.com/
E. Rheem: https://www.rheem.com/
F. Samsung HVAC; https://www.samsunghvac.com/
G. Trane Inc: www.trane.com/#sle.
H. Substitutions: See Section 01 6000 - Product Requirements.

2.02 SYSTEM DESIGN

A. Split-System Heating and Cooling Units: Self-contained, packaged, matched factory-engineered and assembled, pre-wired indoor and outdoor units; UL listed.
    1. Heating: None.
    2. Cooling: Outdoor electric condensing unit with evaporator coil in central ducted indoor unit.
    3. Provide refrigerant lines internal to units and between indoor and outdoor units, factory cleaned, dried, pressurized and sealed, with insulated suction line.
B. Performance Requirements: See Drawings for additional requirements.

2.03 INDOOR AIR HANDLING UNITS FOR DUCTED SYSTEMS

    1. Construction and Ratings: In accordance with AHRI 210/240 and UL 207.
B. Condensate Pump: Integral factory-furnished self-priming condensate pump, minimum 50 ft. hd.

2.04 OUTDOOR UNITS

A. Outdoor Units: Self-contained, packaged, pre-wired unit consisting of cabinet, with compressor and condenser.
    1. Construction and Ratings: In accordance with AHRI 210/240 with testing in accordance with ASHRAE Std 23.1 and UL 207.

B. Air Cooled Condenser: Aluminum fin and copper tube coil, AHRI 520 with direct drive axial propeller fan resiliently mounted, galvanized fan guard.

C. Accessories: Filter drier, high pressure switch (manual reset), low pressure switch (automatic reset), service valves and gauge ports, thermometer well (in liquid line).
   1. Provide thermostatic expansion valves.
   2. Provide factory-furnished condenser hail guards.

D. Operating Controls:
   1. Control by room thermostat to maintain room temperature setting.

2.05 ACCESSORY EQUIPMENT

A. Room Thermostat: Wall-mounted, electric solid state microcomputer based room thermostat with remote sensor to maintain temperature setting; low-voltage; with following features:
   1. Capable of integration with Building Management System. See Section 23 0923 - Direct-Digital Control System for HVAC for details.
   2. Automatic switching from heating to cooling.
   3. Preferential rate control to minimize overshoot and deviation from setpoint.
   4. Thermostat Display:
      a. Actual room temperature.
      b. System Mode Indication: Heating, Cooling, Fan Auto, Off, and On, Auto or On, Off.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with NFPA 90A and NFPA 90B.

B. Install refrigeration systems in accordance with ASHRAE Std 15 and Section 23 2300 - Refrigerant Piping.

END OF SECTION 23 8126.13

SECTION 26 0500
COMMON WORK RESULTS FOR ELECTRICAL

PART 1 GENERAL

1.01 DESCRIPTION AND DEFINITIONS

A. This division of the Specifications covers the complete electrical systems as indicated on the drawings or as specified herein. Provide all equipment, materials, labor, and supervision to install electrical systems. The requirements of this Section apply to all electrical work hereinafter described. The General and Special Conditions are considered a part of this Division of the Specifications and all provisions contained therein which affect this work are as binding as though incorporated herein.

1. The following words and phrases shall be interpreted as indicated:
    a. "approved": approved or accepted by Governing Officials or Authorities Having jurisdiction
    b. "materials": equipment and/or materials
    c. "or equal/or equivalent": an equivalent with respect to appearance or function as determined by the Architect/Engineer; submittal approval may be required - refer to individual specification sections
    d. "provide": furnish, install, connect, and test the operation thereof
    e. "work": materials provided - see above definitions
    f. "wiring": conductors/cabling and raceway system, including fittings, boxes, connectors, supports, hardware, labeling, and related accessories

1.02 QUALITY ASSURANCE

A. All electrical work shall be in accordance with the latest locally adopted edition of the following codes and agency standards:

1. The National Electrical Code, 2020 Edition.
2. The Life Safety Code (NFPA 101), 2018 Edition.
3. Occupation Safety and Health Administration (OSHA) regulations.
4. Regulations of the local serving utility company regarding metering and service entrance.
5. Accessibility Codes: Americans with Disabilities Act Guidelines (ADA), ANSI A117.1, and 2010 ADA Standards for Accessibility Design.
6. International Building Code 2018.
7. International Energy Conservation Code, 2018 Edition.
8. International Fire Code, 2018 Edition.
9. Municipal or other locally enforced ordinances governing electrical work.

B. Material Standards: All material shall conform to the standards where such standards have been established for the particular material indicated. Publications and standards of the organizations listed below are applicable to materials specified herein.
   1. American National Standards Institute (ANSI)
   2. Insulated Cable Engineers Association (ICEA)
   3. Institute of Electrical and Electronic Engineers (IEEE)
   4. National Electrical Manufacturers Association (NEMA)
   5. National Fire Protection Association (NFPA)
   6. Underwriters' Laboratories, Inc. (UL)

C. Listing and Labeling: Provide equipment assemblies that are listed and labeled.
   1. The terms "listed" and "labeled": As defined in the National Electrical Code, Article 100.
   2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

1.03 PERMITS

A. Obtain all permits and inspections for the installation of this work and pay all charges incident thereto. Deliver to the Owner all certificates of said inspection issued by authorities having jurisdiction.

1.04 WARRANTY

A. The Contractor warrants to the Owner and Architect that materials and equipment furnished under this Contract will be of good quality and new unless otherwise required or permitted by the Contract Documents, that the Work will be free from defects not inherent in the quality required or permitted, and that the Work will conform with the requirements of the Contract Documents. Work not conforming to these requirements, including substitutions not properly approved and authorized, may be considered defective. The Contractor's warranty excludes remedy for damage or defect caused by modifications not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear under normal usage. If required by the Architect, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment. Refer to Division 1 for other warranty requirements.

1.05 PROJECT DOCUMENTS

A. Keep on hand at the project site a complete set of all project drawings and specifications, including, but not limited to, all architectural and engineering drawings. Refer to these documents as necessary; coordinate and install all work accordingly so that all electrical equipment will be properly located and accessible.

B. The drawings are diagrammatic and are intended to indicate the arrangements of electrical equipment. Do not scale drawings. Obtain dimensions for layout of equipment from drawings of other trades unless indicated on Electrical plans. Review drawings of other trades for door swings, cabinets, counters, and built-in equipment; conditions indicated on Architectural plans shall govern. Coordinate installation of electrical equipment with structural system and mechanical equipment and access thereto. Coordinate installation of electrical equipment with ductwork and piping, and wall thickness. Verify construction dimensions at the site and make changes necessary to conform to the building as constructed. Work improperly installed due to lack of construction verification shall be corrected at no additional cost to the Owner.

C. Equipment layout is based on one manufacturer's product. Where equipment selected by the Contractor for use on the project differs from layout indicated, the Contractor shall be responsible for coordinating space requirements and connection arrangements.

D. Bring all discrepancies shown on different drawings, between drawings and specifications or between documents and field conditions to the immediate attention of the Architect.

1.06 SUBMITTALS

A. Shop Drawings and Product Data:

1. Submit for review by the Architect data for materials and equipment to be used on the project. Submittals shall be supported by descriptive material, catalog cuts, diagrams, and performance charts published by the manufacturer to show conformance to specification and drawing requirements. Model numbers alone will not be acceptable. Provide documentation of complete electrical characteristics for all equipment.
2. Provide equipment layout plans, drawn to ¼”=1’-0”, showing the space arrangement of electrical spaces such as main service equipment area, electrical closets, and each area where electrical distribution equipment is to be installed. Base layout on dimensions of the equipment submitted for use on the project. Submit plans for review with shop drawings.
3. Refer to the individual sections for indication of equipment for which submittals are required.
4. Refer to Division 1 for additional information on submittal requirements.

B. Record Documents: Refer to Division 1 for requirements for record documents, as-built drawings, and related submittals.

1.07 EQUIPMENT REQUIRING ELECTRICAL SERVICE

A. Review all specification sections and drawings for equipment requiring electrical service. Provide service to and make connections to all equipment requiring electrical service.

B. Drawings indicate equipment with loads, horsepower ratings, voltages, and corresponding control equipment, feeders, and overcurrent devices which were used as a basis for design. If equipment actually furnished have loads other than those indicated on the drawings or specified herein, control equipment, feeders, and overcurrent devices shall be adjusted in size accordingly at no additional cost to the Owner. Such adjustment shall be subject to the review of the Architect.

C. Incidental items not indicated on the drawings or mentioned in the specifications but that can legitimately and reasonably be inferred to belong to the work or be necessary in good practice to provide a complete system, shall be furnished and installed as though itemized here in detail.

1.08 MECHANICAL SYSTEMS INTERFACE

A. All control wiring and associated raceway systems for mechanical systems shall be provided under Divisions 21, 22, 23, 27, and 28, unless otherwise shown on the Electrical drawings. Review other division specifications, project drawings, and shop drawings for control systems to assure compatibility between equipment furnished under Division 26 and wiring furnished under Division 21, 22, 23, 27, and 28.

B. Unless otherwise indicated, motor controllers (starters) shall be provided under Division 21, 22, 23, and 28 or as an integral component of Division 21, 22, 23, and 28 equipment.

C. Power wiring to all motors and controllers and between motors and controllers shall be provided under Division 26.

D. All electric heating equipment shall be provided and installed under Division 23. Power wiring to all electric heating equipment shall be provided under Division 26.

1.09 SITE INVESTIGATION

A. Prior to submitting bids for the project, visit the site of the work to become aware of existing conditions which may affect the cost of the project.

PART 2 PRODUCTS

2.01 MATERIALS

A. Furnish all materials specified herein or indicated on the drawings. All materials shall be new, unless otherwise indicated.

B. Where Underwriters' Laboratories (UL) testing standards and listings exist for an item of material or equipment, the listed material shall bear the UL label.

PART 3 - EXECUTION

3.01 PRODUCT DELIVERY, STORAGE, HANDLING, AND PROTECTION

A. Inspect materials upon arrival at site and verify conformance with project requirements. Prevent unloading of unsatisfactory material. Handle materials in accordance with applicable standards and recommendations, and in a manner to prevent damage to materials. Store packaged materials in original undamaged condition with manufacturer's labels and seals intact. Containers which are broken, opened, damaged, or watermarked are unacceptable and shall be removed from the premises and replaced.

B. All material, except items specifically designed to be installed outdoors, shall be stored in an enclosed, dry building or trailer. Areas for general storage shall be provided. Provide temperature and/or humidity control where necessary. All material for interior installation, including conductors, shall be stored in an enclosed weathertight structure and shall be protected from water, direct sunlight, cold or heat. Equipment stored other than as specified above shall be removed from the premises and replaced.

C. Equipment and materials shall not be installed until such time as the environmental conditions of the job site are suitable to protect the equipment or materials. Conditions shall be those for which the equipment or materials are designed to be installed.

3.02 CLEANING, PAINTING AND IDENTIFICATION

A. Remove oil, dirt, grease and foreign materials from all raceways, boxes, panelboard trims and cabinets to provide a clean surface for painting. Touch-up scratched or marred surfaces of lighting fixtures, panelboard and cabinet trims, or other equipment enclosures with paint furnished by the equipment manufacturer specifically for that purpose.

B. Where painting of trim covers for flush mounted panelboards, communication equipment cabinets, pull boxes, junction boxes, and control cabinets is required under this or any other Division of these specifications, remove trim covers before painting. Do not paint locks, latches, hinges, or exposed trim clamps.

C. Where plywood backboards are used to mount equipment provided under Divisions 26, 27, or 28, paint backboards with two coats of light gray paint. Provide fire-retardant plywood, 3/4" thick minimum.

D. Identify electrical components where required in the individual specification sections.
   1. Equipment connected to utility power shall have black faced nameplates. Equipment connected to emergency power shall have red faced nameplates.
   2. Nameplates shall be constructed from laminated phenolic engraved plastic three-ply with a white interior core at least 1/16 inch thick.

3. Plastic strips shall be stamped, pressure-sensitive adhestive type labels with white letters.
4. Stencils shall be machine cut with 1/4-inch high minimum size letters. Paint shall be enamel or lacquer type. Unless otherwise indicated, labeling shall use condensed gothic letters and Arabic numerals properly spaced for easy and legible reading.
5. Nameplates for surface mounted equipment shall be installed on the exterior and for flush or recessed mounted equipment shall be installed on the side of the door or cover with epoxy cement adhesive, unless otherwise indicated.

3.03 EXCAVATION, TRENCHING AND BACKFILLING

A. Perform all excavation to install underground circuiting and raceway systems indicated on the drawings or specified herein. During excavation, pile material for backfilling back from the banks of the trench to avoid overloading and to prevent cave-ins. Provide shoring as required by OSHA Standards. Remove and dispose of all excavated materials not to be used for backfill. Grade to prevent surface water from flowing into trenches and excavation. Remove any water accumulating therein by pumping.

B. Grade the bottom of trenches to provide uniform bearing and support for underground circuiting and raceway systems on undisturbed soil at every point along entire length. Tamp over depths with loose, granular, moist earth. Remove unstable soil that is not capable of supporting equipment or installation and replace with specified material for a minimum of 12" below invert of equipment or installation.

C. Backfill the trenches with excavated materials approved for backfilling, consisting of earth, loam, sandy clay, or sand and gravel, free from large clods of earth and stones, deposited in 6" layers and tamped until the installation has a cover of not less than the adjacent ground but not greater than 2" above existing ground. Backfill simultaneously on both sides of the trench. Compaction of the filled trench shall be at least equal to that of the surrounding undisturbed material. Do not settle backfill with water. Reopen any trenches not meeting compaction requirements or where settlement occurs, refill, compact, and restore surface, mounded over and smoothed off.

3.04 COORDINATION AND COOPERATION

A. Schedule the work, coordinate, and cooperate with all trades to avoid interferences, delays, and unnecessary work. If any conflicts occur which, in the installer's opinion, necessitate departures from the drawings and specifications, details of departures and reasons therefore shall be submitted in writing for the Architect's consideration.

B. Notify other trades of dedicated electrical space to ensure those spaces stay clear of pipes, duct work and other foreign systems.

3.05 OPERATION AND MAINTENANCE MANUALS AND INSTRUCTIONS

A. Provide printed material for binding in operation and maintenance manuals. Include electrical equipment shop drawings as a minimum, and other information as necessary. Refer to Division 1 for additional information on submittal requirements.

B. Instructions of Owner Personnel:

1. Before final project review, as designated by the Architect, provide a competent representative to instruct Owner's designated personnel in systems indicated.
2. Use Operation and Maintenance Manuals as basis of instruction. Review contents with personnel in detail to explain all aspects of operation and maintenance.
3. Prepare and insert additional data in Operation and Maintenance Manuals when the need for such data becomes apparent during instruction.

3.06 ELECTRICAL ACCEPTANCE TESTS AND MANUFACTURERS CERTIFICATION

A. Refer to the individual specification sections and the Electrical Acceptance Testing section for equipment or system test requirements. Testing documentation shall be provided for reference at the time of final project review.

B. Where specified under the individual system specification sections, the systems shall be reviewed for compliance with these specifications, installation in accordance with the manufacturer's recommendations, and system operation by a representative of the manufacturer.

3.07 CONSTRUCTION OBSERVATION ASSISTANCE

A. Provide personnel to assist the Architect or his representative during all construction observation visits. Provide tools and equipment as required to demonstrate the system operation and provide access to equipment, including screwdrivers, wrenches, ladders, flashlights, circuit testing devices, meters, keys, etc.

B. Remove panelboard trims, motor control covers, device plates, junction box covers, etc. as directed for inspection of internal wiring. Turn over to the Owner one set of keys for all lockable electrical equipment on the project. Accessible ceilings shall be removed as directed for inspection of equipment installed above ceilings.

C. Energize and de-energize circuits and equipment as directed. Demonstrate operation of equipment and systems as directed.

D. Provide authorized representatives of the manufacturers to demonstrate to the Architect compliance with the Contract Documents at a time designated by the Architect.

3.08 LOW VOLTAGE CABLE ROUTING

A. All low voltage and fire alarm cabling shall be run tight to structure, regardless of whether cables are above or below structural elements. Free-standing cables, conduits, or cable trays spanning open spaces or voids is prohibited. All cabling to be routed in areas with exposed ceilings, cloud ceilings, or any other areas where cabling may be visible to building occupants shall be routed inside conduit or cable trays and shall maintain a low-profile installation or be hidden from view. Coordinate electrical, low voltage, building controls, and fire alarm to maintain uniform installation approach.
   1. If any of these conditions are identified in the field, the contractor shall remove and reinstall cabling in accordance with these directions at no additional cost to the owner.
   2. If there are areas where necessary routing cannot comply with these instructions, contractor shall furnish a sketch identifying such areas, how the routing in indicated areas will differ from these instructions and obtain written approval from the architect prior to installation.

B. Electrical shall furnish and install conduit and/or cable trays in areas as described above for low voltage, building control, and fire alarm cabling.

C. Coordination drawings
   1. Submit low voltage cabling pathway plan drawing for review by engineer of record prior to beginning work. Plan shall detail major elements, components, and systems of electrical, low voltage, building control, and fire alarm equipment and materials in relation to other systems, installations, and building components. Show detailed space requirements for installation and maintenance access after installation is complete. Identify areas where conduit and cable tray will be used. Indicate if sequence and coordination of installations are important to efficient flow of the work. Include the following, at a minimum:
      a. Main cabling pathway, including areas where conduit and cable trays will be used.
      b. Clearances for servicing and maintaining equipment, accessories, and specialties, including space for disassembly required for periodic maintenance.
      c. Equipment and accessory service connections and support details.
      d. Exterior wall and foundation penetrations.
      e. Rated wall and floor penetrations (fire, smoke, etc.)
   2. Cabling pathway plan shall bear the signatures of the electrical, low voltage, building control, and fire alarm subcontractors.

D. Cabling and associated equipment, accessories, and specialties shall not be installed without first coordinating the installation of same with other trades. The contractor shall relocate all uncoordinated cabling and other equipment installed at their own expense, should such installation be determined to interfere with the proper installation and mounting of fire protection equipment, plumbing equipment, HVAC equipment, ceilings, or other architectural or structural systems or finishes.

E. Stacking of cabling where it would cause an obstruction or restricted access path for egress or serviceability of equipment is prohibited.

END OF SECTION 26 0500

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SECTION 26 0505
SELECTIVE DEMOLITION FOR ELECTRICAL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electrical demolition.

PART 2 PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. Materials and equipment for patching and extending work: As specified in individual sections.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that abandoned wiring and equipment serve only abandoned facilities.
B. Demolition drawings are based on casual field observation and existing record documents.
C. Beginning of demolition means installer accepts existing conditions.

3.02 PREPARATION

A. Disconnect electrical systems in walls, floors, and ceilings to be removed.
B. Coordinate utility service outages with utility company.
C. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations.
D. Existing Electrical Service: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Minimize outage duration.
E. Existing Fire Alarm System: Maintain existing system in service until new system is accepted. Disable system only to make switchovers and connections. Minimize outage duration.
F. Existing Telephone System: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Minimize outage duration.

3.03 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

A. Remove, relocate, and extend existing installations to accommodate new construction.
B. Remove abandoned wiring to source of supply, as required.
C. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes, as required. Cut conduit flush with walls and floors, and patch surfaces.

D. Disconnect abandoned outlets and remove devices, as required. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets that are not removed.
E. Disconnect and remove abandoned panelboards and distribution equipment, as required.
F. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed, as required.
G. Disconnect and remove abandoned luminaires, as required. Remove brackets, stems, hangers, and other accessories.
H. Repair adjacent construction and finishes damaged during demolition and extension work.
I. Maintain access to existing electrical installations that remain active. Modify installation or provide access panel as appropriate.

3.04 CLEANING AND REPAIR

A. Clean and repair existing materials and equipment that remain or that are to be reused.
B. Panelboards: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide typed circuit directory showing revised circuiting arrangement.
C. Luminaires: Remove existing luminaires for cleaning. Use mild detergent to clean all exterior and interior surfaces; rinse with clean water and wipe dry. Replace lamps, ballasts and broken electrical parts.

END OF SECTION 26 0505

SECTION 26 0526
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Grounding and bonding requirements.
B. Conductors for grounding and bonding.
C. Connectors for grounding and bonding.
D. Ground bars.
E. Ground rod electrodes.

1.02 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
B. NEMA GR 1 - Grounding Rod Electrodes and Grounding Rod Electrode Couplings 2017.
C. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
D. UL 467 - Grounding and Bonding Equipment Current Edition, Including All Revisions.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittals procedures.
B. Product Data: Provide manufacturer's standard catalog pages and data sheets for grounding and bonding system components.

PART 2 PRODUCTS

2.01 GROUNDING AND BONDING REQUIREMENTS

A. Do not use products for applications other than as permitted by NFPA 70 and product listing.
B. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.
C. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
D. Grounding Electrode System:
    1. Provide connection to required and supplemental grounding electrodes indicated to form grounding electrode system.
        a. Provide continuous grounding electrode conductors without splice or joint.
        b. Install grounding electrode conductors in raceway where exposed to physical damage. Bond grounding electrode conductor to metallic raceways at each end with bonding jumper.
    2. Ground Rod Electrode(s):
        a. Provide three electrodes in an equilateral triangle configuration unless otherwise indicated or required.

b. Space electrodes not less than 10 feet from each other and any other ground electrode.

3. Ground Bar: Provide ground bar, separate from service equipment enclosure, for common connection point of grounding electrode system bonding jumpers as permitted in NFPA 70. Connect grounding electrode conductor provided for service-supplied system grounding to this ground bar.
   a. Ground Bar Size: 1/4 by 2 by 12 inches unless otherwise indicated or required.

E. Bonding and Equipment Grounding:
1. Provide bonding for equipment grounding conductors, equipment ground busses, metallic equipment enclosures, metallic raceways and boxes, device grounding terminals, and other normally non-current-carrying conductive materials enclosing electrical conductors/equipment or likely to become energized as indicated and in accordance with NFPA 70.
2. Provide insulated equipment grounding conductor in each feeder and branch circuit raceway. Do not use raceways as sole equipment grounding conductor.
3. Where circuit conductor sizes are increased for voltage drop, increase size of equipment grounding conductor proportionally in accordance with NFPA 70.
4. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
5. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on neutral (grounded) or isolated/insulated ground bus.
6. Provide bonding jumper across expansion or expansion/deflection fittings provided to accommodate conduit movement.

F. Communications Systems Grounding and Bonding:
1. Provide intersystem bonding termination at service equipment or metering equipment enclosure and at disconnecting means for any additional buildings or structures in accordance with NFPA 70.

2.02 GROUNDING AND BONDING COMPONENTS

A. General Requirements:
1. Provide products listed, classified, and labeled as suitable for the purpose intended.
2. Provide products listed and labeled as complying with UL 467 where applicable.

B. Conductors for Grounding and Bonding, in Addition to Requirements of Section 26 0526:
1. Use insulated copper conductors unless otherwise indicated.
   a. Exceptions:

1) Use bare copper conductors where installed underground in direct contact with earth.

C. Connectors for Grounding and Bonding:
   1. Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.
   2. Unless otherwise indicated, use exothermic welded connections for underground, concealed and other inaccessible connections.
   3. Unless otherwise indicated, use mechanical connectors, compression connectors, or exothermic welded connections for accessible connections.

D. Ground Bars:
   1. Description: Copper rectangular ground bars with mounting brackets and insulators.
   2. Size: As indicated.
   3. Holes for Connections: As indicated or as required for connections to be made.

E. Ground Rod Electrodes:
   1. Comply with NEMA GR 1.
   2. Material: Copper-bonded (copper-clad) steel.
   3. Size: 3/4 inch diameter by 10 feet length, unless otherwise indicated.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Ground Rod Electrodes: Unless otherwise indicated, install ground rod electrodes vertically. Where encountered rock prohibits vertical installation, install at 45 degree angle or bury horizontally in trench at least 30 inches (750 mm) deep in accordance with NFPA 70 or provide ground plates.

D. Make grounding and bonding connections using specified connectors.
   1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.
   2. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.
   3. Exothermic Welds: Make connections using molds and weld material suitable for the items to be connected in accordance with manufacturer's recommendations.
   4. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.

5. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

E. Identify grounding and bonding system components in accordance with Section 26 0553.

END OF SECTION 26 0526

SECTION 26 0533.13
CONDUIT FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Galvanized steel rigid metal conduit (RMC).
B. Electrical metallic tubing (EMT).
C. Rigid polyvinyl chloride (PVC) conduit.
D. Conduit fittings.

1.02 RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping.
B. Section 26 0526 - Grounding and Bonding for Electrical Systems.
C. Section 26 0529 - Hangers and Supports for Electrical Systems.

1.03 REFERENCE STANDARDS

A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC) 2020.
B. ANSI C80.3 - American National Standard for Electrical Metallic Tubing -- Steel (EMT-S) 2020.
C. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
D. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT) 2020.
E. NECA 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC) 2017.
F. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable 2014.
G. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit 2020.
H. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing 2021.
I. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
J. UL 6 - Electrical Rigid Metal Conduit-Steel Current Edition, Including All Revisions.
K. UL 514B - Conduit, Tubing, and Cable Fittings Current Edition, Including All Revisions.
L. UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings Current Edition, Including All Revisions.
M. UL 797 - Electrical Metallic Tubing-Steel Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittals procedures.
B. Product Data: Provide manufacturer's standard catalog pages and data sheets for conduits and fittings.

PART 2 PRODUCTS

2.01 CONDUIT APPLICATIONS

A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70 and product listing.

B. Unless otherwise indicated and where not otherwise restricted, use the conduit types indicated for the specified applications. Where more than one listed application applies, comply with the most restrictive requirements. Where conduit type for a particular application is not specified, use galvanized steel rigid metal conduit.

C. Underground:
   1. Exterior, Direct-Buried: Use rigid PVC conduit.
   2. Where rigid polyvinyl (PVC) conduit is provided, transition to galvanized steel rigid metal conduit where emerging from underground.

D. Concealed Within Masonry Walls: Use electrical metallic tubing (EMT).

E. Concealed Within Hollow Stud Walls: Use electrical metallic tubing (EMT).

F. Concealed Above Accessible Ceilings: Use electrical metallic tubing (EMT).

G. Exposed, Interior, Not Subject to Physical Damage: Use electrical metallic tubing (EMT).

H. Exposed, Exterior: Use galvanized steel rigid metal conduit.

2.02 CONDUIT REQUIREMENTS

A. Provide all conduit, fittings, supports, and accessories required for a complete raceway system.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

2.03 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

A. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.

B. Fittings:
   1. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   2. Material: Use steel or malleable iron.
   3. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

2.04 ELECTRICAL METALLIC TUBING (EMT)

A. Description: NFPA 70, Type EMT steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.

B. Fittings:

1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
2. Material: Use steel or malleable iron.
3. Connectors and Couplings: Use compression (gland) or set-screw type.
   a. Do not use indenter type connectors and couplings.

2.05 RIGID POLYVINYL CHLORIDE (PVC) CONDUIT

A. Description: NFPA 70, Type PVC rigid polyvinyl chloride conduit complying with NEMA TC 2 and listed and labeled as complying with UL 651; Schedule 40 unless otherwise indicated, Schedule 80 where subject to physical damage; rated for use with conductors rated 90 degrees C.

B. Fittings:
   1. Manufacturer: Same as manufacturer of conduit to be connected.
   2. Description: Fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; material to match conduit.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Install galvanized steel rigid metal conduit (RMC) in accordance with NECA 101.

D. Install rigid polyvinyl chloride (PVC) conduit in accordance with NECA 111.

E. Conduit Support:
   1. Secure and support conduits in accordance with NFPA 70 and Section 26 0529 using suitable supports and methods approved by the authority having jurisdiction.
   2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

F. Connections and Terminations:
   1. Use approved zinc-rich paint or conduit joint compound on field-cut threads of galvanized steel conduits prior to making connections.
   2. Where two threaded conduits must be joined and neither can be rotated, use three-piece couplings or split couplings. Do not use running threads.
   3. Use suitable adapters where required to transition from one type of conduit to another.
   4. Terminate threaded conduits in boxes and enclosures using threaded hubs or double lock nuts for dry locations and raintight hubs for wet locations.
   5. Provide insulating bushings or insulated throats at all conduit terminations to protect conductors.

6. Secure joints and connections to provide maximum mechanical strength and electrical continuity.

G. Penetrations:
   1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.
   2. Make penetrations perpendicular to surfaces unless otherwise indicated.
   3. Provide sleeves for penetrations as indicated or as required to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.
   4. Conceal bends for conduit risers emerging above ground.
   5. Seal interior of conduits entering the building from underground at first accessible point to prevent entry of moisture and gases.
   6. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
   7. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty. Include proposed locations of penetrations and methods for sealing with submittals.
   8. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.

H. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed conductors or connected equipment. This includes, but is not limited to:
   1. Where conduits cross structural joints intended for expansion, contraction, or deflection.
   2. Where calculated in accordance with NFPA 70 for rigid polyvinyl chloride (PVC) conduit installed above ground to compensate for thermal expansion and contraction.
   3. Where conduits are subject to earth movement by settlement or frost.

I. Condensation Prevention: Where conduits cross barriers between areas of potential substantial temperature differential, provide sealing fitting or approved sealing compound at an accessible point near the penetration to prevent condensation. This includes, but is not limited to:
   1. Where conduits pass from outdoors into conditioned interior spaces.
   2. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.

J. Provide grounding and bonding in accordance with Section 26 0526.

END OF SECTION 26 0533.13

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SECTION 26 0533.16
BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Outlet and device boxes up to 100 cubic inches, including those used as junction and pull boxes.

B. Cabinets and enclosures, including junction and pull boxes larger than 100 cubic inches.

1.02 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.

B. NECA 130 - Standard for Installing and Maintaining Wiring Devices 2016.

C. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable 2014.

D. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports 2013 (Reaffirmed 2020).

E. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.

F. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations Current Edition, Including All Revisions.

H. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations Current Edition, Including All Revisions.

I. UL 508A - Industrial Control Panels Current Edition, Including All Revisions.

J. UL 514A - Metallic Outlet Boxes Current Edition, Including All Revisions.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for cabinets and enclosures, boxes for hazardous (classified) locations, floor boxes, and underground boxes/enclosures.

PART 2 PRODUCTS

2.01 BOXES

A. General Requirements:

1. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and product listing.
2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.
3. Provide products listed, classified, and labeled as suitable for the purpose intended.

4. Where box size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
5. Provide grounding terminals within boxes where equipment grounding conductors terminate.

B. Outlet and Device Boxes Up to 100 cubic inches, Including Those Used as Junction and Pull Boxes:
1. Use sheet-steel boxes for dry locations unless otherwise indicated or required.
2. Use cast iron boxes or cast aluminum boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.
3. Use suitable concrete type boxes where flush-mounted in concrete.
4. Use suitable masonry type boxes where flush-mounted in masonry walls.
5. Use raised covers suitable for the type of wall construction and device configuration where required.
6. Use shallow boxes where required by the type of wall construction.
7. Do not use "through-wall" boxes designed for access from both sides of wall.
8. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.
9. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.
10. Boxes for Supporting Luminaires and Ceiling Fans: Listed as suitable for the type and weight of load to be supported; furnished with fixture stud to accommodate mounting of luminaire where required.
11. Boxes for Ganged Devices: Use multigang boxes of single-piece construction. Do not use field-connected gangable boxes unless specifically indicated or permitted.

C. Cabinets and Enclosures, Including Junction and Pull Boxes Larger Than 100 cubic inches:
1. Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E, or UL 508A.
2. NEMA 250 Environment Type, Unless Otherwise Indicated.
3. Junction and Pull Boxes Larger Than 100 cubic inches:
   a. Provide screw-cover or hinged-cover enclosures unless otherwise indicated.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install boxes in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards where mounting heights are not indicated.

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
D. Box Supports:
   1. Secure and support boxes in accordance with NFPA 70 and Section 26 0529 using suitable supports and methods approved by the authority having jurisdiction.
   2. Provide independent support from building structure except for cast metal boxes (other than boxes used for fixture support) supported by threaded conduit connections in accordance with NFPA 70. Do not provide support from piping, ductwork, or other systems.
E. Install boxes plumb and level.
F. Flush-Mounted Boxes:
   1. Install boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that front edge of box or associated raised cover is not set back from finished surface more than 1/4 inch or does not project beyond finished surface.
   2. Install boxes in combustible materials such as wood so that front edge of box or associated raised cover is flush with finished surface.
   3. Repair rough openings around boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that there are no gaps or open spaces greater than 1/8 inch at the edge of the box.
G. Install boxes as required to preserve insulation integrity.
H. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.
I. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.
J. Close unused box openings.
K. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.
L. Provide grounding and bonding in accordance with Section 26 0526.

END OF SECTION 26 0533.16

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SECTION 26 0533.23
SURFACE RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface raceway systems.

1.02 RELATED REQUIREMENTS

A. Section 26 0526 - Grounding and Bonding for Electrical Systems.
B. Section 26 0529 - Hangers and Supports for Electrical Systems.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
B. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide manufacturer's standard catalog pages and data sheets including dimensions, knockout sizes and locations, materials, fabrication details, finishes, service condition requirements, and accessories.

PART 2 PRODUCTS

2.01 RACEWAY REQUIREMENTS

A. Provide all components, fittings, supports, and accessories required for a complete raceway system.
B. Provide products listed, classified, and labeled as suitable for the purpose intended.
C. Do not use raceways for applications other than as permitted by NFPA 70 and product listing.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install products in accordance with manufacturer's instructions.
B. Perform work in accordance with NECA 1 (general workmanship).
C. Install raceways plumb and level.
D. Secure and support raceways in accordance with Section 26 0529 at intervals complying with NFPA 70 and manufacturer's requirements.
E. Close unused raceway openings.
F. Provide grounding and bonding in accordance with Section 26 0526.

END OF SECTION 26 0533.23

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SECTION 26 0553
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electrical identification requirements.
B. Identification nameplates and labels.
C. Underground warning tape.
D. Warning signs and labels.

1.02 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
B. UL 969 - Marking and Labeling Systems Current Edition, Including All Revisions.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittals procedures.
B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product.

PART 2 PRODUCTS

2.01 IDENTIFICATION REQUIREMENTS

A. Identification for Equipment:
    1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.
        a. Switchboards:
            1) Identify ampere rating.
            2) Identify voltage and phase.
            3) Identify power source and circuit number. Include location when not within sight of equipment.
            4) Use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.
        b. Panelboards:
            1) Identify ampere rating.
            2) Identify voltage and phase.
            3) Identify power source and circuit number. Include location when not within sight of equipment.
            4) Use typewritten circuit directory to identify load(s) served for panelboards with a door. Identify spares and spaces using pencil.
            5) For power panelboards without a door, use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.

c. Transformers:
1) Identify kVA rating.
2) Identify voltage and phase for primary and secondary.
d. Enclosed switches, circuit breakers, and motor controllers:
1) Identify voltage and phase.
e. Transfer Switches:
1) Identify voltage and phase.
2) Identify short circuit current rating based on the specific overcurrent protective device type and settings protecting the transfer switch.

2. Service Equipment:
a. Use identification nameplate to identify each service disconnecting means.
3. Available Fault Current Documentation: Use identification label to identify the available fault current and date calculations were performed at locations requiring documentation by NFPA 70 including but not limited to the following.
a. Service equipment.
b. Industrial control panels.
c. Motor control centers.
d. Elevator control panels.
e. Industrial machinery.
4. Arc Flash Hazard Warning Labels: Use warning labels to identify arc flash hazards for electrical equipment, such as switchboards, panelboards, industrial control panels, meter socket enclosures, and motor control centers that are likely to require examination, adjustment, servicing, or maintenance while energized.

B. Identification for Conductors and Cables:
1. Color Coding for Power Conductors 600 V and Less: Comply with Section 26 0519.
2. Use identification nameplate or identification label to identify color code for ungrounded and grounded power conductors inside door or enclosure at each piece of feeder or branch-circuit distribution equipment when premises has feeders or branch circuits served by more than one nominal voltage system.

2.02 IDENTIFICATION NAMEPLATES AND LABELS

A. Identification Nameplates:
1. Materials:
a. Indoor Clean, Dry Locations: Use plastic nameplates.
b. Outdoor Locations: Use plastic, stainless steel, or aluminum nameplates suitable for exterior use.

2. Plastic Nameplates: Two-layer or three-layer laminated acrylic or electrically non-conductive phenolic with beveled edges; minimum thickness of 1/16 inch; engraved text.
3. Stainless Steel Nameplates: Minimum thickness of 1/32 inch; engraved or laser-etched text.
4. Aluminum Nameplates: Anodized; minimum thickness of 1/32 inch; engraved or laser-etched text.
5. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch high; Four, located at corners for larger sizes.

B. Identification Labels:
1. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.
2. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text unless otherwise indicated.

2.03 UNDERGROUND WARNING TAPE

A. Materials: Use non-detectable type polyethylene tape suitable for direct burial, unless otherwise indicated.
B. Non-detectable Type Tape: 6 inches wide, with minimum thickness of 4 mil.
C. Legend: Type of service, continuously repeated over full length of tape.

2.04 WARNING SIGNS AND LABELS

A. Comply with ANSI Z535.2 or ANSI Z535.4 as applicable.
B. Warning Signs:
1. Materials:
2. Minimum Size: 7 by 10 inches unless otherwise indicated.
C. Warning Labels:
1. Materials: Use factory pre-printed or machine-printed self-adhesive polyester or self-adhesive vinyl labels; UV, chemical, water, heat, and abrasion resistant; produced using materials recognized to UL 969.
2. Machine-Printed Labels: Use thermal transfer process printing machines and accessories recommended by label manufacturer.
3. Minimum Size: 2 by 4 inches unless otherwise indicated.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install products in accordance with manufacturer's instructions.
B. Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance. Unless otherwise indicated, locate products as follows:
1. Surface-Mounted Equipment: Enclosure front.
2. Flush-Mounted Equipment: Inside of equipment door.

3. Free-Standing Equipment: Enclosure front; also enclosure rear for equipment with rear access.
4. Elevated Equipment: Legible from the floor or working platform.
5. Branch Devices: Adjacent to device.
6. Interior Components: Legible from the point of access.
7. Conductors and Cables: Legible from the point of access.

C. Install identification products centered, level, and parallel with lines of item being identified.
D. Secure nameplates to exterior surfaces of enclosures using stainless steel screws and to interior surfaces using self-adhesive backing or epoxy cement.
E. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.
F. Install underground warning tape above buried lines with one tape per trench at 3 inches below finished grade.
G. Mark all handwritten text, where permitted, to be neat and legible.

END OF SECTION 26 0553

SECTION 26 0583
WIRING CONNECTIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electrical connections to equipment.

1.02 REFERENCE STANDARDS

A. NEMA WD 1 - General Color Requirements for Wiring Devices 1999 (Reaffirmed 2020).
B. NEMA WD 6 - Wiring Devices - Dimensional Specifications 2016.
C. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide wiring device manufacturer’s catalog information showing dimensions, configurations, and construction.

PART 2 PRODUCTS

2.01 MATERIALS

A. Cords and Caps: NEMA WD 6; match receptacle configuration at outlet provided for equipment.
   1. Colors: Comply with NEMA WD 1.
   2. Cord Construction: NFPA 70, Type SO, multiconductor flexible cord with identified equipment grounding conductor, suitable for use in damp locations.
   3. Size: Suitable for connected load of equipment, length of cord, and rating of branch circuit overcurrent protection.

PART 3 EXECUTION

3.01 ELECTRICAL CONNECTIONS

A. Make electrical connections in accordance with equipment manufacturer's instructions.
B. Make conduit connections to equipment using flexible conduit. Use liquidtight flexible conduit with watertight connectors in damp or wet locations.
C. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.
D. Provide receptacle outlet to accommodate connection with attachment plug.
E. Provide cord and cap where field-supplied attachment plug is required.
F. Install suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.
G. Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.
H. Install terminal block jumpers to complete equipment wiring requirements.

I. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.

END OF SECTION 26 0583

SECTION 26 0923
LIGHTING CONTROL DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Occupancy/Vacancy sensors.

1.02 RELATED REQUIREMENTS

A. Section 26 0529 - Hangers and Supports for Electrical Systems
B. Section 26 0533.16 - Boxes for Electrical Systems.
C. Section 26 2726 - Wiring Devices: Devices for manual control of lighting, including wall switches, wall dimmers, and fan speed controllers.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
B. NECA 130 - Standard for Installing and Maintaining Wiring Devices 2016.
C. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
D. UL 1472 - Solid-State Dimming Controls Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Include ratings, configurations, standard wiring diagrams, dimensions, colors, service condition requirements, and installed features.

PART 2 PRODUCTS

2.01 LIGHTING CONTROL DEVICES - GENERAL REQUIREMENTS

A. Provide products listed, classified, and labeled as suitable for the purpose intended.
B. Unless specifically indicated to be excluded, provide all required conduit, wiring, connectors, hardware, components, accessories, etc. as required for a complete operating system.

2.02 OCCUPANCY/VACANCY SENSORS

A. All Occupancy Sensors:
    1. Description: Factory-assembled commercial specification grade devices for indoor use capable of sensing both major motion, such as walking, and minor motion, such as small desktop level movements, according to published coverage areas, for automatic control of load indicated.
    2. Sensor Technology:
        a. Passive Infrared/Ultrasonic Dual Technology Occupancy Sensors: Designed to detect occupancy using a combination of both passive infrared and ultrasonic technologies.
    3. Provide LED to visually indicate motion detection with separate color LEDs for each sensor type in dual technology units.

4. Operation: Unless otherwise indicated, occupancy sensor to turn load on when occupant presence is detected and to turn load off when no occupant presence is detected during an adjustable turn-off delay time interval. Vacancy sensor to have manual on operation and to turn load off when no occupant presence is detected during an adjustable turn-off delay time interval.
5. Turn-Off Delay: Field adjustable, with time delay settings up to 30 minutes.
6. Compatibility (Non-Dimming Sensors): Suitable for controlling incandescent lighting, low-voltage lighting with electronic and magnetic transformers, fluorescent lighting with electronic and magnetic ballasts, and fractional motor loads, with no minimum load requirements.

B. Wall Switch Occupancy Sensors:
1. All Wall Switch Occupancy Sensors:
a. Description: Occupancy sensors designed for installation in standard wall box at standard wall switch mounting height with a field of view of 180 degrees, integrated manual control capability, and no leakage current to load in off mode.
b. Operation: Field selectable to operate either as occupancy sensor (automatic on/off) or as vacancy sensor (manual-on/automatic off).
c. Manual-Off Override Control: When used to turn off load while in automatic-on mode, unit to revert back to automatic mode after no occupant presence is detected during the delayed-off time interval.

C. Wall Dimmer Occupancy Sensors:
1. General Requirements:
a. Description: Occupancy sensors designed for installation in standard wall box at standard wall switch mounting height with a field of view of 180 degrees, integrated dimming control capability , and no leakage current to load in off mode.
b. Operation: Field selectable to operate either as occupancy sensor (automatic on/off) or as vacancy sensor (manual-on/automatic off).
c. Dimmer: Solid-state with continuous full-range even control following square law dimming curve, integral radio frequency interference filtering, power failure preset memory, air gap switch accessible without removing wall plate, and listed as complying with UL 1472; type and rating suitable for load controlled.

D. Ceiling Mounted Occupancy Sensors:
1. All Ceiling Mounted Occupancy Sensors:
a. Description: Low profile occupancy sensors designed for ceiling installation.

b. Occupancy sensor to be field selectable as either manual-on/automatic-off or automatic on/off.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install lighting control devices in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.

B. Coordinate locations of outlet boxes provided under Section 26 0533.16 as required for installation of lighting control devices provided under this section.

C. Install lighting control devices in accordance with manufacturer's instructions.

D. Unless otherwise indicated, connect lighting control device grounding terminal or conductor to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

E. Install lighting control devices plumb and level, and held securely in place.

F. Where required and not furnished with lighting control device, provide wall plate in accordance with Section 26 2726.

G. Provide required supports in accordance with Section 26 0529.

H. Where applicable, install lighting control devices and associated wall plates to fit completely flush to mounting surface with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.

I. Occupancy Sensor Locations:

1. Location Adjustments: Within the design intent, reasonably minor adjustments to locations may be made in order to optimize coverage and avoid conflicts or problems affecting coverage.
2. Locate dual technology passive infrared/ultrasonic occupancy sensors a minimum of 4 feet from air supply ducts or other sources of heavy air flow and as per manufacturer's recommendations, in order to minimize false triggers.

END OF SECTION 26 0923

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SECTION 26 2100
LOW-VOLTAGE ELECTRICAL SERVICE ENTRANCE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electrical service requirements.

1.02 RELATED REQUIREMENTS

A. Section 26 0526 - Grounding and Bonding for Electrical Systems.
B. Section 26 0529 - Hangers and Supports for Electrical Systems.
C. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

1.03 REFERENCE STANDARDS

A. IEEE C2 - National Electrical Safety Code(R) (NESC(R)) 2023.
B. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
C. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product. Include ratings, configurations, standard wiring diagrams, outline and support point dimensions, finishes, weights, service condition requirements, and installed features.

1.05 QUALITY ASSURANCE

A. Comply with the following:
   1. IEEE C2 (National Electrical Safety Code).
   2. NFPA 70 (National Electrical Code).
   3. The requirements of the Utility Company.

PART 2 PRODUCTS

2.01 ELECTRICAL SERVICE REQUIREMENTS

A. Provide new electrical service consisting of all required conduits, conductors, equipment, metering provisions, supports, accessories, etc. as necessary for connection between Utility Company point of supply and service entrance equipment.
B. Electrical Service Characteristics: As indicated on drawings.
C. Utility Company: As indicated on drawings.
D. Products Furnished by Contractor: Comply with Utility Company requirements.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install products in accordance with manufacturer's instructions and Utility Company requirements.

B. Perform work in accordance with NECA 1 (general workmanship).
C. Arrange equipment to provide minimum clearances and required maintenance access.
D. Provide required support and attachment components in accordance with Section 26 0529.
E. Provide grounding and bonding for service entrance equipment in accordance with Section 26 0526.
F. Identify service entrance equipment, including main service disconnect(s) in accordance with Section 26 0553.

END OF SECTION 26 2100

SECTION 26 2416
PANELBOARDS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Power distribution panelboards.
B. Lighting and appliance panelboards.
C. Overcurrent protective devices for panelboards.

1.02 RELATED REQUIREMENTS

A. Section 26 0526 - Grounding and Bonding for Electrical Systems.
B. Section 26 0529 - Hangers and Supports for Electrical Systems.

1.03 REFERENCE STANDARDS

A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service 2013e (Amended 2017).
B. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
C. NECA 407 - Standard for Installing and Maintaining Panelboards 2015.
D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.
E. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less 2013.
F. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
G. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations Current Edition, Including All Revisions.
H. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations Current Edition, Including All Revisions.
I. UL 67 - Panelboards Current Edition, Including All Revisions.
J. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide manufacturer's standard catalog pages and data sheets for panelboards, enclosures, overcurrent protective devices, and other installed components and accessories.

PART 2 PRODUCTS

2.01 PANELBOARDS - GENERAL REQUIREMENTS

A. Provide products listed, classified, and labeled as suitable for the purpose intended.
B. Short Circuit Current Rating:
   1. Provide panelboards with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.

C. Mains: Configure for top or bottom incoming feed as indicated or as required for the installation.
D. Branch Overcurrent Protective Devices: Replaceable without disturbing adjacent devices.
E. Bussing: Sized in accordance with UL 67 temperature rise requirements.
    1. Provide solidly bonded equipment ground bus in each panelboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.
F. Conductor Terminations: Suitable for use with the conductors to be installed.
G. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
    1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
    2. Boxes: Galvanized steel unless otherwise indicated.
        a. Provide wiring gutters sized to accommodate the conductors to be installed.
    3. Fronts:
        a. Finish for Painted Steel Fronts: Manufacturer's standard grey unless otherwise indicated.
    4. Lockable Doors: All locks keyed alike unless otherwise indicated.
H. Future Provisions: Prepare all unused spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.

2.02 OVERCURRENT PROTECTIVE DEVICES

A. Molded Case Circuit Breakers:
    1. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
    2. Interrupting Capacity:
        a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than:
            1) 10,000 rms symmetrical amperes at 240 VAC or 208 VAC.
            2) 14,000 rms symmetrical amperes at 480 VAC.
    3. Conductor Terminations:
        a. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
    4. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.
    5. Provide multi-pole circuit breakers for multi-wire branch circuits as required by NFPA 70.

PART 3 EXECUTION

3.01 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship).
B. Install products in accordance with manufacturer's instructions.
C. Install panelboards in accordance with NECA 407 and NEMA PB 1.1.
D. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
E. Provide required support and attachment in accordance with Section 26 0529.
F. Install panelboards plumb.
G. Mount panelboards such that the highest position of any operating handle for circuit breakers or switches does not exceed 79 inches above the floor or working platform.
H. Provide grounding and bonding in accordance with Section 26 0526.
I. Install all field-installed branch devices, components, and accessories.
J. Provide filler plates to cover unused spaces in panelboards.

END OF SECTION 26 2416

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SECTION 26 2726
WIRING DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wall switches.
B. Wall dimmers.
C. Receptacles.
D. Wall plates.

1.02 RELATED REQUIREMENTS

A. Section 26 0533.16 - Boxes for Electrical Systems.

1.03 REFERENCE STANDARDS

A. FS W-C-596 - Connector, Electrical, Power, General Specification for 2014h, with Amendments (2017).
B. FS W-S-896 - Switches, Toggle (Toggle and Lock), Flush-mounted (General Specification) 2014g, with Amendment (2017).
C. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
D. NECA 130 - Standard for Installing and Maintaining Wiring Devices 2016.
E. NEMA WD 1 - General Color Requirements for Wiring Devices 1999 (Reaffirmed 2020).
F. NEMA WD 6 - Wiring Devices - Dimensional Specifications 2016.
G. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
H. UL 20 - General-Use Snap Switches Current Edition, Including All Revisions.
I. UL 498 - Attachment Plugs and Receptacles Current Edition, Including All Revisions.
J. UL 514D - Cover Plates for Flush-Mounted Wiring Devices Current Edition, Including All Revisions.
K. UL 943 - Ground-Fault Circuit-Interrupters Current Edition, Including All Revisions.
L. UL 1472 - Solid-State Dimming Controls Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.

PART 2 PRODUCTS

2.01 WIRING DEVICE APPLICATIONS

A. Provide weather resistant GFCI receptacles with specified weatherproof covers for receptacles installed outdoors or in damp or wet locations.
B. Provide GFCI protection for receptacles installed within 6 feet of sinks.
C. Provide GFCI protection for receptacles installed in kitchens.
D. Provide GFCI protection for receptacles serving electric drinking fountains.

2.02 WIRING DEVICE FINISHES

A. Provide wiring device finishes as described below unless otherwise indicated.
B. Wiring Devices, Unless Otherwise Indicated: White with gray stainless steel wall plate.
C. Wiring Devices Installed in Finished Spaces: White with white stainless steel wall plate.
D. Wiring Devices Installed in Unfinished Spaces: Gray with galvanized steel wall plate.

2.03 WALL SWITCHES

A. Wall Switches - General Requirements: AC only, quiet operating, general-use snap switches with silver alloy contacts, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 20 and where applicable, FS W-S-896; types as indicated on the drawings.
   1. Wiring Provisions: Terminal screws for side wiring and screw actuated binding clamp for back wiring with separate ground terminal screw.
B. Standard Wall Switches: Industrial specification grade, 20 A, 120/277 V with standard toggle type switch actuator and maintained contacts; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.
C. Locking Wall Switches: Industrial specification grade, 20 A, 120/277 V with lever type keyed switch actuator and maintained contacts; switches keyed alike; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.

2.04 WALL DIMMERS

A. Wall Dimmers - General Requirements: Solid-state with continuous full-range even control following square law dimming curve, integral radio frequency interference filtering, power failure preset memory, air gap switch accessible without removing wall plate, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 1472; types and ratings suitable for load controlled as indicated on the drawings.

2.05 RECEPTACLES

A. Receptacles - General Requirements: Self-grounding, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498, and where applicable, FS W-C-596; types as indicated on the drawings.
   1. Wiring Provisions: Terminal screws for side wiring or screw actuated binding clamp for back wiring with separate ground terminal screw.
   2. NEMA configurations specified are according to NEMA WD 6.
B. Convenience Receptacles:
   1. Standard Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R; single or duplex as indicated on the drawings.

2. Weather Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations; single or duplex as indicated on the drawings.

C. GFCI Receptacles:
1. GFCI Receptacles - General Requirements: Self-testing, with feed-through protection and light to indicate ground fault tripped condition and loss of protection; listed as complying with UL 943, class A.
a. Provide test and reset buttons of same color as device.
2. Standard GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style.
3. Weather Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations.

2.06 WALL PLATES

A. Wall Plates: Comply with UL 514D.
1. Configuration: One piece cover as required for quantity and types of corresponding wiring devices.
2. Screws: Metal with slotted heads finished to match wall plate finish.

B. Stainless Steel Wall Plates: Brushed satin finish, Type 302 stainless steel.

C. Weatherproof Covers for Damp Locations: Gasketed, cast aluminum, with self-closing hinged cover and corrosion-resistant screws; listed as suitable for use in wet locations with cover closed.

D. Weatherproof Covers for Wet or Damp Locations: Gasketed, cast aluminum, with hinged lockable cover and corrosion-resistant screws; listed as suitable for use in wet locations while in use with attachment plugs connected and identified as extra-duty type.

PART 3 EXECUTION

3.01 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.

B. Coordinate locations of outlet boxes provided under Section 26 0533.16 as required for installation of wiring devices provided under this section.

C. Install wiring devices in accordance with manufacturer's instructions.

D. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

E. Where required, connect wiring devices using pigtails not less than 6 inches long. Do not connect more than one conductor to wiring device terminals.
F. Connect wiring devices by wrapping conductor clockwise 3/4 turn around screw terminal and tightening to proper torque specified by the manufacturer. Where present, do not use push-in pressure terminals that do not rely on screw-actuated binding.
G. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
H. Install wiring devices plumb and level with mounting yoke held rigidly in place.
I. Install wall switches with OFF position down.
J. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.
K. Do not share neutral conductor on branch circuits utilizing wall dimmers.
L. Install vertically mounted receptacles with grounding pole on top and horizontally mounted receptacles with grounding pole on left.
M. Install wall plates to fit completely flush to wall with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.
N. Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use.

END OF SECTION 26 2726

SECTION 26 2816.16
ENCLOSED SWITCHES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Enclosed safety switches.

1.02 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.
C. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
D. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations Current Edition, Including All Revisions.
E. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations Current Edition, Including All Revisions.
F. UL 98 - Enclosed and Dead-Front Switches Current Edition, Including All Revisions.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide manufacturer's standard catalog pages and data sheets for enclosed switches and other installed components and accessories.

PART 2 PRODUCTS

2.01 ENCLOSED SAFETY SWITCHES

A. Description: Quick-make, quick-break enclosed safety switches listed and labeled as complying with UL 98; heavy duty; ratings, configurations, and features as indicated on the drawings.
B. Provide products listed, classified, and labeled as suitable for the purpose intended.
C. Horsepower Rating: Suitable for connected load.
D. Voltage Rating: Suitable for circuit voltage.
E. Short Circuit Current Rating:
    1. Provide enclosed safety switches, when protected by the fuses or supply side overcurrent protective devices to be installed, with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.
F. Provide with switch blade contact position that is visible when the cover is open.
G. Conductor Terminations: Suitable for use with the conductors to be installed.
H. Provide solidly bonded equipment ground bus in each enclosed safety switch, with a suitable lug for terminating each equipment grounding conductor.
I. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.

1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:

J. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide required support and attachment in accordance with Section 26 0529.

E. Install enclosed switches plumb.

F. Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed switches such that the highest position of the operating handle does not exceed 79 inches above the floor or working platform.

G. Provide grounding and bonding in accordance with Section 26 0526.

END OF SECTION 26 2816.16

SECTION 26 5100
INTERIOR LIGHTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Interior luminaires.
B. Emergency lighting units.
C. Exit signs.

1.02 RELATED REQUIREMENTS

A. Section 26 0529 - Hangers and Supports for Electrical Systems.
B. Section 26 0533.16 - Boxes for Electrical Systems.

1.03 REFERENCE STANDARDS

A. NECA/IESNA 500 - Standard for Installing Indoor Lighting Systems 2006.
B. NECA/IESNA 502 - Standard for Installing Industrial Lighting Systems 1999 (Reaffirmed 2006).
C. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
D. NFPA 101 - Life Safety Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
E. UL 924 - Emergency Lighting and Power Equipment Current Edition, Including All Revisions.
F. UL 1598 - Luminaires Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, installed accessories, and ceiling compatibility; include model number nomenclature clearly marked with all proposed features.

PART 2 PRODUCTS

2.01 LUMINAIRE TYPES

A. Furnish products as indicated in luminaire schedule included on the drawings.

2.02 LUMINAIRES

A. Provide products that comply with requirements of NFPA 70.
B. Provide products that are listed and labeled as complying with UL 1598, where applicable.
C. Provide products listed, classified, and labeled as suitable for the purpose intended.

D. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.
E. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, supports, trims, accessories, etc. as necessary for a complete operating system.
F. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.

2.03 EMERGENCY LIGHTING UNITS

A. Description: Emergency lighting units complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.
B. Operation: Upon interruption of normal power source or brownout condition exceeding 20 percent voltage drop from nominal, solid-state control automatically switches connected lamps to integral battery power for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.
C. Battery:
    1. Size battery to supply all connected lamps, including emergency remote heads where indicated.
D. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation.
E. Provide low-voltage disconnect to prevent battery damage from deep discharge.

2.04 EXIT SIGNS

A. Description: Exit signs complying with NFPA 101 and applicable state and local codes, and listed and labeled as complying with UL 924.
    1. Number of Faces: Single- or double-face as indicated or as required for installed location.
    2. Directional Arrows: As indicated or as required for installed location.

PART 3 EXECUTION

3.01 INSTALLATION

A. Coordinate locations of outlet boxes provided under Section 26 0533.16 as required for installation of luminaires provided under this section.
B. Install products in accordance with manufacturer's instructions.
C. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 500 (commercial lighting) and NECA 502 (industrial lighting).
D. Provide required support and attachment in accordance with Section 26 0529.
E. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.

F. Install accessories furnished with each luminaire.
G. Bond products and metal accessories to branch circuit equipment grounding conductor.
H. Emergency Lighting Units:
    1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.
I. Exit Signs:
    1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.
J. Install lamps in each luminaire.

END OF SECTION 26 5100

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SECTION 26 5600
EXTERIOR LIGHTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Exterior luminaires.

1.02 RELATED REQUIREMENTS

A. Section 26 0529 - Hangers and Supports for Electrical Systems.
B. Section 26 0533.16 - Boxes for Electrical Systems.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
B. NECA/IESNA 501 - Standard for Installing Exterior Lighting Systems 2000 (Reaffirmed 2006).
C. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
D. UL 1598 - Luminaires Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, weight, effective projected area (EPA), and installed accessories; include model number nomenclature clearly marked with all proposed features.

PART 2 PRODUCTS

2.01 LUMINAIRE TYPES

A. Furnish products as indicated in luminaire schedule included on the drawings.

2.02 LUMINAIRES

A. Provide products that comply with requirements of NFPA 70.
B. Provide products that are listed and labeled as complying with UL 1598, where applicable.
C. Provide products listed, classified, and labeled as suitable for the purpose intended.
D. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.
E. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, poles, foundations, supports, trims, accessories, etc. as necessary for a complete operating system.
F. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.

PART 3 EXECUTION

3.01 INSTALLATION

A. Coordinate locations of outlet boxes provided under Section 26 0533.16 as required for installation of luminaires provided under this section.
B. Install products in accordance with manufacturer's instructions.
C. Install luminaires in accordance with NECA/IESNA 501.
D. Provide required support and attachment in accordance with Section 26 0529.
E. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.
F. Install accessories furnished with each luminaire.
G. Bond products and metal accessories to branch circuit equipment grounding conductor.
H. Install lamps in each luminaire.

END OF SECTION 26 5600

SECTION 270000
COMMUNICATIONS

PART 1 GENERAL

1.01 GENERAL REQUIREMENTS

A. Applicable requirements of General Requirements/Provisions shall be considered a part of this section and shall have the same force as if printed herein full. In addition, all information related to communications infrastructure that is documented in the architectural, structural, mechanical, and electrical drawings/documents shall be included as part of the Communications documents.

1.02 QUALITY ASSURANCE

A. Specifications, Standards and Codes: All work shall be in accordance with the following:
   1. The 2017 edition of the National Electrical Code (NFPA 70)
   2. American National Standards Institute (ANSI)
   3. National Electrical Manufacturers Association (NEMA)
   4. Telecommunications Industries Association (TIA)
   5. Electronic Industries Association (EIA)
   6. Institute of Electrical & Electronics Engineers (IEEE)
   7. Underwriters Laboratories (UL)
   8. American Standards Association (ASA)
   9. Federal Communications Commission (FCC)
   10. Occupational Safety and Health Administration (OSHA)
   11. American Society of Testing Material (ASTM)
   12. Americans with Disabilities Act (ADA)
   13. Local city and county ordinances governing electrical work
   14. In the event of conflicts, the more stringent provisions shall apply

1.03 SCOPE

A. The work to be done under this section of the Specifications shall include furnishing labor, material, equipment and tools required for the complete installation of the work indicated on the Drawings or as specified herein.

B. All materials, obviously a part of the Communications Infrastructure and necessary to its proper operation, but not specifically mentioned or shown on the Drawings, shall be furnished and installed without additional charge.

C. The Drawings and Specifications are complementary to each other and what is called for by one shall be as binding as if called for by both. If a discrepancy exists between the Drawing and Specifications, the higher cost shall be included, and the engineer shall be notified of the discrepancy.

1.04 WORK INCLUDED

A. The Communications Infrastructure installed and work performed under this Division of the Specifications shall include but not necessarily be limited to the following:
B. Structured Cabling Infrastructure
C. Communications conduits, raceways, cable tray, racks, cabinets and equipment mounting boards
D. Grounding and Bonding
E. Underground raceway excavation, backfill, and compaction
F. Concrete work for duct banks, maintenance holes, handholes, vaults and restoration (where applicable)

1.05 DEFINITIONS

A. Terms: The following definitions of terms supplement those of the General Requirements and are applicable to Division 27 - Communications:
B. Provide: As used herein shall mean “furnish, install and test (if applicable) complete.”
C. Infrastructure: As used herein shall mean cable, conduit, raceway, cable tray or j-hooks with all required boxes, fittings, connectors, and accessories; completely installed.
D. Work: As used herein shall be understood to mean the materials completely installed, including the labor involved.

1.06 DRAWINGS

A. Drawings are generally diagrammatic and show the arrangement and location of pathways, outlets, support structures and equipment. The Contractor shall carefully investigate the structural and finish conditions affecting his work and arrange his work accordingly. Should conditions on the job make it necessary to make adjustments to pathways or materials, the Contractor shall so advise the Engineer and secure approval before proceeding with such work.
B. Where exact locations are required by equipment for stubbing-up and terminating conduit concealed in floor slabs, the Contractor shall request shop drawings, equipment location drawings, foundation drawings, and any other data required by him to locate the concealed conduit before the floor slab is poured.
C. Materials, equipment or labor not indicated but which can be reasonably inferred to be necessary for a complete installation shall be provided. Drawings and Specifications do not undertake to indicate every item of material, equipment, or labor required to produce a complete and properly operating installation.
D. The right is reserved to make reasonable changes in locations of equipment indicated on Drawings prior to rough-in without increase in contract cost.
E. The Contractor shall not reduce the size or number of conduit runs indicated on the Drawings without the written approval of the Engineer.

F. Any work installed contrary to Contract Drawings shall be subject to change as directed by the Engineer, and no extra compensation will be allowed for making these changes.

G. The location of equipment, support structures, outlets, and similar devices shown on the Drawings are approximate only. Do not scale Drawings. Obtain layout dimensions for equipment from Architectural plans unless indicated on Communications plans.

H. Schematic diagrams shown on the Drawings indicate the required functions only. The technology of a particular manufacturer may be used to accomplish the functions indicated without exact adherence to the schematic Drawings shown. Additional labor and materials required for such deviations shall be furnished at the Contractor's expense.

I. Verify the ceiling type, ceiling suspension systems, and clearance above hung ceilings prior to ordering cabling and associated hardware. Notify the Engineer of any discrepancies.

J. Review all architectural drawings for modular furniture.

K. Portions of these Drawings and Specifications are abbreviated and may include incomplete sentences. Omissions of words or phrases such as “the Contractor shall,” “shall be,” “as indicated on the Drawings,” “In accordance with,” “a,” “the” and “all are intended” shall be supplied by inference.

1.07 SUBMITTALS

A. Submit for approval, details of all materials, equipment and systems to be furnished. Work shall not proceed without the Owner and/or the Project Manager's approval of the submitted items. Three (3) copies of the following shall be submitted:

1. Submittals for individual systems and equipment assemblies that consist of more than one item or component shall be made for the system or assembly as a whole. Partial submittals will not be considered, reviewed or stored, and such submittals will not be returned except at the request and expense of the Contractor.

1. Contractor shall generate shop drawings. Modify reviewed and accepted shop drawings to include revisions based upon completion of work. Submit shop drawings with record drawings on hard copy.

2. Shop drawings shall include equipment racks, patch panels, termination blocks, connection details, rack mounting details and any other details not included in the construction drawings.

B. Any materials and equipment listed that are not in accordance with Specification requirements may be rejected.

C. The approval of material, equipment, systems and shop drawings is a general approval subject to the Drawings, Specifications and verification of all measurements at the job.

Approval does not relieve the Contractor from the responsibility of shop drawing errors. The Contractor shall carefully check and correct all shop drawings prior to submission for approval.

D. Refer to spec section 27080 for close out requirements.

1.08 QUALITY ASSURANCE

A. Equipment and materials required for installation under these Specifications shall be the current model and new (less than one [1] year from the date of manufacture), unused and without blemish or defect.

B. Equipment shall bear labels attesting to Underwriters Laboratories, where subject to label service. Manufacturers of equipment and materials pertinent to these items shall have been engaged in the manufacture of said equipment a minimum of three (3) years and, if so directed by the Owner, be able to furnish proof of their ability by submitting affidavits and descriptive data about their product including size and magnitude comparable to requirements specified herein.

1.09 CONTRACTOR QUALIFICATIONS

A. The Contractor shall have total responsibility for the coordination and installation of the work shown and described in the Drawings and Specifications. The Contractor shall be a company specializing in the design, fabrication and installation of integrated communications systems.

B. Communications Systems specified shall be installed under the direction of a qualified Contractor. Qualification requirements shall include submittal by the Contractor to the Owner of the following:

1. List of previous projects of this scope, size and nature; including names and sizes of projects, description of work, and time of completion and names of contact persons for reference.

1. Shall certify that they are manufacturer-authorized for work to be performed. Submit Certifications with qualification certification package.
2. Shall certify that contractor has employed at least one (1) full-time Registered Communications Distribution Designer (RCDD). Submit certification with qualification certification package.

1.10 COORDINATION WITH OTHER TRADES

A. The Contractor shall coordinate communications work with that of other sections as required to ensure that the entire communications work will be carried out in an orderly, complete and coordinated fashion.

1.11 SITE INVESTIGATION

A. Prior to submitting bids of the project, visit the site of the work to become aware of existing conditions that may affect the cost of the project. Where work under this project requires extension, relocation, reconnections or modifications to existing

equipment or systems, the existing equipment or systems, shall be restored to their original condition before the completion of this project.

1.12 PERMITS

A. Obtain all permits and inspections for the installation of this work and pay all charges incident thereto. Deliver to the Owner all certificates of said inspection issued by authorities having jurisdiction.

PART 2 PRODUCTS

2.01 SUBSTITUTIONS

A. Product substitutions are not allowed unless noted as, “Or Approved Equal (by Owner).” The Engineer's decision as to whether the submitted equipment is acceptable shall be final and binding.

B. All changes necessary to accommodate the substituted equipment shall be made at the Contractor's expense, and shall be as approved by the Engineer. Detailed drawings indicating the required changes shall be submitted for approval at the time the substitution is requested. Follow division 0 and division 1 in submitting substitution request.

C. If substitutions are made in lieu of device specified; form, dimension, design and profile shall be submitted to the Engineer for approval.

D. Submit request for approval of substitute materials in writing to the Owner and Engineer at least ten days prior to bid opening.

2.02 MATERIALS

A. All materials used in this work shall be new and shall bear the inspection label of Underwriters' Laboratories Inc. or certification by other recognized laboratory.

B. The published standards and requirements of the Telecommunications Industries Association (TIA), National Electrical Manufacturers Association (NEMA), the American National Standard Institute (ANSI), the Institute of Electrical and Electronic Engineers (IEEE), and the American Society of Testing Materials (ASTM), are made a part of these Specifications and shall apply wherever applicable.

C. Materials and equipment furnished shall be of current production by manufacturers regularly engaged in the manufacture of such items, for which replacement parts are available.

D. When more than one unit of the same class of equipment or material is required, such units shall be the products of a single manufacturer or partner manufacturers that offer a certified solution.

E. Components of an assembled unit need not be products of the same manufacturer, but must offer a certified end-to-end solution.

F. Manufacturers of equipment assemblies, which include components made by others, shall assume complete responsibility for the final assembled unit.

G. Components shall be compatible with each other and with the total assembly for the intended service.

PART 3 EXECUTION

3.01 EXAMINATION OF CONDITIONS

A. Prior to the start of work, the Contractor shall carefully inspect the installed work of other trades and verify that such work is complete to the point where installation may properly commence. Start of work indicates acceptance of conditions.

B. Install equipment in accordance with applicable codes and regulations, the original design and the referenced standards.

C. In the event of a discrepancy, immediately notify the Project Manager.

D. Do not proceed with installation until unsatisfactory conditions and discrepancies have been fully resolved.

3.02 PROTECTION OF SYSTEMS AND EQUIPMENT

A. Protect materials and equipment from damage during storage at the site and throughout the construction period. Equipment and materials shall be protected during shipment and storage against physical damage, dirt, theft, moisture, extreme temperature and rain.

B. Damage from rain, dirt, sun and ground water shall be prevented by storing the equipment on elevated supports and covering the sides with securely fastened protective rigid or flexible waterproof coverings.

C. During installation, equipment shall be protected against entry of foreign matter on the inside and be vacuum cleaned both inside and outside before testing, operating or painting.

D. As determined by the Project Manager, damaged equipment shall be fully repaired or shall be removed and replaced with new equipment to fully comply with requirements of the Contract Documents. Decision of the Project Manager shall be final.

E. Damaged paint on equipment and materials shall be repainted with painting equipment and finished with the same quality of paint and workmanship as used by the manufacturer.

3.03 ACCESS TO EQUIPMENT

A. Equipment shall be installed in location and manner that will allow convenient access for maintenance and inspection.

B. Working spaces shall be not less than specified in the National Electrical Code (NEC) for voltages specified.

C. Where the Project Manager determines that the Contractor has installed equipment not conveniently accessible for operation and maintenance, equipment shall be removed and reinstalled, one time only, as directed by the Project Manager, at no additional cost to the Owner. “Conveniently accessible” is defined as being capable of

being reached without the use of ladders or without climbing or crawling under or over obstacles such as motors, pumps, belt guards, transformers, piping and duct work.

3.04 CLEANING

A. During construction, and prior to Owner acceptance of the building, remove from the premises and dispose of packing material and debris caused by communications work.
B. Remove dust and debris from interiors and exteriors of electrical equipment. Clean accessible current carrying elements prior to being energized.

3.05 COMPLETION

A. General: Upon completion of the work, remove excess debris, materials, equipment, apparatus, tools and similar items. Leave the premises clean, neat and orderly.
B. Results Expected: Systems shall be complete and operational and controls shall be set and calibrated. Testing, start-up and cleaning work shall be complete.
C. Maintenance Materials: Special tools for proper operation and maintenance of the equipment provided under this Specification shall be delivered to the Owner.

3.06 TESTING AND VERIFICATION

A. See specific Division 27 sections for testing parameters of sub-systems.
B. The Contractor shall verify that requirements of this Specification are met. Verification shall be through a combination of analyses, inspections, demonstrations and tests, as described below.
C. Verification by inspection includes examination of items and comparison of pertinent characteristics against the qualitative or quantitative standard set forth in the Specifications. Inspection may require moving or partially disassembling the item to accomplish the verification, included as part of the work at no additional cost to the Owner.
D. The Contractor shall verify by formal demonstrations or tests that the requirements of this Specification have been met. The Contractor shall demonstrate that the communications systems, components and subsystems meet Specification requirements in the “as-installed” operating environment during the “System Operation Test.” Even though no formal environmental testing is required, the Contractor shall measure and record temperature, humidity and other environmental parameters and the environmental conditions, which were encountered during the “System Operation Test.”
E. The Contractor shall carefully plan and coordinate the final acceptance tests so that tests can be satisfactorily completed. The Contractor shall provide necessary instruments, labor and materials required for tests, including the equipment manufacturer's technical representative and qualified technicians in sufficient numbers to perform the tests within a reasonable time period.

F. The Contractor shall satisfy all items detailed in the final acceptance check-off list (punch list). The list shall be a complete representation of specified installation requirements. At the time of final acceptance punch list items shall be corrected until the system is found to be acceptable to the Owner and the Project Manager.

G. After the Contractor systems have been installed and tested, the completed test plan shall be signed by the Communications Contractor Project Manager and submitted for approval.

END OF SECTION 270000

SECTION 27 0510

FIRESTOPPING FOR COMMUNICATIONS SYSTEMS

PART 1 GENERAL

1.01 GENERAL REQUIREMENTS

A. Applicable requirements of Division 27 - Communications shall be considered a part of this section and shall have the same force as if printed herein full.

B. This document describes the products and execution requirements relating to Firestopping for Communications Systems.

C. Product specifications, general design considerations, and installation guidelines are provided in this document. The successful vendor shall meet or exceed all requirements described in this document and on the drawings.

1.02 SUBMITTALS

A. Provide product data from manufacturer's specifications.

1.03 WORK INCLUDED

A. The work included under this Specification consists of furnishing all labor, equipment, materials, supplies and performing all operations necessary to complete the installation. The Contractor will provide and install all of the required material whether specifically addressed in the Specification or not.

PART 2 PRODUCTS

2.01 APPROVED PRODUCTS

A. Approved Firestopping Manufacturer(s)

1. Hilti (Firestop Devices, Putties, Caulks, Sealants, etc.)
2. STI Firestop Products (Firestop Devices, Putties, Caulks, Sealants, etc.)
3. 3M Firestop Products (Firestop Devices, Putties, Caulks, Sealants, etc.)
4. Flamestopper Thru-Wall Fitting - Wiremold Company (Firestop Devices)
5. Unique Firestop Products (Firestop Devices)

2.02 TYPES OF PRODUCTS

A. Sealants

1. Intumescent Firestop Sealants and Caulks
2. Latex Firestop Sealant
3. Acrylic Water-Based Sealant
4. Silicone Firestop Sealants and Caulks
5. Firestop Putty
6. Firestop Collars
7. Firestop Sleeves
8. Wrap Strips
9. 2-Part Silicone Firestop Foam
10. Firestop Mortar

11. Firestop Pillows
12. Elastomeric Spray
13. Accessories:
14. Forming/Damming Materials: Mineral fiberboard or other types as per manufacturer recommendation

B. Firestop Devices
   1. Thru-Wall Fitting
      a. The firestop device box shall be constructed of 16 gauge G90 steel.
      b. The firestop device intumescent block shall be constructed of a graphite base material with expansion starting at 375°F and an unrestrained expansion between 6 to 12 times. The intumescent block shall be held securely by the box in order to prevent tampering and damage during installation.
      c. The firestop device shall have doors which can be adjusted to prevent materials from penetrating the device if the device is empty or completely full. The doors shall be constructed of 16 gage G90 steel with No. 10-32 screws use to adjust opening size.
      d. The firestop device shall be available for 2" and 4" trade size EMT conduit.
      e. The firestop device shall be available in safety yellow powder coat, custom colors and an unpainted galvanized finish.
   2. Threaded Firestop Device
      a. Threaded steel sleeve device incorporating flat washers secured by threaded device shall be installed around cables. The device shall be available in 1, 2 and 4-inch sizes. Maximum diameter of the wall penetration for 1, 2 and 4-inch sizes shall be 1-1/4, 2-7/16 and 4-1/2 inches respectively. All sleeve devices to be provided with gang plates. Size gang plate per number of sleeves. Utilize manufacturer specific gang plate per sleeves installed.
   3. Smooth Firestop Device
      a. Smooth steel sleeve device incorporating flat washers secured by sliding compression couplers. The device shall be available in 1, 2 and 4-inch sizes. Maximum diameter of the wall penetration for 1, 2 and 4-inch sizes shall be 1-1/4, 2-7/16 and 4-1/2 inches respectively. All sleeve devices to be provided with gang plates. Size gang plate per number of sleeves. Utilize manufacturer specific gang plate per sleeves installed.
   4. Split-Sleeve Firestop Device
      a. Threaded steel sleeve halves incorporating split couplings and slotted washers to fit the specific diameter of the opening. The device shall be available in 1, 2 and 4-inch sizes. Maximum diameter of the wall penetration for 1, 2 and 4-inch sizes shall be 1-1/4, 2-7/16 and 4-1/2 inches respectively.

All sleeve devices to be provided with gang plates. Size gang plate per number of sleeves. Utilize manufacturer specific gang plate per sleeves installed.

b. Sleeves shall be capable of being sealed with built-in intumescent mesh.

5. Fire Rated Cable Pathway
   a. Fire rated cable pathway device modules shall be comprised of steel raceway with intumescent foam pads allowing 0-100 percent cable fill.

2.03 UL CLASSIFICATION

A. Thru-Wall Fitting - The firestop device for use in through-penetration firestop systems shall have been examined and tested by Underwriters Laboratories Inc. to UL1479 (ASTM E 814) and bear the U.S. and Canadian UL Classification Mark.

B. Threaded, Smooth and Split-Sleeve Firestop Devices - Firestopping sealants and devices shall be used together as a firestop system. All firestop systems shall bear a UL Classification system number. UL Classification system numbers are as follows:
   1. Threaded Firestop System
      a. Block Wall - W-J-3049
      b. Dry Wall - W-L-3138
   2. Threaded Firestop System (Vertical)
      a. Slab - F-A-3010
   3. Smooth Firestop System
      a. Block Wall - W-J-3048
      b. Dry Wall - W-L-3137
   4. Split-Sleeve Firestop System
      a. Block Wall - W-J-3047
      b. Dry Wall - W-L-3136

2.04 FIRESTOPPING SYSTEMS

A. Thru-Wall Fitting Firestop System:
   1. The device shall be classified for use in one-, two-, three, and four-hour rated gypsum, concrete and block walls and provide a maximum L rating of six cfm. The devices shall also been tested by Underwriters Laboratories Inc. to UL2043 and determined to be suitable for use in air handling spaces.

B. Threaded, Smooth and Split-Sleeve Firestop Systems:
   1. Shall conform to both Flame (F) and Temperature (T) ratings as required by local building codes and as tested by nationally accepted test agencies per ASTM E814 or UL 1479 fire tests in a configuration that is representative of field conditions.
   2. The F rating must be a minimum of one (1) hour but not less than the fire resistance rating of the assembly being penetrated. T rating when required by code authority shall be based on measurement of the temperature rise on

penetrating item(s). The fire test shall be conducted with a minimum positive pressure differential of 0.01 inches of water column.

3. For joints, must be tested to UL 2079 with movement capabilities equal to those of the anticipated conditions.

C. Firestopping materials and systems must be capable of closing or filling through-openings created by 1) the burning or melting of combustible pipes, cable jacketing, or pipe insulation materials, or 2) deflection of sheet metal due to thermal expansion (electrical & mechanical duct work).

D. Firestopping material shall be asbestos and lead free and shall not incorporate nor require the use of hazardous solvents.

E. Firestopping sealants must be flexible, allowing for normal pipe movement.

F. Firestopping materials shall not shrink upon drying as evidenced by cracking or pulling back from contact surfaces.

G. Firestopping materials shall be moisture resistant, and may not dissolve in water after curing.

PART 3 EXECUTION

3.01 CONDITIONS REQUIRING FIRESTOPPING

A. General

1. Provide firestopping for conditions specified whether or not firestopping is indicated, and if indicated, whether such material is designed as insulation, safing, or otherwise.

B. Through-Penetrations

1. Firestopping shall be installed in all open penetrations and in the annular space in all penetrations in any bearing or non-bearing fire-rated barrier.

C. Membrane-Penetrations

1. Where required by code, all membrane-penetrations in rated walls shall be protected with firestopping products that meet the requirements of third party time/temperature testing.

D. Construction Joints/Gaps

1. Firestopping shall be provided between the edges of floor slabs and exterior walls, between the tops of walls and the underside of floors, in the control joint in masonry walls and floors and in expansion joints.

E. Smoke-Stopping

1. As required by the other sections, smoke-stops shall be provided for through-penetrations, membrane-penetrations, and construction gaps with a material approved and tested for such application.

3.02 EXAMINATION

A. Examine the areas and conditions where firestops are to be installed and notify the Design Professional of conditions detrimental to the proper and timely completion of the work. Do not proceed with work until unsatisfactory conditions have been corrected.
B. Verify that environmental conditions are safe and suitable for installation of firestop products.
C. Verify that all pipes, conduit, cable, and other items that penetrate fire-rated construction have been permanently installed prior to installation of firestops.

3.03 INSTALLATION

A. General
   1. Installation of firestops shall be performed by an applicator/installer qualified and trained by the manufacturer. Installation shall be performed in strict accordance with manufacturer's detailed installation procedures.
   2. Apply firestops in accordance with fire test reports, fire resistance requirements, acceptable sample installations, and manufacturer's recommendations.
   3. Unless specified and approved, all insulation used in conjunction with through-penetrants shall remain intact and undamaged and may not be removed.
   4. Seal holes and penetrations to ensure an effective smoke seal.
   5. In areas of high traffic, protect firestopping materials from damage. If the opening is large, install firestopping materials capable of supporting the weight of a human.
   6. Insulation types specified in other sections shall not be installed in lieu of firestopping material specified herein.
   7. All combustible penetrants (e.g. non-metallic pipes or insulated metallic pipes) shall be firestopped using products and systems tested in a configuration representative of the field condition.
B. Dam Construction
   1. When required to properly contain firestopping materials within openings, damming or packing materials may be utilized. Combustible damming material must be removed after appropriate curing. Noncombustible damming materials may be left as a permanent component of the firestop system.

3.04 FIELD QUALITY CONTROL

A. Prepare and install firestopping systems in accordance with manufacturer's printed instructions and recommendations.
B. Follow safety procedures recommended in the Material Safety Data Sheets.
C. Finish surfaces of firestopping that are to remain exposed in the completed work to a uniform and level condition.

D. All areas of work must be accessible until inspection by the applicable Code Authorities.
E. Correct unacceptable firestops and provide additional inspection to verify compliance with this Specification.

3.05 CLEANING

A. Remove spilled and excess materials adjacent to firestopping without damaging adjacent surfaces.
B. Leave finished work in a neat and clean condition with no evidence of spill-overs or damage to adjacent surfaces.

3.06 IDENTIFICATION

A. Refer to Section 27 0553 - Identification for Communications Systems for labeling details.

END OF SECTION 27 0510

SECTION 27 0526 - GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

PART 1 GENERAL

1.01 GENERAL REQUIREMENTS

A. Applicable requirements of Division 27 - Communications shall be considered a part of this section and shall have the same force as if printed herein full.

B. This document describes the products and execution requirements relating to Grounding and Bonding for Communications Systems.

1. Product specifications, general design considerations, and installation guidelines are provided in this document. The successful vendor shall meet or exceed all requirements described in this document and on the drawings.

1.02 SUBMITTALS

A. Provide product data from the manufacturer's specifications.

1.03 WORK INCLUDED

A. The work included under this Specification consists of furnishing all labor, equipment, materials, supplies and performing all operations necessary to complete the installation. The Contractor will provide and install all of the required material whether specifically addressed in the Specification or not.

B. The work shall include, but not be limited to the following:

1. Furnish and install all Grounding Conductors.
2. Furnish and install all Grounding Lugs and Hardware.

C. A licensed electrical contractor shall perform installation and termination of the main bonding conductor to the building service entrance ground.

PART 2 PRODUCTS

2.01 APPROVED PRODUCTS

A. Approved Equipment Grounding Conductor Manufacturer(s)

1. Southwire
2. West Penn
3. Belden

B. Approved Grounding Lug Manufacturer(s)

1. Burndy
2. Thomas & Betts
3. Chatsworth Products, Inc.
4. Harger
5. Hubbell

C. Approved Grounding Busbar Manufacturer(s)

1. Chatsworth Products, Inc.
2. Hubell
3. Thomas & Betts

4. Burndy
5. Harger

2.02 GROUNDING CONDUCTORS

A. Grounding Conductor
   1. Construction shall be Type THHN copper conductors, insulated with heat and moisture resistant PVC over which a UL listed jacket is applied.
   2. Jacket color shall be green.

2.03 GROUNDING LUGS

A. Grounding Lugs and Hardware
   1. Grounding lugs shall be 2-hole and installed with a crimper that when properly executed the die of the crimper impresses the die # on the lug base. All lugs shall be sleeved with clear heat-shrink to allow for inspection of the crimp. Silicon bronze or stainless-steel bolts and washers shall be used to install lugs to equipment. Exothermic welding is also allowed.

2.04 GROUNDING BUSBARS

A. Grounding Busbar
   1. The grounding busbar shall be made of 1/4" thick solid copper, pre-drilled.
   2. The grounding busbar shall be installed with minimum clearance, 1" offsets and 1-1/2" insulators.
   3. The grounding busbar shall be pre-drilled and accommodate 2-hole compression lugs.
   4. The grounding busbar shall meet or exceed ANSI/TIA-607-C requirements.
   5. TMGB shall be minimum .25” thick by 4” wide and minimum 20” Length. Size Length of Busbar to accommodate all required grounding connections.
   6. TGB shall be minimum .25” thick by 2” wide and minimum 12” Length. Size Length of Busbar to accommodate all required grounding connections.
   7. All Grounding Busbars must be approved BICSI & ANSI/EIA/TIA Grounding Busbars.

PART 3 EXECUTION

3.01 GROUNDING

A. The facility shall be equipped with a Telecommunications Bonding Backbone (TBB). This backbone shall be used to ground all communications cable shields, equipment, racks, cabinets, raceways, and other associated hardware that has the potential to act as a current-carrying conductor. The TBB shall be installed independent of the building's electrical and building ground and shall be designed in accordance with the recommendations contained in the ANSI/TIA-607-C Telecommunications Bonding and Ground Standard. The Telecommunications Bonding Backbone shall be a continuous conductor, not daisy-chained or segmented in any way.

B. The main entrance facility/equipment room in each building shall be equipped with a telecommunications main grounding busbar (TMGB). Each telecommunications room (TR) shall be provided with a telecommunications ground busbar (TGB). The TMGB shall be connected with a Telecommunications Bonding Conductor (TBC) to ac grounding electrode system via the ac main service entrance panelboard. The TBC should always be as short as possible and never be longer than 30 ft.

C. The Telecommunications Bonding Backbone(s) shall be connected on the top floor and every third floor between the top and bottom floor with a Backbone Bonding Conductor (BBC). The BBC shall be sized to match the largest size (AWG) TBB.

D. The gauge of the connecting ground/earth cable, known as the Telecommunications Bonding Backbone (TBB), Grounding Equalizer (GE), and the Telecommunications Bonding Conductor (TBC) to the main building electrical entrance facility will follow ANSI/TIA- 607-C guidelines, as is shown in the table below. The TBB shall be one continuous conductor as shown on one-line drawings.

Sizing of the TBB	
TBB Length in Linear (feet)	TBB Size (AWG)
Less than (13)	6
(14-20)	4
(21-26)	3
(27-33)	2
(34-41)	1
(42-52)	1/0
(53-66)	2/0
(67-84)	3/0
(85-105)	4/0
(106-125)	250 kcmil
(126-150)	300 kcmil
(151-175)	350 kcmil
(176-250)	500 kcmil
(251-300)	600 kcmil
(301+)	750 kcmil

E. All racks, cabinets, metallic enclosures, conduits, metallic backboards, cable sheaths, metallic strength members, splice cases, cable trays, etc. entering or residing in the

MC/IC/TC shall be grounded to the respective TGB or TMGB using a minimum #6 AWG stranded copper bonding conductor and compression lugs.

F. Every equipment rack and cabinet shall be provided with a rack bonding busbar (RBB). Each RBB shall be bonding the TMGB/TGB with a Telecommunications Equipment Bonding Conductor (TEBC).

G. All wires used for communications grounding purposes shall be identified with a green insulation. All cables and busbars shall be identified and labeled in accordance with the ANSI/TIA-606-B.

H. See Section 27 0543 - Underground Ducts and Raceways for Communications Systems for underground duct and raceway systems ground requirements.

3.02 IDENTIFICATION

A. Refer to Section 27 0553 - Identification for Communications Systems for labeling details.

END OF SECTION 27 0526

SECTION 27 0528

PATHWAYS FOR COMM. SYS.

PART 1 GENERAL

1.01 GENERAL REQUIREMENT

A. Applicable requirements of Division 27 - Communications shall be considered a part of this section and shall have the same force as if printed herein full.

B. This document describes the products and execution requirements relating to Pathways for Communications Systems.

C. Product specifications, general design considerations, and installation guidelines are provided in this document. The successful vendor shall meet or exceed all requirements described in this document and on the drawings.

1.02 SUBMITTALS

A. Provide product data from manufacturer's specifications.

1.03 WORK INCLUDED

A. The work included under this specification consists of furnishing all labor, equipment, materials, supplies and performing all operations necessary to complete the installation. The Contractor will provide and install all of the required material whether specifically addressed in the Specification or not.

PART 2 PRODUCTS

2.01 APPROVED PRODUCTS

A. Rigid/Intermediate Conduit Manufacturer(s)
   1. Allied
   2. Triangle
   3. Wheatland
   4. Youngstown
   5. Or Approved Equal (by Design Engineer)

B. Non-Metallic (PVC) Manufacturer(s)
   1. Carlon
   2. Or Approved Equal (by Design Engineer)

C. Electrical Metallic Tubing (EMT) Manufacturer(s)
   1. Allied
   2. Triangle
   3. Wheatland
   4. Youngstown
   5. Or Approved Equal (by Design Engineer)

D. EMT Fittings Manufacturer(s)
   1. Thomas & Betts
   2. Steel City

3. Or Approved Equal (by Design Engineer)

E. Innerduct/Inner-Conduit Channel Manufacturer(s)
   1. MaxCell
   2. Carlon
   3. Endot Industries
   4. Petroflex
   5. Eastern
   6. Or Approved Equal (by Design Engineer)

F. Metallic Communications Outlet Box Manufacturer(s)
   1. Steel City
   2. Raco
   3. Or Approved Equal (by Design Engineer)

G. Pull Box Manufacturer(s)
   1. Hoffman
   2. OZ Gedney
   3. Or Approved Equal (by Design Engineer)

H. Approved Cable / Basket Tray System Manufacturer(s)
   1. B-Line
   2. Or Approved Equal (by Design Engineer)
   3. CABLOFIL Inc.

I. Approved Cable Hanger Manufacturer(s)
   1. Erico Products – Caddy
   2. B-Line
   3. Or Approved Equal (by Design Engineer)
   4. CABLOFIL Inc.

J. Approved Tie Wrap/Velcro Strap Manufacturer(s)
   1. Leviton
   2. Panduit
   3. Siemon
   4. Commscope
   5. Or Approved Equal (by Design Engineer))
   6. Ortronics / Legrand

K. Approved Surface Mounted Raceway Manufacturer(s)
   1. Coordinate with Division 26 (Electrical Contractor). Refer to Drawings.

2.02 CONDUIT

A. Rigid and Intermediate Conduit

1. Rigid conduit, intermediate conduit, couplings, locknuts, bushings, elbows and connectors shall be standard thread. All materials shall be steel. Set screw or non-threaded fittings are not permitted.

B. Non-Metallic (PVC) Conduit
   1. Non-metallic conduit shall be heavy wall, Schedule 40 PVC.
   2. Couplings and connectors for non-metallic conduit shall be of the same material and be the product of the same manufacturer of the conduit furnished.

C. Electrical Metallic Tubing (EMT)
   1. Electrical metallic tubing (EMT), couplings and connectors shall be steel. Malleable iron, pressure-cast or die-cast fittings are not permitted.
   2. Fittings for 2" EMT and smaller shall be steel set screw type, except where otherwise noted. Fittings for 2.5" and larger shall be steel set screw type with two (2) screws for connectors and four (4) screws for couplings. All connectors shall be insulated throat type.

D. Conduit Support
   1. Individual conduit hangers shall be galvanized spring steel specifically designed for the purpose and sized appropriately for the conduit type and diameter. Support individual conduits 1-1/2 inch and smaller with 1/4 inch threaded steel rods and use 3/8 inch rods for 2 inch and larger.
   2. Conduit support channels shall be 14 gauge galvanized (or equivalent treatment) channel sized for the amount of conduit to be supported. Channel suspension shall be 3/8" threaded steel rods. Attach suspension rods to structure with swivel type connectors. Conduit straps shall be spring steel type compatible with channel.
   3. Conduit straps shall be single hole cast metal type or two hole galvanized metal type. Conduit clamps shall be spring steel type for use with exposed structural steel.

E. Innerduct/Inner-Conduit Channel
   1. Innerduct shall be corrugated plastic equipped with pull-string or mule tape.
   2. Inner-conduit channel (MaxCell) shall be 3-channel with each channel equipped with mule tape.
   3. See Drawings for innerduct / inner-conduit channel (MaxCell) details.

2.03 METALLIC COMMUNICATIONS OUTLET BOXES

A. Metallic outlet boxes and device covers shall be galvanized steel not less than 1/16" thick.

B. The dimensions of the metallic outlet box shall be 4 -11/16” square with a minimum depth of 2-1/8".

C. Metallic outlet boxes shall be equipped with single device covers (or two-device covers where needed). Where installed in plaster, gypsum board, etc., covers shall be raised to compensate for the thickness of the wall finish.
D. Where metallic outlet boxes are to be empty for future use, blank coverplates shall be used.

2.04 PULL BOXES

A. Pull boxes shall be constructed of galvanized steel with flat, removable covers fastened with plated steel screws.
B. Pull boxes shall be equipped with keyhole screw slots in the cover to permit removal of the cover without extracting the screws.
C. Pull boxes shall have provisions for grounding.

2.05 TELECOM ROOM LADDER RACK

A. Ladder Rack System
    1. See Drawings for ladder rack system details.
    2. The ladder rack system shall be securely mounted with hardware designed for use in ladder rack systems.
    3. End caps shall be installed on the exposed ends of the ladder racks, channel supports and bolts. Protective covers shall be installed on threaded rods that come in contact with cabling plant.
        a. Ladder Rack System color shall be black.

2.06 BASKET TRAY SYSTEM

A. See Drawings for ladder rack system details.
B. The ladder rack system shall be securely mounted with hardware designed for use in ladder rack systems.
C. Center mounted supports are not acceptable.
D. End caps shall be installed on the exposed ends of the ladder racks, channel supports and bolts. Protective covers shall be installed on threaded rods that come in contact with cabling plant.
E. Tray to be constructed of galvanized steel.

2.07 CABLE HANGERS

A. J-Hooks
    1. J-hooks shall provide a bearing surface of sufficient width to comply with required bend radii of high-performance cables. J-hook shall be cULus Listed.
        1. J-hooks shall have flared edges to prevent damage while installing cables.
        2. J-hooks sized 1 5/16" and larger shall have a cable retainer strap to provide containment of cables within the hanger. The cable retainer strap shall be removable and reusable and be suitable for use in air handling spaces.

3. J-hooks should be metallic. Plastic J-hooks are not acceptable.

2.08 TIE WRAPS AND VELCRO STRAPS

A. Velcro Straps
   1. Cables shall be fastened to support structures with Velcro straps.
   2. Velcro straps installed in air handling spaces must be plenum rated.
      a. Non-plenum Tie Wrap color shall be black.
      b. Plenum Tie Wrap color shall be red.
      c. Non-plenum Velcro strap color shall be black.
      d. Plenum Velcro strap color shall be red.
   3. Tie wraps are not permitted

2.09 SURFACE MOUNTED RACEWAY

A. Surface Mounted Raceway
   1. Coordinate with Division 26 (Electrical Contractor). Refer to Drawings.

PART 3 EXECUTION

3.01 PENETRATIONS

A. Holes through concrete and masonry in new and existing structures shall be cut with a diamond core drill or concrete saw upon approval of the structural engineer of record for the base of building. Pneumatic hammer, impact electric, hand or manual hammer type drills shall not be allowed, except where permitted by the Project Manager as required by limited working space. X-ray all floor penetrations accordingly.
B. Holes shall be located so as not to affect structural sections such as ribs or beams.
C. Holes shall be laid out in advance. The Project Manager shall be advised prior to drilling through structural sections, for determination of proper layout.
D. Structural Penetrations: Where conduits, wireways and other raceways pass through fire partitions, fire walls or walls and floors provide a code compliant effective barrier against the spread of fire, smoke and gases.
E. All penetrations where conduit is not used shall be sleeved.
F. No gaps or rough edges shall be allowed between wall and conduit/sleeve.

3.02 CONDUIT SYSTEM

A. Provide metallic conduit for cabling in exposed areas, mechanical spaces, food service areas, and elevator control rooms.
B. Leave all empty conduits with a 200 pound test nylon cord pull line.
C. Flattened, dented, or deformed conduits are not permitted and shall be removed and replaced.
D. Fasten conduit support device to structure with wood screws on wood, toggle bolts on hollow masonry, anchors as specified on solid masonry or concrete, and machine bolts, clamps, or spring steel clips, on steel.

E. Install conduit with wiring, including homeruns as indicated on the Drawings. Any change resulting in a savings in labor or materials is to be made only in accordance with a contract change. Deviations shall be made only where necessary to avoid interferences and when approved by Engineer by written authorization.

F. Conduit shall be run parallel or at right angles to existing walls, ceilings, and structural members.

G. Attach backbone conduits larger than one-inch trade diameter to or from structure on intervals not exceeding twelve feet with conduit beam clamps, one-hole conduit straps or trapeze type support.

H. Where conduits must pass through structural members obtain approval of Design Professional or Engineer.

I. Install all conduits or sleeves penetrating or routed within rated firewalls or fire floors to maintain fire rating of wall or floor. Conduit shall not be installed in rated floors or walls if it compromises or violates the fire rating of floor or wall. Refer to architectural documents.

J. Provide expansion and deflection coupling where conduit passes over a building expansion joint.

K. Service entrance conduits and feeder conduits in direct contact with earth shall be schedule 40, heavy wall PVC. All service entrance conduit elbows shall be galvanized rigid steel. Service entrance conduits installed exposed or concealed in walls or above ceilings shall be galvanized rigid steel (G.R.S.) or intermediate metal conduit (IMC). Provide concrete encasement where required or as indicated on Drawings.

L. All other conduit, unless specified herein, shall be electrical metallic tubing (EMT). PVC conduit is not allowed in exposed or concealed areas, but only within concrete.

M. Conduit Installations Within Slab/Floor

1. Conduit shall be run following the most direct route between points.
2. Conduit shall not be installed in concrete where the outside diameter is larger than 1/3 of the slab thickness.
3. Conduits shall not be installed within shear walls unless specifically indicated on the Drawings. Conduit shall not be run directly below and parallel with load bearing walls.
4. Protect each metallic conduit installed in concrete slab or conduits 1-1/2 inch and smaller passing through a concrete slab against corrosion where conduit enters and leaves concrete by wrapping conduit with vinyl all-weather electrical tape.
5. Protect all conduits entering and leaving concrete floor slabs from physical damage during construction.
6. Provide expansion fittings in all conduits where length or run exceeds 200 feet or where conduits pass through building expansion joints.

7. Install all conduits penetrating or routed within rated fire floors to maintain the fire rating of the floor. Conduit shall not be installed in rated floors or walls if it compromises or violates the fire rating of floor or wall. Refer to architectural documents.
8. Conduits installed within concrete floor slabs which are in direct contact with grade or which penetrate the building roof shall be galvanized rigid steel (G.R.S.), intermediate metal conduit (I.M.C.) or Schedule 40, heavy wall PVC.

N. Communications cables shall not occupy conduits with power cables.
O. Metallic conduits shall be grounded in accordance with ANSI/TIA-607-C.
P. Conduit runs shall not have more than two (2) 90-degree bends or an aggregate of 180-degress of bends between pull points.
Q. Conduit runs shall not exceed 100-feet between pulling points.
R. Communications conduit system shall contain no condulets (also know as an LB).
S. Rigid metal conduit (RMC) or intermediate metal conduit (IMC) shall be used for entrance conduits that exceed 50 feet into the building.
T. Horizontal Conduits
1. Support horizontal conduits at intervals not exceeding ten feet and within three feet of each outlet, junction box, backboard, enclosure or cabinet. Support conduits from structural steel members with spring steel type or beam conduit clamps and to non-metallic structural members with one-hole conduit straps. For exposed conduits and where conduits must be suspended below structure, single conduit runs shall be supported from structure by hanger rod and conduit clamp assembly, and multiple conduits shall be supported by trapeze type support suspended from structure. Do not attach conduits to ceiling suspension system channels or suspension wires.
2. For runs that total more than 100 feet in length, insert pull boxes so that no segment between boxes exceeds the 100 feet limit.
3. Size conduit per NEC 40% fill requirements.

U. All conduit and sleeve ends shall have snap in bushing at each end for cable protection.

3.03 COMMUNICATIONS OUTLET BOXES

A. Exact locations of the outlet boxes shall be coordinated with the electrical contractor and other trades.
B. Non-metallic communications outlet boxes shall not be used.
C. The approximate locations of the outlets are indicated on the Drawings. The exact locations of outlets shall be determined at the building. The right is reserved to change, without additional cost, the exact location of any outlet, a maximum of 10' before it is permanently installed.

D. Orientation of outlet boxes (horizontal or vertical) shall be as indicated on the architectural elevations. Contractor shall match orientation of adjacent power receptacle.
E. Location of outlet boxes (horizontal and vertical) shall be coordinated with electrical and architectural plans.
F. Install all outlet boxes in finished areas flush with the wall. Maintain 1/4" or less space between outlet box front and finished wall surface.
G. Outlet boxes shall be firmly anchored in place and shall not depend on the coverplate to hold it secure to the wall.
H. Outlet boxes installed back-to-back in fire-rated walls shall be separated horizontally by a minimum of 24".

3.04 PULL BOXES

A. Pull boxes shall be secured, independent of the conduit entries into the box. Pull boxes shall be secured to the building structure. In ceiling applications, pull boxes shall not be supported with ceiling wires.
B. Conduits entering pull boxes shall connect to pull boxes using die-cast zinc connectors.
C. Pull boxes shall be free from burrs, dirt and debris.
D. Pull boxes shall be installed in accordance with ANSI/TIA-569-B.
E. Pull boxes shall be grounded in accordance with ANSI/TIA-607-C.

3.05 CABLE TRAY SYSTEM

A. Install trays in accordance with recognized industry practices, to ensure that the cable tray equipment complies with requirements of the NEC.
B. All open trays shall be installed a minimum of six (6) inches away from any light fixture.
C. Provide external grounding strap at expansion joints, sleeves, crossover and other locations where tray continuity is interrupted.
D. Support all pathways from building construction. Do not support pathways from ductwork, piping or equipment hangers.
E. Install cable tray level and straight.
F. Provide all hardware, accessories, fasteners, anchors, threaded rods and support channels required to provide a complete cable tray system.
G. Cable trays shall not be used to house both low voltage and power cables.
H. Cable tray system shall be grounded in accordance with ANSI/TIA-607-C.
I. Cable Tray shall be trapeze style supported with unistrut and threaded rod. Where trapeze style is not possible, tray shall be wall supported with steel L-brackets. All supports shall meet requirements of manufacturer specific tray.
J. Cable Tray shall be supported in accordance with manufacturer specific recommendations for max loading capacities.

3.06 CABLE HANGERS

A. J-hooks shall only be permitted in closed, accessible ceiling spaces.
B. Installation and configuration shall conform to the requirements of ANSI/TIA-568-C.0, ANSI/TIA-568-C.1 & ANSI/TIA-569-B, NFPA 70 (National Electrical Code), applicable local codes, and to the manufacturer's installation instructions.
C. Install cables using techniques, practices, and methods that are consistent with Category 6A or higher requirements and that supports Category 6A or higher performance of completed and linked signal paths, end to end.
D. Install cables without damaging conductors, shield, or jacket.
E. Do not bend cables, in handling or in installing, to smaller radii than minimums recommended by manufacturer.
F. Pull cables without exceeding cable manufacturer's recommended pulling tensions. Use pulling means that will not damage media.
G. Do not exceed load ratings specified by manufacturer.
H. Adjustable non-continuous support sling shall have a static load limit of 100 lbs.
I. To avoid electromagnetic interference (EMI), pathways shall provide minimum clearances of four feet from motors or transformers, one foot from conduit and cables used for electrical power distribution, and five inches from fluorescent lighting. Pathways shall cross perpendicular to fluorescent lighting and electrical power cables or conduits.

3.07 VELCRO STRAPS

A. Velcro straps shall be installed around cables at intervals of 12" minimum.
B. Velcro Straps shall secure cables to cable trays using an "X" pattern.
C. Do not over-cinch cables.

3.08 IDENTIFICATION

A. Refer to Section 270553 - Identification for Communications Systems for labeling details.

END OF SECTION 27 0528

SECTION 27 0543
UNDERGROUND DUCTS AND RACEWAYS FOR COMMUNICATIONS SYSTEMS

PART 1 GENERAL

1.01 GENERAL REQUIREMENTS

A. Applicable requirements of Division 27 - Communications shall be considered a part of this section and shall have the same force as if printed herein full.

B. This document describes the products and execution requirements relating to Underground Ducts and Raceways for Communications Systems.

C. Product specifications, general design considerations, and installation guidelines are provided in this document. The successful vendor shall meet or exceed all requirements described in this document and on the drawings.

1.02 SUBMITTALS

A. Provide product data from the manufacturer's specifications.

1.03 WORK INCLUDED

A. The work included under this specification consists of furnishing all labor, equipment, materials, supplies and performing all operations necessary to complete the installation. The Contractor will provide and install all of the required material whether specifically addressed in the Specification or not.

PART 2 PRODUCTS

2.01 APPROVED PRODUCTS

A. Rigid/Intermediate Conduit Manufacturer(s)
   1. Allied
   2. Triangle
   3. Wheatland
   4. Youngstown
   5. Or Approved Equal (by Design Engineer)

B. PVC/HDPE Conduit Manufacturer(s)
   1. Carlon
   2. FiberTel
   3. Or Approved Equal (by Design Engineer)

C. Innerduct/Inner-Conduit Channel Manufacturer(s)
   1. Maxcell
   2. Endot Industries
   3. Carlon
   4. Petroflex
   5. Or Approved Equal (by Design Engineer)

D. Marker Tape Manufacturer(s)

1. William Frick & Associates
2. Or Approved Equal (by Design Engineer)

E. Approved Maintenance Hole/Handhole Manufacturer(s)
1. Old Castle
2. Pencell (Handholes Only)
3. Quazite (Handholes Only)
4. Or Approved Equal (by Design Engineer)

F. Approved Conduit Plug/Cap Manufacturer(s)
1. Jack Moon
2. Or Approved Equal (by Design Engineer)

2.02 CONDUIT SYSTEM

A. PVC conduit for concrete encasement shall be Type DB, UL Labeled for 90 degrees C cables. Fittings shall be Type DB, solvent type, and from the same manufacturer as the conduit.

B. Concrete shall have a minimum strength of 2,500 psi at 28 days.

C. PVC conduit for direct burial shall be Schedule 40, UL Labeled for 90 degrees C cables. Fittings shall be Schedule 40, solvent type, and from the same manufacturer as the conduit.

D. Rigid and Intermediate Conduit
1. Rigid conduit, intermediate conduit, couplings, locknuts, bushings, elbows and connectors shall be standard thread. All materials shall be steel. Set screw or non-threaded fittings are not permitted.
2. Galvanized rigid steel conduit shall be hot dipped galvanized inside and outside, in 10 foot lengths and threaded on both ends. Fittings and bushings shall be threaded, cast or malleable iron, and hot dipped galvanized inside and outside.

E. Non-Metallic Conduit
1. Non-metallic conduit shall be heavy wall, Schedule 40 PVC / HDPE.
2. Couplings and connectors for non-metallic conduit shall be of the same material and be the product of the same manufacturer of the conduit furnished.

F. Conduit Support
1. Conduit straps shall be single-hole cast metal type or two-hole galvanized metal type.
2. Conduit clamps shall be spring steel type for use with exposed structural steel.

G. Innerduct/Inner-Conduit Channel
1. Innerduct shall be non-corrugated PVC equipped with mule tape.
2. Inner-conduit channel (MaxCell) shall be 3-channel with each channel equipped with mule tape.

3. See Drawings for innerduct/inner-conduit channel (MaxCell) details.

H. Marker Tape

1. Marker tape shall be detectable, orange for communications, and labeled to indicate the type of circuit buried below.

2.03 MAINTENANCE HOLES/HANDHOLES

A. Maintenance Holes

1. Maintenance holes shall be pre-cast or cast in place concrete with a strength of 3,500 psi at 28 days, and steel reinforced.
2. Maintenance holes shall include a cast iron frame with cover, a hot dipped galvanized steel ladder, and hot dipped galvanized pulling eyes embedded in the concrete opposite each duct entrance and in the floor beneath the cover.
3. Maintenance holes shall be equipped with grounding busbar.
4. Maintenance holes shall be equipped with racking for cable storage.
5. Ground splices and connections at maintenance holes shall be exothermic welds, copper or bronze compression ground fittings, or bolted compression ring lugs.
6. The cover for maintenance holes shall have the lettering, “COMMUNICATIONS.”

B. Handholes

1. Handholes shall be non-conductive and shall not require grounding for safety.
2. Handholes shall be unaffected by freeze/thaw and resistant to sunlight and chemicals.
3. Handholes shall be pre-cast polymer concrete, heavy duty rated and bottomless.
4. Handholes shall be equipped with racking for cable storage.
5. Handholes shall have the word “COMMUNICATIONS” molded in the cover by the manufacturer. The cover shall be attached with penta-head stainless steel bolts.
6. Handholes shall be able to withstand 10,000 lbs minimum.
7. See Drawings for handhole dimensions and locations.

2.04 CONDUIT PLUGS/CAPS

A. Conduit Plugs/Caps

1. Conduit plugs shall provide a watertight seal at expose ends of conduits.
2. Conduit plugs shall be conduit size specific.
3. Triplex and Quadplex duct plugs shall provide a watertight seal between the conduit and innerduct(s).
4. Simplex duct plugs shall provide a watertight seal between the innerduct and the cable that occupies it.
5. TDUX inflatable bladders shall be used to seal conduits equipped with MaxCell.

PART 3 EXECUTION

3.01 CONDUIT SYSTEM

A. Excavation and Backfill
   1. Contractor shall call underground utilities locator company before digging.
   2. Barricades shall be provided around open holes and trenches. Temporary bridges shall be provided over trenches cut through major sidewalk routes. Major sidewalk routes shall not be closed to pedestrian traffic.
   3. Barriers shall be provided to protect landscaping adjacent to the excavation area.
   4. When rocks, concrete or other debris are encountered during excavation, remove completely.
   5. Where sidewalk sections must be removed for installation of underground ducts, remove the sidewalk sections completely from joint to joint.
   6. Where asphalt must be removed for installation of underground ducts, saw cut the asphalt in two, straight, parallel lines.
   7. Backfill excavations in 6-inch layers and mechanically compact to 98 percent compaction.
   8. Excavated materials may be used as backfill only if the backfill is sand or clean dirt that is free of rocks and debris over 3/4" in diameter.
   9. In landscaped areas, backfill and mechanically compact to a depth of 6 inches below grade.
   10. Backfill the last 6 inches with clean topsoil. Reseed lawn areas.
   11. Restore concrete sidewalks and asphalt.
   12. The Contractor shall perform all excavation to install the electrical work herein specified and as indicated on Drawings. During excavation, material for backfilling shall be piled back from the banks of the trench to avoid overloading and to prevent slides and cave-ins. All excavated materials not to be used for backfill shall be removed and disposed of by the Contractor. Grading shall be done to prevent surface water from flowing into trenches and others excavation and any water accumulating therein shall be removed by pumping. All excavation shall be made by open cut.
   13. The bottom of the trenches shall be graded to provide uniform bearing and support for conduits, cables, or duct bank on undisturbed soil at every point along its entire length. Overdepths shall be backfilled with loose, granular, moist earth, tamped. Remove unstable soil that is not capable of supporting equipment or installation and replace with specified material for a minimum of 12" below invert of equipment or installation.
   14. The trenches shall be backfilled with the excavated materials approved for backfilling, consisting of earth, loam, sandy clay, sand and gravel or soft shale, free from large clods of earth and stones, deposited in 6" layers and rammed

until the installation has a cover of not less than the adjacent ground but not greater than 2" above existing ground. The backfilling shall be carried on simultaneously on both sides of the trench so that injurious pressures do not occur. The compaction of the filled trench shall be at least equal to 95% of the maximum density as determined by the Standard Proctor Test. Settling the backfill with water will not be permitted. Reopen any trenches not meeting compaction requirements or where settlement occurs, refill, compact, and restore the surface to the grade and compaction indicated, mounded over and smoothed off

B. Duct Banks

1. Duct banks shall be sloped downward toward maintenance holes/handholes and away from buildings a minimum of 6 inches per 100 feet. Duct banks shall not route water from maintenance holes handholes into buildings. Duct banks shall not contain traps between maintenance holes/handholes where water may accumulate.
2. Directional changes in duct banks shall be made with 20' minimum radius bends. Duct banks and direct buried ducts shall be supported on undisturbed soil or on piers extending down to undisturbed soil.
3. Where power and communications duct banks run in parallel, they shall be separated by a minimum of 12 inches.
4. Prior to concrete encasement, ducts, reinforcing steel and ground wires shall be secured with nonmetallic straps or cable ties to nonmetallic duct spacers at intervals not exceeding 8 feet. Duct spacers shall be sized for the ducts being held, and shall provide the minimum spacing between ducts required for concrete flow and by the NEC. Duct spacers shall be anchored to the ground using nonmetallic bands and stakes.
5. Duct banks shall have a minimum of 3 inches of concrete cover on all sides.
6. Where duct banks enter maintenance holes or buildings, they shall be constructed as integral to the wall.
7. Duct bank shall extend to the inside surfaces of the walls, and the duct bank reinforcing shall be integrated with the wall reinforcing.
8. Bell ends shall be provided on ducts where the ducts enter maintenance holes or buildings.
9. Direct buried ducts and fittings shall have bend radii greater than the minimum bend radii of the cables enclosed, and shall not be smaller than the radii of standard manufactured elbows.

10. Direct buried ducts shall be installed parallel to or at right angles to building lines and site features, and as close to curbs and sidewalks as possible to avoid interferences with future landscaping.
11. Where direct buried PVC ducts cannot be buried deep enough to meet the NEC minimum cover requirements, rigid steel conduits shall be installed instead, or a concrete cover shall be poured over the ducts.
12. An orange detectable marker tape (for communications) shall be buried in the backfill approximately 12 inches above duct banks or direct buried cables for the entire length of the duct run.
13. A flexible mandrel and a stiff bristled brush shall be pulled through the ducts to clean them prior to cable pulling.
14. Ducts shall be identified in the maintenance holes and at both ends.

C. Additional OSP Conduit Requirements
1. Leave all empty conduits with a 200-pound test nylon cord pull line.
2. Install a #14 AWG tracer wire in one conduit for the entire length of each duct run.
3. Flattened, dented, or deformed conduits are not permitted and shall be removed and replaced.
4. Install conduit, including homeruns as indicated on the Drawings. Any change resulting in a savings in labor or materials is to be made only in accordance with a contract change. Deviations shall be made only where necessary to avoid interferences and when approved by Engineer by written authorization.
5. Where conduits must pass through structural members obtain approval of Design Professional or Engineer.
6. Install all conduits or sleeves penetrating or routed within rated firewalls or fire floors to maintain fire rating of wall or floor. Conduit shall not be installed in rated floors or walls if it compromises or violates the fire rating of floor or wall. Refer to architectural documents.
7. Provide expansion and deflection coupling where conduit passes over a building expansion joint.
8. Service entrance conduits and feeder conduits in direct contact with earth shall be schedule 40, heavy wall PVC/HDPE. All service entrance conduit elbows shall be galvanized rigid steel. Service entrance conduits installed exposed or concealed in walls or above ceilings shall be galvanized rigid steel (GRS) or intermediate metal conduit (IMC). Provide concrete encasement where required or as indicated on Drawings.
9. Seal all conduits entering building to prevent entrance of moisture.

10. Conduit fittings shall be gland and ring compression type for all conduit exposed to outdoor environments.
11. Below Grade Conduit Installations
    a. Install top of conduits 24 inches minimum below finished grade or as indicated on Drawings.
    b. Install top of conduits 6 inches minimum below bottom of building slabs.
    c. Where transition is made from below grade PVC installation to a metallic conduit system above grade or slab.
12. Communications cables shall not occupy conduits with power cables.
13. All metallic conduits shall be grounded in accordance with ANSI/TIA-607-C.
14. For runs that total more than 400 feet in length, insert handholes/maintenance holes so that no segment exceeds the 400 feet limit.
15. Conduit runs shall not have more than two (2) 90-degree bends or an aggregate of 180-degree bends between pull points.
16. Communication conduit system shall contain no condulets (also known as an LB).

3.02 MAINTENANCE HOLES/HANDHOLES

A. Maintenance holes/handholes shall be installed on a base of pea gravel at least 12 inches deep.
B. Tops of maintenance holes/handholes shall be level with the existing grade.
C. Ducts should enter as perpendicular to the wall surface as possible.
D. Maintenance holes shall be grounded with four 3/4 inch diameter by 8 foot long ground rods, one driven inside of the maintenance hole at each corner. Connect the ground rods and any duct bank ground conductors together with a No. 4/0 AWG bare, stranded copper ground wire loop. A No. 2 AWG bare stranded copper pigtail from the ground wire loop shall be used to ground the maintenance hole cover frame, ladder support bracket, any metallic concrete inserts and metallic cable racks, and the shields of any cables that are spliced in the maintenance hole.

3.03 CONDUIT PLUGS/CAPS

A. Protect conduits against dirt, plaster, and foreign debris with conduit plugs. Plugs shall remain in place until ready for use.
B. Simplex, triplex or quadplex duct plugs shall be installed in conduits to house and seal cables.
C. TDUX inflatable bladders shall be used to seal conduits equipped with MaxCell.

3.04 IDENTIFICATION

A. Refer to Section 270 553 - Identification for Communications Systems for labeling details.

END OF SECTION 27 0543

SECTION 270553
IDENTIFICATION FOR COMMUNICATIONS SYSTEMS

PART 1 GENERAL

1.01 GENERAL REQUIREMENTS

A. Applicable requirements of Division 27 - Communications shall be considered a part of this section and shall have the same force as if printed herein full.

B. This document describes the equipment and execution requirements relating to Identification for Communications Systems.

C. Equipment specifications, general considerations, and guidelines are provided in this document. The successful vendor shall meet or exceed all requirements described in this document and on the drawings.

1.02 WORK INCLUDED

A. The work included under this Specification consists of furnishing all labor, equipment, materials, supplies and performing all operations necessary to complete installation. The Contractor will provide and install all of the required materials whether specifically addressed in the Specification or not.

PART 2 LABELING

2.01 LABELING REQUIREMENTS

A. Labeling shall be done in accordance with the recommendations made in the ANSI/TIA-606-B document, manufacturer's recommendations and best industry practices.

B. All spaces, pathways, outlets, cables, termination hardware, grounding system and equipment shall be labeled with machine-generated labels.

C. All labels shall be clear with black text.

D. All cables shall be labeled with machine generated, wrap around labels.

E. A total of three (3) labels per horizontal cable are required at the following locations: 6" from outlet, 18" from outlet, and 12" from termination block/patch panel.

F. Labeling scheme shall be alphanumeric.

END OF SECTION 270553

SECTION 27 0800
COMMISSIONING OF COMMUNICATIONS SYSTEMS

PART 1 GENERAL

1.01 GENERAL REQUIREMENTS

A. Applicable requirements of Division 27 - Communications shall be considered a part of this section and shall have the same force as if printed herein full.

B. This document describes the equipment and execution requirements relating to Commissioning of Communications.

C. Equipment specifications, general considerations, and guidelines are provided in this document. The successful vendor shall meet or exceed all requirements described in this document and on the drawings.

1.02 WORK INCLUDED

A. The work included under this specification consists of furnishing all labor, equipment, materials, supplies and performing all operations necessary to complete installation. The Contractor will provide and install all of the required material whether specifically addressed in the Specification or not.

PART 2 TESTING

2.01 TESTING REQUIREMENTS

A. General

1. All cables and termination hardware shall be 100% tested for defects in installation and to verify cabling system performance under installed conditions according to the requirements of ANSI/TIA-568-C.0, ANSI/TIA-568-C.1, and/or ANSI/TIA-1152. All conductors/strands of each installed cable shall be verified prior to system acceptance. Any defect in the cabling system installation including but not limited to cable, connectors, feed through couplers, patch panels, and connector blocks shall be repaired or replaced in order to ensure 100% useable conductors/strands in all cables installed.

B. Copper Testing

1. All twisted-pair copper cable links shall be tested for continuity, pair reversals, shorts, opens and performance as indicated below. Additional testing is required to verify Category 6A performance. Horizontal balanced twisted pair cabling shall be tested using a level III and/or IV test unit for category 6A performance compliance.
2. Continuity - Each pair of each installed cable shall be tested using a test unit that shows opens, shorts, polarity and pair-reversals, crossed pairs and split pairs. The test shall be recorded as pass/fail as indicated by the test unit and referenced to the appropriate cable identification number and circuit or pair number. Any

faults in the wiring shall be corrected and the cable re-tested prior to final acceptance.

3. Length - Each installed cable link shall be tested for installed length using a TDR type device. The cables shall be tested from patch panel to patch panel, block to block, patch panel to outlet or block to outlet as appropriate. The cable length shall conform to the maximum distances set forth in the ANSI/TIA-568-C.2 Standard. Cable lengths shall be recorded, referencing the cable identification number and circuit or pair number. For multi-pair cables, the shortest pair length shall be recorded as the length for the cable.
4. Approved tester is as follows:
    a. Fluke DTX

C. Fiber Testing
1. All fiber testing shall be performed on all fibers in the completed end-to-end system. There shall be no splices unless clearly defined in the RFP and/or Drawings. These tests also include continuity checking of each fiber.
2. Singlemode
    a. Test the optical fiber cable bi-directionally with an OTDR and uni-directionally with a power meter/light source. Fiber must be tested at both 1310nm and 1550nm. Maximum attenuation dB/Km @ 1310nm/1550nm shall be 0.5/0.5 for outside plant and 1.0/1.0 for inside plant. Maximum attenuation per connector pair shall be .75 dB. Attenuation testing shall be performed with a stable launch condition using one-meter or two-meter jumpers to attach the test equipment to the cable plant. The light source shall be left in place after calibration and the power meter moved to the far end to take measurements. Test set-up and performance shall be conducted in accordance with ANSI/TIA-568-C.3, and to the manufacturer's application guides.
3. Approved optical fiber test equipment manufacturers are as follows:
    a. Power Meters & Light Sources
        1) Optical Wavelength Laboratories (OWL)
        2) Noyes
        3) Photonix
        4) Fluke
        5) Agilent
    b. Optical Time Domain Reflectometers (OTDR)
        1) GN Nettest
        2) Agilent

3) Fluke
4) Anritsu
5) Tektronix

D. Test Results

1. Test documentation shall be provided on disk as part of the as-built package. The disk shall be clearly marked on the outside front cover with the words “Project Test Documentation,” the project name, and the date of completion (month and year). The results shall include a record of test frequencies, cable type, conductor pair (or strand) and cable (or outlet) I.D., measurement direction, reference setup, and crew member name(s). The test equipment name, manufacturer, model number, serial number, software version and last calibration date will also be provided at the end of the document. Unless the manufacturer specifies a more frequent calibration cycle, an annual calibration cycle is anticipated on all test equipment used for this installation. The test document shall detail the test method used and the specific settings of the equipment during the test as well as the software version being used in the field test equipment.
2. The field test equipment shall meet the requirements of ANSI/TIA-568-C.2, ANSI/TIA-568-C.3, and/or ANSI/TIA-1152.
3. Printouts generated for each cable by the wire (or fiber) test instrument shall be submitted as part of the documentation package. Alternately, the Contractor may furnish this information in electronic form (CD). These CDs shall contain the electronic equivalent of the test results as defined by the Specification and be of a format readable from Microsoft Word.
4. When repairs and re-tests are performed, the problem found and corrective action taken shall be noted, and both the failed and passed test data shall be documented.

PART 3 DOCUMENTATION, AS-BUILTS, TRAINING AND RECORDS

3.01 DOCUMENTATION & AS-BUILTS

A. As-Built record documentation for communications work shall include:

1. Cable routing and identification
2. System function diagrams
3. Manufacturers' description literature for equipment
4. Connection and programming schedules as appropriate
5. Equipment material list including quantities
6. Spare parts list with quantities
7. Details not on original Contract Documents
8. Test results

9. Warranties
10. Release of liens

B. The Contractor shall provide and maintain at the site a set of prints on which shall be accurately shown the actual installation of all work under this section, indicating any variation from contract drawings, including changes in pathways, sizes, locations and dimensions. All changes shall be clearly and completely indicated as the work progresses.

C. Progress prints shall be available for inspection by the Owner or any of his representatives and may be used to determine the progress of communications infrastructure work.

D. At the completion of the work, prepare a new set of as-built drawings, of the work as actually noted on the marked-up prints, including the dimensioned location of all pathways.

E. Furnish as-built drawings and documentation to the Project Manager. As-built drawings shall be generated in AutoCad 2012 or later. Submit as-built drawings electronically and hard copy.

3.02 OPERATIONS AND MAINTENANCE MANUAL

A. After completion of the work, the Contractor shall furnish and deliver to the Engineer three (3) copies of a complete Operations & Maintenance Manual. A system wiring diagram shall be furnished for each separate system.

B. The manual shall be subdivided into separate sections with tab dividers to identify subsystems of the integrated system. Reference appropriate Specification sections.

C. Provide the following additional information for each electronic system. Information shall be edited for this project where applicable.

1. Operations manuals for components and for systems as a whole
2. Maintenance manuals for components and for system as a whole
3. Point-to-point diagrams, cabling diagrams, construction details and cabling labeling details
4. List of spare parts, materials and suppliers of components. Provide name, address and telephone number for each supplier.
5. Emergency instructions for operational and maintenance requirements
6. Delivery time frame for replacement of component parts from suppliers
7. Recommended inspection schedule and procedures for components and for system as a whole
8. List of spare parts, materials and suppliers of components. Provide name, address and telephone number for each supplier.

9. Complete “reviewed” shop drawings and product data for components and system as a whole
10. Troubleshooting procedures for each system and for each major system component

3.03 TRAINING

A. The Contractor shall be responsible for training of facility personnel. Training shall take place after occupancy and before acceptance and shall include programs for on-site operations and maintenance of technology and communications systems. Training shall be for not more than ten (10) people, shall be held at the Owner's site and shall be of sufficient duration and depth to ensure that the trained personnel can operate the installed systems and can perform usual and customary maintenance actions.

3.04 WARRANTY

A. General
   1. All equipment is to be new and warranted free of faulty workmanship and damage.
   2. Replacement of defective equipment and materials and repair of faulty workmanship within 24 hours of notification, except emergency conditions (system failures), which must be placed back in service within eight (8) hours of notification, all at no cost to the Owner.
   3. The minimum warranty provisions specified shall not diminish the terms of individual equipment manufacturer's warranties.

B. Structured Cabling
   1. Manufacturer(s) shall provide a minimum 25-year warranty for components used in the installed Structured Cabling System. Defective and/or improperly installed products shall be replaced and/or correctly installed at no cost to the Owner.

C. Pathway & Support Infrastructure
   1. Manufacturer(s) shall provide a minimum 1-year warranty for components used in the installed Pathway & Support Infrastructure. Defective and/or improperly installed products shall be replaced and/or correctly installed at no cost to the Owner.

END OF SECTION 270800

SECTION 271113
COMMUNICATIONS ENTRANCE PROTECTION

PART 1 GENERAL

1.01 GENERAL REQUIREMENTS

A. Applicable requirements of Division 27 - Communications shall be considered a part of this section and shall have the same force as if printed herein full.

B. This document describes the products and execution requirements relating to Communications Entrance Protection.

C. Product specifications, general design considerations, and installation guidelines are provided in this document. The successful vendor shall meet or exceed all requirements described in this document and on the drawings.

1.02 SUBMITTALS

A. Provide product data from manufacturer's specifications.

1.03 WORK INCLUDED

A. The work included under this specification consists of furnishing all labor, equipment, materials, supplies and performing all operations necessary to complete the installation. The Contractor will provide and install all of the required material whether specifically addressed in the Specification or not.

PART 2 PRODUCTS

2.01 APPROVED PRODUCTS

A. Approved Building Entrance Protector Terminal Manufacturer(s)
   1. Circa
   2. Marconi
   3. Porta Systems
   4. Or Approved Equal (by Design Engineer)

B. Approved Bonding Shield Connector Manufacturer(s)
   1. 3M
   1. Or Approved Equal (by Design Engineer)

2.02 BUILDING ENTRANCE PROTECTOR TERMINALS

A. Indoor Building Entrance Protector Terminal
   1. The indoor building entrance protector terminal shall be equipped with 110-connector inputs and outputs and shall accommodate industry standard 5-pin protection modules.
   2. The indoor building entrance protector terminal shall protect up to 100-pairs and shall be equipped with an internal fuse link.
   3. The indoor building entrance protector terminal shall be wall or frame mountable, and able to be stacked for future expansion.

4. The indoor building entrance protector terminal shall be equipped with external ground connectors that accept 6-14 AWG ground wire.

B. Solid State Surge Protection Modules
   1. The solid-state surge protector module shall be 5-pin and shall provide transient and power fault protection for standard telephone line applications.
   2. The solid-state surge protector module shall be designed to provide a balanced configuration to protect against line-to-line metallic surges.
   3. The solid-state surge protector module shall feature an external failsafe mechanism, which permanently grounds module under sustained high current conditions.
   4. The solid-state surge protector module shall feature nanosecond response time and safe mode operation in adverse situations.
   5. The solid-state surge protector module shall be UL & cUL Listed.

2.03 BONDING SHIELD CONNECTOR

A. Shield Connector
   1. The purpose of the bonding shield connector is to make a stable, low resistant electrical connection between the shield of a communications cable and a ground conductor.
   2. The bonding shield connector shall be tin-plated tempered brass.

PART 3 EXECUTION

3.01 BUILDING ENTRANCE PROTECTOR TERMINALS

A. All copper circuits shall be provided with protection between each building with an entrance cable protector panel. All building-to-building circuits shall be routed through this protector. The protector shall be connected with a #6 AWG copper bonding conductor between the protector ground lug and the telecommunications room (TR) busbar.

B. Building entrance protector shall be installed in accordance with the recommendations contained in the ANSI/TIA-607-C Telecommunications Bonding and Ground Standard.

C. Building entrance protector panels shall be installed as per the requirements specified by the manufacturer's installation guidelines.

3.02 BONDING SHIELD CONNECTOR

A. Bonding shield connector shall be installed in accordance with the recommendations contained in the ANSI/TIA-607-C Standard.

B. Bonding shield connector shall be installed as per the requirements specified by the manufacturer's installation guidelines.

3.03 IDENTIFICATION

A. Refer to Section 27 05 53 - Identification for Communications Systems for labeling details.

END OF SECTION 271113

SECTION 27 1116

COMMUNICATIONS CABINETS, RACKS AND ENCLOSURES

PART 1 GENERAL

1.01 GENERAL REQUIREMENTS

A. Applicable requirements of Division 27 - Communications shall be considered a part of this section and shall have the same force as if printed herein full.

B. This document describes the products and execution requirements relating to Communications Cabinets, Racks, and Enclosures.

C. Product specifications, general design considerations, and installation guidelines are provided in this document. The successful vendor shall meet or exceed all requirements described in this document and on the drawings.

1.02 SUBMITTALS

A. Provide product data from the manufacturer's specifications.

1.03 WORK INCLUDED

A. The work included under this specification consists of furnishing all labor, equipment, materials, supplies and performing all operations necessary to complete the installation. The Contractor will provide and install all of the required material whether specifically addressed in the Specification or not.

PART 2 PRODUCTS

2.01 APPROVED PRODUCTS

A. Approved Equipment Rack/Cabinet Manufacturer(s)

1. Chatsworth Products, Inc.
2. Hoffman
3. Middle Atlantic
4. Panduit
5. Hammond
6. Or Approved Equal (by Design Engineer)

B. WALL MOUNTED CABINET

1. Ventilation fans (minimum of two) shall be provided and installed at the top of the equipment cabinet.
1. hinged, lockable front door must be provided and installed.
2. Wire management accessories should be provided
3. No cables will be allowed to enter the cabinet without being properly supported by wire management.
4. Power strips, power supplies must be provided and mounted with-in the rack
5. Cabinet shall be at minimum. 24" W x 24"D x 36" H.
6. Cabinet must have integrated vertically supported 19" rails with a minimum of 4RU of spacing.

7. Basis of design is typical to Mid Atlantic Low Profile Wall Rack VWM-4-536K-PW
8. Cabinet must have integrated Din rails for mounting of equipment

2.02 RACK-MOUNTED PDUS

A. Wall Mount RACKS
   1. Horizontal configuration
   2. 120V/15A Monitored
   3. 5-15P Plug
   4. (12) 5-15R receptacles

PART 3 EXECUTION

3.01 EQUIPMENT RACKS/CABINETS

A. Equipment racks shall be securely attached to the concrete floor using minimum 3/8" hardware or as required by local codes.
B. Equipment cabinets shall be installed as per the requirements specified by the manufacturer's installation guidelines.
C. Equipment racks/cabinets shall be placed with a minimum of 40-inch clearance from the walls from the front and rear of the rack or as indicated on Drawings.
D. All equipment racks/cabinets shall be grounded to the telecommunications ground bus bar.
E. Mounting screws not used for installing patch panels and other hardware shall be bagged and left with the rack upon completion of the installation.
F. Contractor shall provide one (1) 25-count bag of rack screws per rack for IT Department personnel. These screws are in addition to what will be used by the contractor to mount the equipment that they are contracted to install.

3.02 BACKBOARDS

A. Backboards shall be 3/4" void free Grade AC plywood. Size of backboard shall be 4' x 8' unless noted differently on Drawings. Backboards shall be painted with two (2) coats of gray fire-retardant paint.
B. Mount Plywood 8” AFF with side Grade C facing the wall.
C. When mounting backboards to concrete walls, contractor to provide and install two layers of 3/4” void free Grade AC plywood.

3.03 IDENTIFICATION

A. Refer to Section 270553 - Identification for Communications Systems for labeling details.

END OF SECTION 271116

SECTION 271119
COMMUNICATIONS TERMINATION BLOCKS AND PATCH PANELS

PART 1 GENERAL

1.01 GENERAL REQUIREMENTS

A. Applicable requirements of Division 27 - Communications shall be considered a part of this section and shall have the same force as if printed herein full.

B. This document describes the products and execution requirements relating to Communications Termination Blocks and Patch Panels.

C. Product specifications, general design considerations, and installation guidelines are provided in this document. The successful vendor shall meet or exceed all requirements described in this document and on the drawings.

1.02 SUBMITTALS

A. Provide product data from manufacturer's specifications.

1.03 WORK INCLUDED

A. The work included under this specification consists of furnishing all labor, equipment, materials, supplies and performing all operations necessary to complete the installation. The Contractor will provide and install all of the required material whether specifically addressed in the Specification or not.

PART 2 PRODUCTS

2.01 APPROVED PRODUCTS

A. Approved Patch Panel Manufacturer(s) –Note: owner preferred solution is Legrand/Superior Essex. Must be matched with cabling and provided with manufacturer-based 25 year warranty.

1. Berk-Tek Leviton
    a. Patch Panel – QuickPort Series
    b. Jacks – Atlas-X1 Cat. 6A
    c. Jacks – Atlas X1 Cat. 6
2. Panduit – Mini-Com (Enterprise Solution)
    a. Patch Panel – Modular CPP Series
    b. Jacks – Mini-Com TX6 PLUS
    c. WiFi Jacks – Mini-Com TX6A 10Gig
3. CommScope – Systimax
    a. Patch Panel – Systimax 360 GigaSPEED XL/X10D
    b. Jacks – GigaSPEED X10D MGS600 Cat. 6A
    c. Jacks – GigaSPEED XL MGS400 Series Cat. 6
4. Siemon – Z-Max
    a. Patch Panel – Z-Max 6/6A

b. Jacks – Z-MAX 6
c. Jacks – Z-MAX 6A

5. Legrand

B. Approved Optical Fiber Enclosure Manufacturer(s)
1. Leviton
a. Rack Mount - 1000i SDX
b. Wall Mount – SDX Series
2. Panduit
a. Rack Mount - Opticom FRME
b. Wall Mount – Opticom FWME
3. CommScope – Systimax
a. Rack Mount SD-2U/SD-4U
b. Wall Mount
4. Siemon
a. Rack Mount – RIC3
b. Wall Mount – SWIC3
5. Legrand

C. Approved Termination Block Manufacturer(s)
1. Leviton
2. Panduit
3. CommScope
4. Siemon
5. Legrand

2.02 PATCH PANELS

A. Category 6 Patch Panel (Data & Video Surveillance)
1. The Category 6 patch panel shall be modular in design and equipped with Cat 6 jacks.
2. The Category 6 patch panel shall be compatible with 19" equipment racks, cabinets or wall mount brackets.
3. The Category 6 patch panel shall be 2U, angled, high density type.
4. The Category 6 patch panel shall be equipped with front labeling space to facilitate port identification.
5. All Jacks shall be component–rated.
6. The connector module shall exceed the Category 6 performance criteria per ANSI/TIA-568-C.2.
a. Icons shall be used if offered from the manufacturer.
b. Jack/Icon colors shall be:

1) Green for Video Surveillance
2) Blue for Data

A. Category 6A Patch Panel (WiFi)

7. The Category 6A patch panel shall be modular in design and equipped with Cat 6A jacks.
8. The Category 6A patch panel shall be compatible with 19" equipment racks, cabinets or wall mount brackets.
9. The Category 6A patch panel shall be 2U, angled, high density type.
10. The Category 6A patch panel shall be equipped with front labeling space to facilitate port identification.
11. All Jacks shall be component–rated.
12. The connector module shall exceed the Category 6A performance criteria per ANSI/TIA-568-C.2.
    a. Icons shall be used if offered from the manufacturer.
    b. Jack/Icon colors shall be:
        1) Yellow for WiFi

B. Voice-Grade Patch Panel (Voice)

13. The Voice-Grade patch panel shall be modular in design and equipped with Cat 3 jacks.
14. The Voice-Grade patch panel shall be compatible with 19" equipment racks, cabinets or wall mount brackets.
15. The Voice-Grade patch panel shall be 1U, flat, voice-grade, standard density type, 24 port.
16. The Voice-Grade patch panel shall be equipped with front labeling space to facilitate port identification.
    a. Icons shall be used if offered from the manufacturer.
    b. Jack/Icon colors shall be:
        1) Gray For Voice

2.03 OPTICAL FIBER PANELS/ENCLOSURES

A. Rack Mount Optical Fiber Panel/Enclosure

1. The rack mount optical fiber panel/enclosure shall be equipped with either a swing out mechanism or a sliding drawer to access fibers.
2. The rack mount optical fiber panel/enclosure shall be capable of terminating tight-buffered or loose tube optical fiber cable.
3. The rack mount optical fiber panel/enclosure shall provide for bend radius control throughout the panel as well as storage space for slack cabling.

4. The panel/enclosure shall meet or exceed the performance criteria per ANSI/TIA-568-C.3.
5. The rack mount optical fiber panel/enclosure shall be equipped with optical fiber adapter panels from same manufacturer.
    a. The optical fiber adapter panels shall accommodate singlemode terminated optical fiber.
    b. The optical fiber adapter panels shall be compatible with LC connectors.
    c. Singlemode adaptors shall be blue in color and equipped with zirconia ceramic sleeves.

B. Wall Mount Optical Fiber Panel/Enclosure
1. The wall mount optical fiber panel/enclosure shall have a hinged door for access, with locking available for security.
2. The wall mount optical fiber panel/enclosure shall be capable of terminating tight-buffered or loose tube optical fiber cables and all popular connector types.
3. The wall mount optical fiber panel/enclosure shall provide for bend radius control throughout the panel as well as storage space for slack cabling.
4. The panel/enclosure shall meet or exceed the performance criteria per ANSI/TIA-568-C.3.
5. The wall mount optical fiber panel/enclosure shall be equipped with optical fiber adapter panels from same manufacturer.
    a. The optical fiber adapter panels shall accommodate singlemode terminated optical fiber.
    b. The optical fiber adapter panels shall be compatible with LC connectors.
    c. Singlemode adaptors shall be blue in color and equipped with zirconia ceramic sleeves.

2.04 TERMINATION BLOCKS

A. 110 Type Wiring Blocks/Cross-Connect Kits:
1. The 110-type wiring blocks shall be available in 100- and/or 300-pair configurations.
2. The 110-type wiring block shall be Category 6 for backbone terminations.
3. The cross-connect kits shall include all the components required to complete a wall-mounted 110 cross-connect installation and be available in both 100-pair and 300-pair configurations (Includes 110-blocks, connecting blocks and designation strips).
4. The termination block shall meet or exceed the performance criteria per ANSI/TIA-568-C.2.
5. Backbone blocks shall use 5-pair connecting blocks on each 25-pair row.

B. 66-Blocks
   1. The 66-type wiring block shall be a 50-pair configuration.
   2. The 66-type wiring block shall have a split clip system using bridge clips to connect incoming pairs to outgoing pairs.
   3. The 66 block's labeling system shall use designation strips or covers to accommodate labels.

PART 3 EXECUTION

3.01 PATCH PANELS

A. Cables shall be dressed and terminated in accordance with the recommendations made in ANSI/TIA-568-C.0 and/or ANSI/TIA-568-C.1, manufacturer's recommendations and best industry practice.
B. Pair untwist at the termination shall not exceed 13 mm (0.5 inch).
C. Bend radius of the cable in the termination area shall not exceed 4 times the outside diameter of the cable.
D. Cables shall be neatly bundled and dressed to their respective patch panel. Each patch panel shall be fed by an individual bundle separated and dressed back to the point of cable entrance into the rack or frame.
E. Each cable shall be clearly labeled on the cable jacket behind the patch panel at a location that can be viewed without removing the bundle support ties. Cables labeled within the bundle, where the label is obscured from view shall not be acceptable.

3.02 OPTICAL FIBER PANELS/ENCLOSURES

A. Cables shall be dressed and terminated in accordance with the recommendations made in ANSI/TIA-568-C.0 and/or ANSI/TIA-568-C.1, manufacturer's recommendations and best industry practices.
B. Each cable shall be individually attached to the respective splice enclosure by mechanical means. The cables strength member shall be securely attached the cable strain relief bracket in the enclosure.
C. Bend radius of the optic fiber cable in the panel/enclosure shall not exceed 10 times the outside diameter of the cable.
D. Each fiber bundle shall be stripped upon entering the splice tray and the individual fibers routed in the splice tray.
E. Each cable shall be clearly labeled at the entrance to the splice enclosure. Cables labeled within the bundle shall not be acceptable.
F. A maximum of 12 strands of fiber shall be spliced in each fiber splice tray.
G. All spare strands shall be installed into spare splice trays.
H. Fiber slack shall be neatly coiled within the fiber splice tray or enclosure. No slack loops shall be allowed external to the fiber panel.

3.03 TERMINATION BLOCKS

A. Cables shall be dressed and terminated in accordance with the recommendations made in ANSI/TIA-568-C.0 and/or ANSI/TIA-568-C.1, manufacturer's recommendations and best industry practice.
B. Pair untwist at the termination shall not exceed 13 mm (0.5 inch).
C. Bend radius of the cable in the termination area shall not exceed 4 times the outside diameter of the cable.
D. Cables shall be neatly bundled and dressed to their respective termination block. Each termination block shall be fed by an individual bundle separated and dressed back to the point of cable entrance into the rack or frame.
E. Each cable shall be clearly labeled on the cable jacket within 12" of the termination block at a location that can be viewed without removing the bundle support ties. Cables labeled within the bundle, where the label is obscured from view shall not be acceptable.
F. Wall mounted termination block fields shall be mounted on communications backboard.
G. Wall mounted termination block fields shall be installed as per the requirements specified by the manufacturer's installation guidelines.

3.04 IDENTIFICATION

A. Refer to Section 270553 - Identification for Communications Systems for labeling details.

END OF SECTION 271119

SECTION 27 1123

COMMUNICATIONS CABLE MANAGEMENT AND LADDER RACK

PART 1 GENERAL

1.01 GENERAL REQUIREMENTS

A. Applicable requirements of Division 27 - Communications shall be considered a part of this section and shall have the same force as if printed herein full.

B. This document describes the products and execution requirements relating to Communications Cable Management and Ladder Rack.

C. Product specifications, general design considerations, and installation guidelines are provided in this document. The successful vendor shall meet or exceed all requirements described in this document and on the drawings.

1.02 SUBMITTALS

A. Provide product data from manufacturer's specifications.

1.03 WORK INCLUDED

A. The work included under this specification consists of furnishing all labor, equipment, materials, supplies and performing all operations necessary to complete the installation. The Contractor will provide and install all of the required material whether specifically addressed in the Specification or not.

PART 2 PRODUCTS

2.01 APPROVED PRODUCTS

A. Approved Horizontal Cable Management Manufacturer(s)
   1. Leviton
   2. Panduit
   3. CommScope - Systimax
   4. Chatsworth Products, Inc. (CPI)
   5. Siemon
   6. Legrand

B. Approved Vertical Cable Management Manufacturer(s)
   1. Leviton
   2. Panduit
   3. CommScope - Systimax
   4. Chatsworth Products, Inc. (CPI)
   5. Legrand

C. Approved Ladder Rack System Manufacturer(s)
   1. Chatsworth Products, Inc. (CPI)
   2. Hoffman
   3. Or Approved Equal (Owner)
   4. Legrand

D. Approved C-Ring/D-ring Manufacturer(s)
   1. Chatsworth Products, Inc. (CPI)
   2. Or Approved Equal (Owner)
   3. Legrand

2.02 CABLE MANAGEMENT - HORIZONTAL

A. Horizontal Cable Management
   1. The horizontal wire manager shall be compatible with 19-inch equipment racks, cabinets or wall mount brackets.
   2. The horizontal cable manager shall provide support for patch cords at the front of the panel.
   3. The horizontal cable manager shall be 2 rack-units in height when matched with a 2 rack-unit patch panel or switch.
   4. The horizontal cable manager shall be 1 rack-unit in height when matched with a 1 rack-unit patch panel or switch.
   5. See Drawings for Requirements.

2.03 CABLE MANAGEMENT - VERTICAL

A. Vertical Cable Management
   1. The vertical cable manger shall be double-sided.
   2. The vertical cable manager shall provide support for patch cords at the front of the rack and wire management at the rear of the rack.
   3. The vertical cable manager shall be a minimum width of 8" for end of rows and 10” for between two racks.
   4. Vertical cable manager color shall be black.
   5. Vertical Cable Manger shall be 9’ 84” in height.
   6. See Drawings for Requirements.

2.04 LADDER RACKS

A. Ladder Rack System
   1. See Drawings for ladder rack system details.
   2. The ladder rack system shall be securely mounted with hardware designed for use in ladder rack systems.
   3. End caps shall be installed on the exposed ends of the ladder racks, channel supports and bolts. Protective covers shall be installed on threaded rods that come in contact with cabling plant.
   4. Provide vertical sections of ladder rack to support vertical cabling spans greater than 4 feet.
   5. Ladder Rack System color shall be black.

2.05 VELCRO STRAPS

A. Velcro Straps

1. Backbone cables shall be fastened to support structures with Velcro straps.
2. Horizontal cables shall be fastened to support structures with Velcro straps.
   a. Velcro Strap color shall be black (or red in plenum spaces).
3. Tie Wraps shall not be permitted.

2.06 C-RINGS/D-RINGS

A. C-Rings/D-rings
   1. C-rings/D-rings shall be used on backboards to support cables, patch cords and cross-connect wire.
   2. C-rings/D-rings shall be made of high-strength, fire-retardant material with rounded edges to prevent damage to cable and wire insulation.

PART 3 EXECUTION

3.01 CABLE MANAGEMENT - HORIZONTAL

A. Horizontal cable managers shall be installed as indicated on Drawings.

3.02 CABLE MANAGEMENT - VERTICAL

A. Vertical cable managers shall be installed on both sides of a single equipment rack. Where two (2) or more racks are positioned in a row, vertical cable managers shall be installed between each rack and each end of the row.

3.03 LADDER RACKS

A. Ladder rack system shall be installed straight, level and perpendicular to walls and ceiling slabs.
B. Ladder racks shall be supported at 5' intervals maximum.
C. Provide all hardware, accessories, fasteners, anchors, threaded rods and support channels required to provide a complete ladder rack system.
D. See Drawings for ladder rack system details.
E. Provide cable radius protection (turn-downs/ waterfalls) at each location within telecom room where cabling transitions from horizontal to vertical routing from the ladder rack.
F. Provide vertical section of cable runway to support vertical cabling spans greater than 3’.

3.04 VELCRO STRAPS

A. Velcro straps shall be installed around cables at intervals of 12" minimum.
B. Velcro straps shall secure cables to ladder racks using an “X” pattern.
C. Do not over-cinch cables.

3.05 C-RINGS/D-RINGS

A. C-ring/D-rings shall be installed on 3/4" backboard, straight and level.

3.06 IDENTIFICATION

A. Refer to Section 270553 - Identification for Communications Systems for labeling details.

END OF SECTION 27 1123

SECTION 27 1313 - COMMUNICATIONS COPPER BACKBONE

PART 1 GENERAL

1.01 GENERAL REQUIREMENTS

A. Applicable requirements of Division 27 - Communications shall be considered a part of this section and shall have the same force as if printed herein full.

B. This document describes the products and execution requirements relating to Communications Copper Backbone.

C. Product specifications, general design considerations, and installation guidelines are provided in this document. The successful vendor shall meet or exceed all requirements described in this document and on the drawings.

1.02 SUBMITTALS

A. Provide product data from manufacturer's specifications.

1.03 WORK INCLUDED

A. The work included under this specification consists of furnishing all labor, equipment, materials, supplies and performing all operations necessary to complete the installation. The Contractor will provide and install all of the required material whether specifically addressed in the Specification or not.

PART 2 PRODUCTS

2.01 APPROVED PRODUCTS

A. Approved Copper Backbone Cable (Inside Plant) Manufacturer(s)
   1. Berk-Tek
   2. General
   3. CommScope
   4. Siemon
   5. Superior Essex

B. Approved Copper Backbone Cable (Outside Plant) Manufacturer(s)
   1. General
   2. Berk-tek
   3. Commscope
   4. Siemon
   5. Superior Essex
   6. Or Approved Equal (by Design Engineer)

2.02 COPPER BACKBONE CABLE (INSIDE PLANT)

A. 100-Ohm Balanced Twisted Pair Building Backbone Cables (Inside Plant)
   1. Generic Characteristics
      a. The inside plant, balanced twisted pair building backbone cable shall meet the 25-Ohm balanced twisted pair backbone requirements per the latest issue of ANSI/TIA-568-C.2.

b. The inside plant, 100-Ohm balanced twisted pair cable shall be CMR or CMP rated (according to the space it occupies).
c. The inside plant, balanced twisted pair building backbone cable core shall consist of 25-pair sub-units.

2.03 COPPER BACKBONE CABLE (OUTSIDE PLANT)

A. 100-Ohm PE-89 Backbone Cables (Outside Plant)
1. Generic Characteristics
a. The outside plant backbone cable shall be assigned the RDUP designation of PE-89.
b. The outside plant backbone cable core shall consist of 25-pair sub-units.
c. The outside plant backbone cable shall contain water-blocking gel and have a jacket made of polyethylene.

PART 3 EXECUTION

3.01 BACKBONE CABLES (INSIDE PLANT)

A. Cables shall be dressed and terminated in accordance with the recommendations made in ANSI/TIA-568-C.0 and/or ANSI/TIA-568-C.1, manufacturer's recommendations and best industry practices.
B. Backbone cables shall be installed separately from horizontal distribution cables
C. A plastic or nylon pull cord with a minimum test rating of 90 Kg (200 lb.) shall be co-installed with all cable installed in any conduit.
D. Where cables are housed in conduits, the backbone and horizontal cables shall be installed in separate conduits
E. Exposed cables must be CMP or MMP rated if installed in an air return plenum. CMR rated cables shall be installed in metallic conduit if installed in an air return plenum.
F. Where backbone cables and distribution cables are installed in a cable tray or wireway, backbone cables shall be installed first and bundled separately from the horizontal distribution cables.
G. Leave 10' of slack on each end of copper backbone cable.
H. Backbone cables spanning more than three floors shall be securely attached at the top of the cable run with a wire mesh grip and on alternating floors or as required by local codes.
I. Vertical runs of cable shall be supported to messenger strand, cable ladder, or other method to provide proper support for the weight of the cable.
J. Large bundles of cables and/or heavy cables shall be attached using metal clamps and/or metal banding to support the cables.
K. The cable's minimum bend radius and maximum pulling tension shall not be exceeded. Refer to manufacturer's requirements.

L. Copper cables shall be neatly bundled and dressed to their respective panels or blocks. Each panel or block shall be fed by an individual bundle separated and dressed back to the point of cable entrance into the rack or frame.

M. Each copper cable shall be clearly labeled on the cable jacket behind the patch panel or block at a location that can be viewed without removing the bundle support ties. Cables labeled within the bundle, where the label is obscured from view shall not be acceptable.

N. Copper backbone cables shall be installed separately from horizontal distribution cables

3.02 BACKBONE CABLES (OUTSIDE PLANT)

A. All OSP cables brought to the Entrance Facilities shall have 15 ft of slack coiled and secured to the wall in the proximity of the termination field.

B. All cables shall be tagged and identified within each handhole/maintenance hole.

C. Place initial cables in bottom conduits to facilitate easy subsequent cable placement.

D. Place leader guard in the duct before placing cable to prevent damaging the cable sheath on the sharp edge of the duct.

E. Ventilate maintenance where gas has been detected before entering the maintenance hole.

F. A 600 lb. break-away swivel, along with a slip clutch capstan winch that shows the dynamometer (pulling tension) reading, shall be used at all times during pulling.

G. At each splice location the cable ends will be sealed watertight at all times. Reels will be continuously manned during cable installation.

H. Copper backbone cables shall be bonded and grounded in accordance with the recommendations made in the ANSI/TIA-607-C standard, manufacturer's recommendations and best industry practice.

3.03 IDENTIFICATION

A. Refer to Section 270553 - Identification for Communications Systems for labeling details.

END OF SECTION 27 1313

SECTION 27 1323
COMMUNICATIONS OPTICAL FIBER BACKBONE CABLING

PART 1 GENERAL

1.01 GENERAL REQUIREMENTS

A. Applicable requirements of Division 27 - Communications shall be considered a part of this section and shall have the same force as if printed herein full.

B. This document describes the products and execution requirements relating to Communications Optical Fiber Backbone Cabling.

C. Product specifications, general design considerations, and installation guidelines are provided in this document. The successful vendor shall meet or exceed all requirements described in this document and on the drawings.

1.02 SUBMITTALS

A. Provide product data from manufacturer's specifications.

1.03 WORK INCLUDED

A. The work included under this specification consists of furnishing all labor, equipment, materials, supplies and performing all operations necessary to complete the installation. The Contractor will provide and install all of the required material whether specifically addressed in the Specification or not.

PART 2 PRODUCTS

2.01 APPROVED PRODUCTS

A. Approved Optical Fiber Backbone Cable (Inside Plant) Manufacturer(s) (must be matched with connectivity and provided with manufacturer-based 25 year warranty.)
   1. Berk-Tek
   2. General Cable
   3. CommScope
   4. Siemon
   5. Corning
   6. Superior Essex

B. Approved Optical Fiber Backbone Cable (Outside Plant) Manufacturer(s) (must be matched with connectivity and provided with manufacturer-based 25 year warranty.)
   1. Berk-Tek
   2. General Cable
   3. CommScope
   4. Siemon
   5. Corning
   6. Superior Essex

C. Approved Optical Fiber Connectivity Manufacturer(s) (must be matched with cabling and provided with manufacturer-based 25 year warranty.)
   1. Leviton
   2. Panduit
   3. CommScope
   4. Siemon
   5. Corning
   6. Legrand

D. Approved Splice Case Manufacturer(s)
   1. Commscope
   2. 3M
   3. Corning

2.02 OPTICAL FIBER BACKBONE CABLE (INSIDE PLANT)

A. Riser - Indoor 8.3/125-micron, Singlemode Optical Fiber Conductive (OFCR) (OS2)
   1. Generic Characteristics
      a. The indoor optical fiber cable with up to twelve 250-micron coated fibers placed in a color-coded sub-unit bundle.
         1) The indoor optical fiber cable shall meet or exceed the performance criteria found in ANSI/TIA-568-C.3.
         2) All singlemode fibers shall be pigtail spliced into a rack mounted optical fiber panel or wall-mounted enclosure.
         3) The loss of fiber shall not exceed 0.50 dB per kilometer @ 1550 nm and 0.50 dB per kilometer @ 1310 nm.
         4) All Indoor Fiber shall be armored.

B. Plenum Indoor Distribution 50/125 Multimode Optical Fiber Non Conductive (OFNP)
   1. Generic Characteristics:
      a. The optical fiber cable shall be available with up to twelve 900-micron tight-buffered 250-micron fibers placed in a color-coded sub-unit bundle with aramid strength elements.
      b. The indoor optical fiber cable shall have sequential length marking printed on the cable jacket.
      c. Maximum attenuation dB/Km @ 850/1300 nm: 3.5/1.0
      d. Bandwidth (RML-2000, OFL-1500) MHz-km @ 850 nm.
      e. Bandwidth 500 MHz-km @ 1300 nm.
      f. All multi-mode fiber optic cable shall be laser optimized, “OM-3” rated.

2.03 OPTICAL FIBER BACKBONE CABLE (OUTSIDE PLANT)

A. Indoor/outdoor 8.3/125-micron, Singlemode Optical Fiber Non-Conductive (OFNR) (OS2)
   1. Generic Characteristics
      a. The indoor/outdoor optical fiber cable with up to twelve 250-micron coated fibers placed in a color-coded sub-unit bundle with moisture-blocking gel.
      b. The indoor/outdoor optical fiber cable shall meet or exceed the performance criteria found in ANSI/TIA-568-C.3.
      c. The indoor/outdoor optical fiber cable shall have sequential length markings printed on the cable jacket.
      d. All singlemode fibers shall be pigtail spliced into a rack mounted optical fiber enclosure or wall-mounted enclosure.
      e. The loss of fiber shall not exceed 0.50 dB per kilometer @ 1550 nm and 0.50 dB per kilometer @ 1310 nm.

B. Plenum - Outdoor Distribution 50/125 Multimode Optical Fiber Non-Conductive (OFNP) Tight Buffered Cable
   1. Generic Characteristics:
      a. The optical fiber cable shall be available with up to twelve 900-micron tight-buffered 250-micron fibers placed in a color-coded sub-unit bundle with aramid strength elements.
      b. The indoor optical fiber cable shall have sequential length marking printed on the cable jacket.
      c. Maximum attenuation dB/Km @ 850/1300 nm: 3.5/1.0
      d. Bandwidth (RML-2000, OFL-1500) MHz-km @ 850 nm.
      e. Bandwidth 500 MHz-km @ 1300 nm.
      f. All multi-mode fiber optic cable shall be laser optimized, “OM-3” rated.
      g. Cable routed in conduit in grade slab or below grade shall be Outside Plant – Wet Rated.

2.04 OPTICAL FIBER CONNECTORS

A. Singlemode & multimode Fiber Connectivity
   1. The optical fiber connector shall be LC.
   2. The optical fiber connector and pigtail assembly shall meet or exceed the performance criteria found in ANSI/TIA-568-C.3.
   3. The method of terminating singlemode and multimode fiber is pigtail splicing into a rack mounted optical fiber panel or wall-mounted enclosure. Pigtails shall be factory terminated and 3 meters in length. A fiber enclosure with slack storage trays must be used when pigtail-splicing method is used.
   4. The splice loss through each connector pair shall not exceed 0.50 dB.

5. Singlemode fiber connector color shall be blue and multimode connectors shall be orange.

2.05 SPLICE CASES

A. Canister Splice Case
   1. Splice cases shall be water tight and designed for outside plant applications.
   2. All splice trays, seals and hardware shall be from the same manufacturer as the splice case.
   3. Splice trays shall utilize heat-shrink seals.
   4. See Drawings for size requirements.

PART 3 EXECUTION

3.01 BACKBONE CABLES (INSIDE PLANT)

A. Cables shall be dressed and terminated in accordance with the recommendations made in ANSI/TIA-568-C.0 and/or ANSI/TIA-568-C.1, manufacturer's recommendations and best industry practices.
B. Backbone cables shall be installed separately from horizontal distribution cables
C. A plastic or nylon pull cord with a minimum test rating of 90 Kg (200 lb.) shall be co-installed with all cable installed in any conduit.
D. Where cables are housed in conduits, the backbone and horizontal cables shall be installed in separate conduits
E. Exposed cables must be OFNP rated if installed in an air return plenum. Riser rated cables shall be installed in metallic conduit if installed in an air return plenum.
F. Where backbone cables and distribution cables are installed in a cable tray or wireway, backbone cables shall be installed first and bundled separately from the horizontal distribution cables.
G. Leave 10' of slack on each end of fiber backbone cable.
H. Backbone cables spanning more than three floors shall be securely attached at the top of the cable run with a wire mesh grip and on alternating floors or as required by local codes.
I. Vertical runs of cable shall be supported to messenger strand, cable ladder, or other method to provide proper support for the weight of the cable.
J. Large bundles of cables and/or heavy cables shall be attached using metal clamps and/or metal banding to support the cables.
K. The cable's minimum bend radius and maximum pulling tension shall not be exceeded. Refer to manufacturer's requirements.
L. Each optical fiber cable shall be individually attached to the respective enclosure by mechanical means. The cables strength member shall be securely attached the cable strain relief bracket in the enclosure.

M. Each optical fiber cable shall be clearly labeled at the entrance to the enclosure. Cables labeled within the bundle shall not be acceptable.
N. Each fiber bundle shall be stripped upon entering the splice tray and the individual fibers routed in the splice tray.
O. A maximum of 12 strands of fiber shall be spliced in each splice tray
P. All spare fiber strands shall be installed into spare splice trays.
Q. Fiber slack shall be neatly coiled within the fiber splice tray or enclosure. No slack loops shall be allowed external to the fiber panel.

3.02 BACKBONE CABLES (OUTSIDE PLANT)

A. All OSP cables brought to the Entrance Facilities shall have 15 ft of slack coiled and secured to the wall in the proximity of the fiber enclosure.
B. All cables shall be tagged and identified within each handhole/maintenance hole.
C. Place initial cables in bottom conduits to facilitate easy subsequent cable placement.
D. Place leader guard in the duct before placing cable to prevent damaging the cable sheath on the sharp edge of the duct.
E. Ventilate maintenance where gas has been detected before entering the maintenance hole.
F. To ensure that the optical fiber cable's qualities and characteristics are not degraded during installation, excessive pulling tensions and short bending radii will not be allowed. The maximum pulling tension is 600 lbs. The minimum bending radius for cable under tension is 20 times the outside diameter of the cable and for cable at rest is 10 times the outside diameter of the cable.
G. A 600 lb. break-away swivel, along with a slip clutch capstan winch that shows the dynamometer (pulling tension) reading, shall be used at all times during pulling.
H. At each splice location the cable ends will be sealed watertight at all times. Reels will be continuously manned during cable installation.
I. Contractor shall coil 60 feet of spare optical fiber cable in each handhole/maintenance hole without a splice and 75 feet of each optical fiber cable in each handhole/maintenance hole with a splice. Cable coils shall have at least two points of support on the optical fiber racking system.
J. When mounting the optical fiber slack coils, the minimum bend radius shall not be exceeded; this radius is equal to 10 times the outside diameter of the cable in a static application and 20 times the outside diameter in a dynamic application. At anytime during the entire handling process of the optical fiber cable, as much care as possible should be maintained and all the manufacturer's recommendations should be followed.

3.03 OPTICAL FIBER CONNECTIVITY / SPLICING

A. Optical fiber connectors shall be installed as per the requirements specified by the manufacturer's installation guidelines.
B. All splicing shall be of the fusion type made under Light Injection and Detection Mode, whenever applicable. The Contractor shall provide certified and experienced personnel for splicing.
C. Contractor's tools and equipment shall be in excellent working order. Any worn or improperly working tools shall be discarded and not used on this project. All fusion splicers shall be calibrated and labeled according to the manufacturer's specifications. Contractor shall submit certification of calibration for the fusion splicers to the Engineer.

3.04 SPLICE CASES

A. Splice Cases shall be installed as per the requirements specified by the manufacturer's installation guidelines.

3.05 IDENTIFICATION

A. Refer to Section 270553 - Identification for Communications Systems for labeling details.
B. Refer to Section 270800 – Commissioning of Communications for Testing Requirements.

END OF SECTION 27 1323

SECTION 27 1500

COMMUNICATIONS COPPER HORIZONTAL CABLING

PART 1 GENERAL

1.01 GENERAL REQUIREMENTS

A. Applicable requirements of Division 27 - Communications shall be considered a part of this section and shall have the same force as if printed herein full.

B. This document describes the products and execution requirements relating to Communications Copper Horizontal Cabling.

C. Product specifications, general design considerations, and installation guidelines are provided in this document. The successful vendor shall meet or exceed all requirements described in this document and on the drawings.

1.02 SUBMITTALS

A. Provide product data from manufacturer's specifications.

1.03 WORK INCLUDED

A. The work included under this specification consists of furnishing all labor, equipment, materials, supplies and performing all operations necessary to complete the installation. The Contractor will provide and install all of the required material whether specifically addressed in the Specification or not.

PART 2 PRODUCTS

2.01 APPROVED PRODUCTS –MUST BE MATCHED WITH CONNECTIVITY HARDWARE AND PROVIDED MANUFACTURER-BASED 25 YEAR WARRANTY.

A. Approved CATEGORY 6 Horizontal Copper Cable Manufacturer(s)
   1. Berk-Tek – LANmark 2000
   2. General – GenSPEED 6500 Premium
   3. CommScope / Systimax 360 – GigaSPEED XL
   4. Siemon – Premium 6 UTP Cable
   5. Superior Essux – NextGain Category6eX

B. Approved CATEGORY 6A Horizontal Copper Cable Manufacturer(s)
   1. Berk-Tek – LANmark XTP
   2. General – GenSPEED 10
   3. CommScope / Systimax – GigaSPEED X10D
   4. Siemon – Category 6A GT UTP
   5. Superior Essux – 10Gain XP

2.02 CATEGORY 6A HORIZONTAL COPPER CABLE

A. 100 OHM Category 6A Balanced Twisted Pair Cable
   1. The horizontal balanced twisted pair cable shall exceed the Category 6A transmission characteristics per issue of ANSI/TIA-568-C.2.

2. Cable shall have maximum OD size of .29 inch.
3. Cable jacket shall be CMP/CMR rated, according to the space it occupies.
4. Jacket color shall be: White for Wifi

2.03 CATEGORY 6 HORIZONTAL COPPER CABLE

A. 100 OHM Category 6 Balanced Twisted Pair Cable
   1. The horizontal balanced twisted pair cable shall exceed the Category 6A transmission characteristics per issue of ANSI/TIA-568-C.2.
   2. Cable jacket shall be CMP/CMR rated, according to the space it occupies.
   3. Jacket color shall be:
      a. Green for Video Surveillance.
      b. Blue for Data

PART 3 EXECUTION

3.01 HORIZONTAL CABLES

A. Cable shall be installed in accordance with manufacturer's recommendations and best industry practices.
B. A plastic or nylon pull cord with a minimum test rating of 90 Kg (200 lb.) shall be co-installed with all cable installed in any conduit.
C. Cable raceways shall not be filled greater than the ANSI/TIA-569-B maximum fill for the particular raceway type.
D. Cables shall be installed in continuous lengths from origin to destination (no splices) except for transition points, or consolidation points.
E. Where transition points or consolidation points are allowed, they shall be located in accessible locations and housed in an enclosure intended and suitable for the purpose.
F. The cable's minimum bend radius and maximum pulling tension shall not be exceeded. Refer to manufacturer's requirements.
G. If a J-hook or trapeze system is used to support cable bundles all horizontal cables shall be supported at a maximum of 48 to 60 inch (1.2 to 1.5 meter) intervals. At no point shall cable(s) rest on acoustic ceiling grids or panels.
H. Horizontal distribution cables shall be bundled in groups of no more than 50 cables. Cable bundle quantities in excess of 50 cables may cause deformation of the bottom cables within the bundle and degrade cable performance.
I. Cable shall be installed above fire-sprinkler systems and shall not be attached to the system or any ancillary equipment or hardware. The cable system and support hardware shall be installed so that it does not obscure any valves, fire alarm conduit, boxes, or other control devices.

J. Cables shall not be attached to ceiling grid or lighting fixture wires. Where support for horizontal cable is required, the Contractor shall install appropriate carriers to support the cabling.

K. Any cable damaged or exceeding recommended installation parameters during installation shall be replaced by the Contractor prior to final acceptance at no cost to the Owner.

L. Cables shall be dressed and terminated in accordance with the recommendations made in the ANSI/TIA-568-C.2 document, manufacturer's recommendations and best industry practices.

M. Leave a minimum of 12" of slack for twisted pair cables at the outlet. Cables shall be coiled in the in-wall box, surface-mount box or modular furniture raceway if adequate space is present to house the cable coil without exceeding the manufacturers bend radius. Excess slack shall be loosely coiled and stored in the ceiling above each drop location when there is not enough space present in the outlet box to store slack cable.

N. Cables shall be neatly bundled and dressed to their respective termination device. Each terminating device shall be fed by an individual bundle separated and dressed back to the point of cable entrance into the rack or frame.

O. Each cable shall be clearly labeled on the cable jacket behind the termination device at a location that can be viewed without removing the bundle support ties. Cables labeled within the bundle, where the label is obscured from view shall not be acceptable.

3.02 IDENTIFICATION

A. Refer to Section 270553 - Identification for Communications Systems for labeling details.

B. Refer to Section 270800 - Commissioning of Communications for Testing Requirements.

END OF SECTION 271513

SECTION 27 1543
COMMUNICATIONS FACEPLATES AND CONNECTORS

PART 1 GENERAL

1.01 GENERAL REQUIREMENTS

A. Applicable requirements of Division 27 - Communications shall be considered a part of this section and shall have the same force as if printed herein full.

B. This document describes the products and execution requirements relating to Communications Faceplates and Connectors.

C. Product specifications, general design considerations, and installation guidelines are provided in this document. The successful vendor shall meet or exceed all requirements described in this document and on the drawings.

1.02 SUBMITTALS

A. Provide product data from manufacturer's specifications.

1.03 WORK INCLUDED

A. The work included under this Specification consists of furnishing all labor, equipment, materials, supplies and performing all operations necessary to complete the installation. The Contractor will provide and install all of the required material whether specifically addressed in the Specification or not.

PART 2 PRODUCTS

2.1 APPROVED PRODUCTS – NOTE: OWNER PREFERRED SOLUTION IS LEGRAND/SUPERIOR ESSEX

A. Approved Cat. 6 Copper Connectivity Manufacturer(s) (must be matched with cabling and provided with manufacturer-based 25-year warranty.)
   1. Leviton – Atlas X1 Cat. 6
   2. Panduit - Mini-Com TX6 PLUS
   3. Siemon – Z-MAX 6
   4. CommScope / Systimax 360 – GigaSPEED XL MGS400
   5. Legrand – KT2J6-XX

B. Approved Category 6A Copper Connectivity Manufacturer(s) (must be matched with cabling and provided with manufacturer-based 25-year warranty.)
   1. Leviton – Atlas X1 – Cat. 6A
   2. Panduit - Mini-Com TX6A 10Gig
   3. Siemon – Z-MAX 6A UTP
   4. CommScope / Systimax 360 – MGS600
   5. Legrand – KT2J6A-XX

C. Approved Faceplate Manufacturer(s)
   1. Leviton
   2. Panduit

3. Siemon
4. CommScope
5. Legrand

D. Approved Surface Mount Box manufacturer(s)
1. Leviton
2. Panduit
3. Siemon
4. CommScope
5. Legrand

E. Approved Harsh-Environment Faceplate Manufacturer(s)
1. Leviton
2. Panduit
3. Commscope
4. Siemon
5. Legrand

2.02 CATEGORY 6 COPPER CONNECTIVITY

A. Category 6, 8-Position, 8-Contact (8P8C) Modular Jack
1. The connector module shall exceed the Category 6 performance criteria per ANSI/TIA-568-C.2.
2. The eight-position connector module shall accommodate six-position modular plug modular cords without damage to either the cord or the module.
3. The connector module shall be designed for use at the work area (WA), communications room (TR) and/or equipment room (ER) without modification.
4. The connector module shall be available in both the T568A and T568B wiring configurations within the same module.
5. The connector module shall have an insulation displacement connection featuring insulation slicing of 22 to 24 AWG plastic-insulated solid copper conductors forming a gas-tight connection.
6. Icons shall be used if offered from the manufacturer.
7. All Jacks shall be component–rated.
8. Jack/Icon colors shall be:
a. Gray for Voice
b. Green for Video Surveillance
c. Blue for Data

2.03 CATEGORY 6A COPPER CONNECTIVITY

A. Category 6A, 8-Position, 8-Contact (8P8C) Modular Jack
1. The connector module shall exceed the Category 6A performance criteria per ANSI/TIA-568-C.2.

2. The eight-position connector module shall accommodate six-position modular plug modular cords without damage to either the cord or the module.
3. The connector module shall be designed for use at the work area (WA), communications room (TR) and/or equipment room (ER) without modification.
4. The connector module shall be available in both the T568A and T568B wiring configurations within the same module.
5. The connector module shall have an insulation displacement connection featuring insulation slicing of 22 to 24 AWG plastic-insulated solid copper conductors forming a gas-tight connection.
6. Icons shall be used if offered from the manufacturer.
7. All Jacks shall be component–rated.
8. Jack/Icon colors shall be:
    a. White for WiFi

2.04 FIELD TERMINATED DIRECT ATTACH PLUG

A. All WIFI and Video Surveillance shall be field terminated with Direct Attach Plugs.
B. Components must comply with ANSI/TIA-863 Building Automation Standard
C. UTP Cable Connecting Hardware shall be a Field Terminated Direct Attach Category 6A RJ-45 Plug. The RJ-45 Plug shall utilize the printed circuit board technology to insure Cat-6A (WIFI) performance. The Field Terminated plug shall utilize IDC connections with a compression cap method for termination.
D. Testing shall be completed using the manufacturer approved testing device and adapter cord.

2.05 FACEPLATES

A. Faceplates
    1. Faceplates shall be white on gypsum walls and stainless steel on any wood/acoustic panel walls.
    2. The faceplate housing the connector modules shall have no visible mounting screws.
    3. It shall be possible to install the connector modules in wall-mounted single- and dual-gang electrical boxes, utility poles and modular furniture (cubicle) access points using manufacturer-supplied faceplates and/or adapters.
    4. The faceplate housing the connector modules shall have the option of being mounted on adapter boxes for surface mount installation.
    5. The faceplate housing the connector modules shall have a labeling capability using built-in labeling windows, to facilitate outlet identification and ease network management.

6. The faceplate housing the connector modules shall provide flexibility in configuring multimedia workstation outlets that respond to present or future network needs such as audio, video, coaxial and optical fiber applications.

2.06 SURFACE MOUNT BOXES

A. The surface mount box shall accommodate connections of any type, UTP, optical fiber or coax.
B. The surface mount box shall have internal storage space for slack cabling and a built-in spool for controlling cable bend radius.
C. Color shall be same as electrical faceplates.

2.07 HARSH ENVIRONMENT FACEPLATES

A. The harsh environment faceplate shall provide a dust and watertight seal connector to house a Cat 6A jack. It shall feature a housing that uses a twist-lock system to secure the patch cord to the jack.
B. The harsh environment faceplate shall be IP67 rated.
C. Harsh environment faceplate shall be stainless steel.

PART 3 EXECUTION

3.01 COPPER CONNECTIVITY

A. 8-position, 8-contact (8P8C) modular jacks shall be installed in accordance with manufacturer's recommendations and installation guides, and best industry practices.
B. Pair untwist at the termination shall not exceed 13 mm (0.5 inch).

3.02 FACEPLATES

A. Blank inserts shall be installed where ports are not used.
B. The same orientation and positioning of jacks and connectors shall be used throughout the installation.
C. Faceplates shall be installed straight and level.
D. Faceplates shall be installed at the same heights and orientation as electrical faceplates.

3.03 SURFACE MOUNT BOXES

A. Blank inserts shall be installed where ports are not used.
B. The same orientation and positioning of jacks and connectors shall be used throughout the installation.
C. Surface mount boxes shall be installed straight and level.
D. Surface mount shall be installed at heights as electrical receptacles.

3.04 HARSH ENVIRONMENT FACEPLATES

A. Housing with connector cap shall be installed where ports are not used.
B. Faceplates shall be installed straight and level.
C. Faceplates shall be installed at the same heights as electrical faceplates.

3.05 IDENTIFICATION

A. Refer to Section 270553 - Identification for Communications Systems for labeling details.

END OF SECTION 27 1543

SECTION 274116

INTEGRATED AV COMMUNICATIONS

PART 1 - GENERAL

1.1 GENERAL

A. This specification outlines Presentation Systems Contractor (PSC) requirements to furnish and install presentation systems and all low voltage wiring required for completely operational systems in the East Point Starr Park Phase 1 project. All necessary infrastructure shall be required and provided by the PSC for a completely operational audio-visual presentation system inclusive of sound, display, distribution, controls and signage. A separate bid for all work required in conjunction with the stated A/V package for a complete and functioning electrical packing will be required.

B. The systems shall not be considered complete until the completion of as-built documentation, final system commissioning, and facility personnel training. This facet of the services to be provided by the PSC is deemed very important to the satisfactory completion of the contract. To that end a final payment reserve of 10% of the system purchase price shall be held from payment until the documentation package and training described in Part III are delivered.

C. Systems are described by the drawings and equipment product list.

1.2 INTENT AND INTERPRETATIONS

A. It is the intent of the Construction Documents that the PSC shall include all items necessary for the proper execution and completion of the project, resulting in complete and fully operational system(s) ready for the Owner's use, in full compliance with all applicable standards, codes and ordinances.

1. Work or product not specifically indicated in the Construction Documents, but which are necessary to result in complete and fully operational system(s) ready for the Owner's use, shall be provided by the PSC.
2. The specification of certain products in the Construction Documents shall not be construed as a release from furnishing such additional products and materials necessary to furnish complete and fully operational system(s) ready for the Owner's use.

B. In the event that discrepancies exist or required items or details have been omitted in the Construction Documents, the PSC shall notify the Owner/Consultant in writing ten (10) days prior to the bid date. Failure to do so shall be construed as willingness to provide a complete and fully operational system within the amount bid by the PSC. Where such discrepancies are not brought to the attention of the

Owner/Consultant, the most stringent (costly) requirements shall be construed to be the basis for the PSC's bid.

C. Drawings and Specifications are complementary. Items required by either are binding as though they are required by both. In the event of conflict between the requirements of the Drawings and the Specifications:
   1. The specification and drawings are to provide an intent of the type of systems required. Any item not addressed by these documents but are typically required shall be part of the AV contractors work.
   2. With regards to the preparation of proposals and/or bids, the PSC shall assume the more stringent (costly) condition shall prevail. The PSC shall notify the Owner/Consultant of such a minimum ten (10) days prior to the bid date.
   3. With regards to actual construction, the PSC shall notify the Owner/Consultant and await the Owner's/Consultant's instruction prior to proceeding with procurement and installation.

D. Drawings:
   1. Drawings are diagrammatic and approximate in character, are not intended to show all features of required work, and do not necessarily indicate every required component.
   2. Symbols used on the Drawings are defined in the legend on the Drawings. Symbols indicated on the legend may not necessarily be required.

1.3 DEFINITIONS

A. The term "Contractor", "Supplier", or "Presentation Systems Contractor (PSC)" as used herein refers to the party responsible for supplying all services and equipment covered herein and on related drawings.

B. The term "Owner" shall refer to City of East Point.

C. The term "Consultant" shall refer to the consultant who is responsible for the design of the audio, video, and control systems.

D. The term "Electrical Contractor" shall refer to the Division 26 contractor.

E. The term "provide" will mean to supply, install, verify performance and coordinate interconnection and power.

F. Specialized terms particular to technical systems and related work shall be used in the following manner, in accordance with:
   1. Captions on related drawings.
   2. Generally recognized audio engineering and production usage.
   3. Relevant usage and definitions of handbooks, guidebooks or trade group recommendations by manufacturers' associations or professional and engineering societies such as SMPTE, ICIA, UL, and NEMA.

1.4 RELATED DOCUMENTS

A. The PSC shall read, review and understand all documents listed below prior to bidding or proceeding with work. The PSC shall also refer to and understand all other related documents indicated herein. Failure to familiarize itself with the construction documents will not relieve the PSC of its responsibility to complete the work in accordance with the construction documents.

B. Division 1: Applicable provisions of Division 1 shall govern all work under this section.

C. Contract: In addition to the conditions and work described herein, all conditions of the Contract shall apply.

D. Presentation System Drawings

1. EPSL LEGEND
2. EPS0.1 BUILDING A SITE PLAN
3. EPS1.1 BUILDING A FLOOR PLAN
4. EPS2.1 BUILDING A REFLECTED CEILING PLAN
5. EPS3.1 BUILDING A ELEVATION
6. EPS3.2 BUILDING A SECTION – AUDIO & LIGHTING
7. EPS4.1 PRODUCTION PANEL & FACE PLATE DETAILS
8. EPS4.2 RACK DETAILS
9. EPS4.3 LOUDSPEAKER DETAILS
10. EPS4.4 LIGHTING DETAILS

1.5 DESCRIPTION OF SYSTEMS

A. AMPHITHEATER - AUDIO

1. The auditorium shall be equipped to support presentations and productions with high quality amplification of speech, performance instruments of all types, program material content playback, and presentation audio for video playback. There will be two primary operational modes of the sound system and a third mode for production company supported events. The first mode will be the *Production Mode.* In this mode, primarily for theatrical productions or band / concert performances, the operator will have constant hands-on manual control of the mix and levels. The second mode will be the *Presentation Mode*. In this mode, the audio levels from portable audio devices and the presenter's microphone level will be controlled from a control system touch panel. This system operates independently from the production equipment. In the event there is a fire alarm instance, the sound system shall mute. Coordination with the fire alarm contractor is key to obtain a contact closure or other signal to engage the audio system accordingly.
2. For larger productions like concerts, plays, or orchestral performances, the facility will be equipped with company switches to supply power to rental and staging production trucks. In this mode, the house sound system will not be utilized.

3. The main house PA speaker system will consist of a left and right line array loudspeaker system with subwoofers.
4. The audio system front-of-house mixer shall be a digital mixer with 40 mixing channel capability on a portable cart. The audio mixer console shall have locally 16 mono mic inputs, 2 stereo inputs, and 16 analog outputs. The accompanying stage rack shall have 16 analog inputs, and 16 analog outputs. The stage rack and the console shall be connected via a DANTE connection. The connection will be a CAT5 cable that will be deployed in an in-grade trough from the stage to the Front of House (FOH) position.
5. There shall be a total of 5 channels of digital wireless microphones. 4 systems for production use primarily. There shall be a handheld wireless system primarily dedicated for lectures or presentations. The volume for this wireless will be controlled through the remote system.
6. There shall be an audio CD / MP3 / Tuner player available for playback of various audio formats. The player shall have Bluetooth connectivity capabilities.
7. There shall be a Bluetooth receiver for connection of user's portable devices.
8. There shall be 2 discreet channels of stage monitor mix available for floor wedges, side fills, or hotspots. These outputs shall be available at the rack & wall I/O plate locations.
9. There shall be a RF based assisted listening system for the auditorium. In compliance to the ADA regulations, the appropriate number of receivers, loop lanyards, and standard earphones shall be included.
10. There shall be means to record and stream presentations or productions in the auditorium.

B. AMPHITHEATER - CONTROL SYSTEM
   1. The remote control system shall provide integration and control of key components using wired touch panels. Programming shall focus on operation of the presentation system ranging from simple podium events to manual operated productions. Menu shall include, but not limited to the following.
      1) Presentation or Production Mode
         a. Volume for handheld wireless
      2) System power cycle screen
         a. All sound
            i. Wall plate connections
            ii. Bluetooth connections
      3) Media player commands
         a. CD/MP3/Bluetooth transport commands and menu functions

C. AHMPHITHEATER - LIGHTING
   1. The amphitheater shall be equipped with a state-of-the-art lighting system to support theatrical productions and presenter meetings.

2. The lighting console and dimming system shall be used to control the theatrical lights and the architectural house lights in and around the stage area.
3. There shall be a touch panel at the stage to recall preset lighting scenes and manually adjust settings.
4. For larger events in Production Mode, a 40 channel lighting console on a portable cart shall be deployed.
5. There shall be three over stage lighting electrics.
6. All theatrical fixtures shall be LED and be supplied complete with safety cable, c-clamp, lenses, DMX/power cables and extension cables as needed.
7. Theatrical Lighting fixtures are to be LED type controlled with constant power and DMX. Lighting fixtures mount on pipe pattens and connect to power and DMX positions.
8. Production events are to be controlled by a full programable theatrical lighting console
9. The Contractor is responsible for programming the following production scenes for initial commissioning.
    1) Full stage wash
    2) Podium or Presentation Event
    3) Preset scenes

D. RIGGING

1. There shall be three dead hung battens for lights positioned above the stage area behind (upstage) of the main curtain.
2. The PSC shall supply all mounting and safety hardware for all rigging of lighting and all loudspeakers. Rigging to be in compliance with best practices and safety cables shall be used.

1.6 ADD ALTERNATES

A. No Add Alts

1.7 SCOPE OF WORK

A. Provide all labor and material for the complete installation of the presentation systems as hereafter specified and shown.

B. PSC shall review the entire project package, including drawings and notes for other trades that may impact the Presentation Systems work, and make provision for such.

C. Equipment shall be new, current production, with original warranty. Demo, refurbished, used or B-stock equipment shall not be acceptable.

D. Quantities are listed for reference only. It is the PSC responsibility to verify quantities of all components.

E. All equipment must be installed in a neat and orderly fashion by competent workmen according to the manufacturer’s instructions.

F. All system components shall be completely prewired with all field connections clearly labeled. All equipment shall be UL and or CE listed and shall comply with the National Electrical Code or equivalent authority and all applicable regulations of serving utilities and governmental bodies having jurisdiction.

G. Presentation equipment shall not be stored at the job site. Equipment shall be moved to the job site from a conditioned space only when scheduled for installation.

1.8 CONTRACTOR'S QUALIFICATIONS

A. General

1. The PSC shall be a company that regularly engages in the furnishing and installation of systems similar in complexity to those required for this project and in this section and must meet the following requirements in each discipline listed here to include Audio, Control, Lighting, and Rigging.
2. A subcontractor so employed as the "Presentation Systems Contractor" must be accepted and/or pre-approved by virtue of their standing and agreements with all equipment manufacturers to be installed and commissioned in this section. The PSC must be acceptable to the Architect and the Consultant and shall be identified on the Bid Proposal Form.
3. The primary business of the PSC shall be the sale and installation of professional performance related sound, video, control, lighting, and rigging systems.
4. The PSC shall have no less than five years of experience with equipment and systems of the specified types of systems that follow.
5. Proof of successful completion with present key staff, of five projects of the type or magnitude of that specified here in this project.
6. Regular business under the same name and/or address for a period of five years.
7. Have technicians trained in the specific installation and maintenance of the equipment supplied.
8. Have suitable service facilities and test equipment for providing competent service for all types of professional dimming, rigging, sound, video and control system equipment.
9. Maintain shop and office facilities within a 125-mile radius of the project site.
10. Employ a minimum of 1 full time engineer with InfoComm International Certified Technology Specialist - Design (CTS-D) certification.
11. Employ a minimum of 1 full time installer with InfoComm International Certified Technology Specialist - Installation (CTS-I) certification.
12. At the request of the Owner, the PSC shall demonstrate to the satisfaction of the Architect and Consultant that the PSC has:
    a. Adequate facilities and equipment to complete the work.
    b. Adequate staff with commensurate technical experience.

c. Suitable financial status to meet the obligations of the work.

B. Audio
1. Personnel engaged in the audio portion of this project shall have the following certifications
a. BiAmp Audio senior level programmer
b. Dante Level 3 Master Certification
c. InfoComm International Certified Technology Specialist - Design (CTS-D)
d. InfoComm International Certified Technology Specialist - Installation (CTS-I)
e. EASE Training
f. Syn-Aud-Con certification
2. Employ a qualified "sound system and A/V production expert" with sufficient experience in production to providing training and assistance to the Owner during the initial system use period.

C. Control
1. Personnel engaged in the video portion of this project shall have the following certifications
a. Crestron Master Programmer
2. Employ a minimum of 1 full time programmer that is a Crestron Certified Programmer.

D. Lighting
1. The PSC shall be pre-approved as an ETC lighting provider for all stage lighting fixtures, stage/house dimming and dimming controls with various interfaces.
2. Lighting system equipment in this section shall be provided, installed and commissioned by a pre-approved ETC dealer.
3. If the system design requires, the PSC shall be responsible for the convergence of the house and theatrical lighting system with the AV remote control system. This will enable lighting presets to be recalled from the AV control system.

E. Rigging
1. The PSC shall employ only fully trained permanent stage riggers and mechanics who can be assisted by common laborers, for the erection and installation of the stage rigging equipment. The riggers shall be completely familiar with the types of equipment being installed.
2. All rigging shall be in conjunction and signed of by the structural engineer on the project.
3. A competent Job Supervisor shall be on the job site at all times while work is in progress. The Job Supervisor of rigging shall represent the PSC and all directions given by him/her shall be as binding as if given by the PSC directly. The Job Supervisor shall be ETCP certified in theatrical rigging installation. This certification shall be presented in bid submittal process.

F. Subcontracting

1. Any other Contractor/Supplier who intends to bid this work as the prime Contractor/Supplier and does not meet the required qualifications shall employ the services of a single "Presentation Systems Contractor" who does meet the requirements noted above and is approved by the Owner, Architect and Consultant as well. This "Presentation Systems Contractor" shall:
   a. Furnish the equipment.
   b. Meet all qualifications stated earlier in this section.
   c. Shop fabricate the equipment racks and subassemblies.
   d. Make all audio, video and control connections to equipment racks, each piece of equipment, and connection panels.
   e. Continuously supervise the installation and connections of cable and equipment.
   f. Program the digital signal processor, video processing systems and control system.

G. The PSC shall be a company that regularly engages in the furnishing and installation of systems similar in complexity to those required for this project and meet the following requirements.
   1. The primary business of the PSC shall be the sale and installation of professional performance related sound and video systems.
   2. No less than five years of experience with equipment and systems of the specified types.
   3. Proof of successful completion, with present key staff, of five projects of the type or magnitude of that specified herein.
   4. Regular business under the same name and/or address for a period of five years.
   5. Be a franchised dealer and service facility for the major products furnished.
   6. Have technicians trained in the specific installation and maintenance of the equipment supplied.
   7. Have suitable service facilities and test equipment for providing competent service for all types of professional dimming, sound and A/V equipment.
   8. Maintain shop and office facilities within a 125-mile radius of the project site.
   9. Employ a minimum of 1 full time engineer with InfoComm International Certified Technology Specialist - Design (CTS-D) certification.
   10. Employ a minimum of 1 full time installer with InfoComm International Certified Technology Specialist - Installation (CTS-I) certification.
   11. Employ a minimum of 1 full time programmer that is a Crestron Certified Programmer.
   12. Employ a qualified "sound system and A/V production expert" with sufficient experience in production to providing training and assistance to the Owner during the initial system use period.
   13. Certifications for permanent staff members:
      a. BiAmp Audio senior level programmer

b. Dante Level 3 Master Certification
c. InfoComm International Certified Technology Specialist - Design (CTS-D)
d. InfoComm International Certified Technology Specialist - Installation (CTS-I)
e. Crestron Master Programmer
f. EASE training
g. ETC Lighting Layout and System Design Certification
h. Syn-Aud-Con Electro Acoustics Certification

H. At the request of the Owner, the PSC shall demonstrate to the satisfaction of the Architect and Consultant that the PSC has:
1. Adequate facilities and equipment to complete the work.
2. Adequate staff with commensurate technical experience.
3. Suitable financial status to meet the obligations of the work.

I. Any other Contractor/Supplier who intends to bid this work as the prime Contractor/Supplier and does not meet the required qualifications shall employ the services of a single "Presentation Systems Contractor" who does meet the requirements noted above and is approved by the Owner. This "Presentation Systems Contractor" shall:
1. Furnish the equipment.
2. Shop fabricate the equipment racks and subassemblies.
3. Make all audio, video and control connections to equipment racks, each piece of equipment, and connection panels.
4. Continuously supervise the installation and connections of cable and equipment.
5. Program the digital signal processor, video processing systems and control system.

J. A subcontractor so employed as the "Presentation Systems Contractor" must be acceptable to the Architect and the Consultant and shall be identified on the Bid Proposal Form.

1.9 BID SUBMITTALS

A. Along with the bid price, the PSC shall include the following:
1. Proposed team member names, certifications and biographies for each. Include names and biographies of service and technical support personnel who will be responsible for this project after completion.
2. Equipment list noting equipment quantities, manufacturer, brief description and specification number.
3. Statement that the bid is based on specified products.
4. Address of staffed office within 125 miles of the job site.

5. Statement that the Contractor has an established toll-free hot-line and will provide 24-hour/7-day-a-week phone support and on-site emergency service as necessary to correct technical failures.
6. List of five installations completed within the last three years, which are similar in size, type and scope to the work specified in this Section. Include project name, date of installation, name of contact and phone number.
7. Examples of typical design drawings (elevations, mounting details, millwork details, etc.)
8. A minimum of five touch panel menu templates from projects completed by the PSC.
9. Examples of training materials (PowerPoint slides, quick-start guide).
10. Target project schedule with timeline, skills and labor requirements.
11. Client reference letters.
12. Any proposed subcontractors, their qualifications, and scope of work.

1.10 PROJECT SUBMITTALS

A. Upon award of the contract, PSC shall provide:
1. Preliminary project schedule with timeline, skills and labor requirements.
2. Name and qualifications of PSC personnel who shall be supervising the installation of the system. This person shall be a full-time employee of the PSC. The PSC shall submit a minimum of three (3) suitable bound sets, or electronic documents, of the following for review by the Architect and the Consultant. Refer to the General and Special Conditions for additional set(s) which may be required. All documents shall be submitted prior to ordering any materials.
3. A complete list of all equipment and materials which are to be furnished. Accompanying the list shall be manufacturers' specification or cut sheets for all equipment.
4. Shop drawings generated by the Contractor. The Contractor shall be provided with electronic copies of the floor plans, device layouts and room sections only for use in preparing their shop drawings. The Contractor is responsible for editing these sheets as required by these submittal requirements. The Contractor is required to generate all other sheets as required by these submittal requirements.
   a. Detailed wiring diagrams showing interconnection of components and products, wiring and cabling diagrams depicting cable types and wire numbers, and device designators.
   b. Plan view showing locations of all equipment. Plan(s) shall be properly dimensioned, and all equipment labeled.
   c. Wall elevations and room sections showing all installed equipment. Elevations and sections shall be properly dimensioned, and all equipment labeled.
   d. Equipment rack layout details, including power, grounding, ventilation and conduit/cable entry as applicable.

e. Loudspeaker system suspension schematic including hardware types and load capacity.
f. Complete drawings of custom-fabricated plates or panels. Drawings shall include dimensioned locations of components, component types, engraving information, plate material and color, and bill of material.
g. Power requirements, one-line riser diagrams, and installation circuit diagrams for electrical equipment. Show all required wire sizes and counts between all components.
h. Manufacturer's detailed shop drawings of all dimming, control and distribution equipment, and published literature for all equipment.

1.11 FINAL INSPECTION AND TESTING

A. In addition to supplying and installing the equipment as part of this contract the PSC is to aid the owner's consultant during on site observations, systems commission/performance verification, video system proof and owner training and production assistance.

B. The process of testing the system may necessitate moving and adjusting certain components such as loudspeakers and video projectors. Movement and replacement as required is to be performed at no additional expense to the Owner.

C. In the event further adjustment or Work becomes evident during testing, the Contractor shall continue his work until the system is acceptable at no additional expense to the Owner. If approval is delayed because of defective equipment, or failure of equipment or installation to meet the requirements of these specifications, the Contractor shall pay for additional time and expenses of the Consultant and Owner at the standard rate in effect at that time.

1.12 WARRANTY

A. All equipment is to be new and warranted free of faulty workmanship and damage.

B. The total system (parts and labor) is to be warranted free of defects for a period of one year from date of final acceptance.

C. The entire system (excluding lamps and fuses) shall be fully factory tested prior to shipment and shall be guaranteed against defects in material and workmanship for one year from date of acceptance by the Owner or (18) eighteen months from the date of shipment, whichever occurs first.

D. No equipment having a shorter warranty shall be considered and equipment purchased shall be covered by this warranty. Unspecified length of warranties shall not be acceptable.

E. Contractor shall provide for replacement of defective materials and repair of faulty workmanship within (48) forty-eight hours of notification by owner guaranteed at no cost to the owner during the warranty period.

F. Contractor shall provide emergency service and support 24 hours a day and 7 days a week. This service is intended as emergency response to failures that require immediate help from a qualified systems technician. The Contractor shall provide this service through an established toll-free line. This emergency service must include a return call from a qualified systems technician within 2 hours. This emergency service must also provide an on-site visit from a qualified systems technician within 12 hours of the initial phone call, should it be deemed necessary by both parties to resolve the service issue. This emergency service and support shall be made available throughout the warranty period at no additional charge to the owner.

G. Paint and exterior finishes, fuses and lamps are excluded from the above warranties except when damage or failure results from defective materials or workmanship covered by warranty.

H. The minimum warranty provisions specified above shall not diminish the terms of individual equipment manufacturer warranties.

1.13 INSTRUCTION OF OWNER PERSONNEL

A. PSC is to provide at least fourteen hours (2 each six to eight-hour sessions) of training to person(s) selected by the Owner on operation and basic maintenance of all systems and equipment. In addition to training, a representative of the Contractor knowledgeable of the system installation and operation is to be present for the first special events selected by the Owner that all or any part of the sound and video systems is used. The training and event attendance is to take place during the 30-day period after system completion.

PART 2 - PRODUCTS

2.0 GENERAL

A. It is the intention of these specifications to provide a complete and properly operating system. The major items of equipment shall be furnished in the quantity indicated by the project drawings or in the quantity specified herein. In the event of a quantity discrepancy between the drawings and specifications for an item, the PSC shall provide the greater. PSC is responsible for providing all accessories and miscellaneous equipment required to form a complete and operational system, including, but not limited to, power supplies, cabling, mounts, attachment hardware and software licenses.

B. Provide only new products, and include the manufacturer's original factory warranty, product documentation and the latest version of any software required for configuration and/or operation.

C. Where the specifications list several manufacturers for a particular major item of equipment, such as power amplifiers, the PSC shall supply all of that item of equipment from one manufacturer.

2.1 AUDIO

A. AUDIO INPUT OUTPUT RACK
   1. Analog inputs, (16) combo jacks
   2. Analog outputs, (8) XLR-3
   3. Dante capable, rack mountable
   4. Basis of Design
      a. Yamaha TIO1608-D

B. DIGITAL SOUND PROCESSOR
   1. Eight on-board Flex channels and GPIO
   2. up to 32 x 32 Dante audio channels, minimum 8 x 8 included
   3. RS-232 control
   4. Rack mountable
   5. Basis of Design
      a. QSC CORE 8 FLEX

C. AUDIO DANTE SWITCH
   1. 1 Gbps Switch Ports (PoE+/PoE++) – 26 (24)
   2. PoE budget – 300w
   3. SFP port – 4x 1 Gbps
   4. Basis of Design
      a. QSC NS26-300++

D. WIRELESS RECEIVER
   1. AES 256-bit encryption-enabled
   2. Up to 60 dB independently adjustable gain for each channel
   3. XLR connectors with switchable mic/line output level
   4. Basis of Design
      a. Shure ULXD4D
      b. Frequency band to be verified by installer

E. AUDIO CONSOLE
   1. Fader configuration – 16 + 1(master)
   2. Input channels - 16 mic/line (XLR/TRS combo) + 2 stereo line (RCA pin)
   3. Output channels – 16 XLR
   4. RJ45 port for control
   5. Basis of Design
      a. Yamaha TF1

F. BLURAY/DVD/CD PLAYER
   1. RS-232C and IP controllability
   2. XLR balanced audio outputs
   3. Supported CD formats: CD, CD-R, CD-RW, DTS Music Disc (DTS Audio CD, 5.1 Music Disc), HDCD, Super Video CD (SVCD), Video CD (VCD)
   4. Supported DVD formats: DVD, DVD+R, DVD-R, DVD+RW, DVD-RW

5. Basis of Design
    a. Denon Pro DN-500BD

G. AUDIO AMPLIFIER TYPE 1
1. 4 Channels x 1600W
2. Input channels – 4 analog, 4 Dante
3. Output channels - Output Channels 4 Hi-Z or Lo-Z (bridgeable per ch. pair)
4. Basis of Design
    a. Biamp Systems ALC-1604D

H. AUDIO AMPLIFIER TYPE 2
1. 4 channels x 400W
2. Input channels – 4 analog, 4 Dante
3. Output channels - Output Channels 4 Hi-Z or Lo-Z (bridgeable per ch. pair)
4. Basis of Design
    a. Biamp Systems ALC-404D

I. AUDIO LOUDSPEAKERS TYPE 1
1. A two-way, full-range bass reflex design
2. NL4 +2/-2 connections shall be wired in parallel
3. Weather-resistant, ability to be flown and permanently installed
4. Operating range of 40 Hz to 18.5 kHz (-10dB SPL)
5. Basis of Design
    a. Biamp Systems IV6-112WR15

J. AUDIO SUBWOOFER TYPE 1
1. A two-way, full-range bass reflex design
2. NL4 +2/-2 connections shall be wired in parallel
3. Weather-resistant, ability to be flown and permanently installed
4. Operating range of 40 Hz to 18.5 kHz (-10dB SPL)
5. Basis of Design
    a. Biamp Systems IV6-118SWR

K. AUDIO LOUDSPEAKERS TYPE 2
1. Nominal Beamwidth (H x V) 120°x 60°, rotatable waveguide
2. Weather-resistant, ability to be flown and permanently installed
3. HIGH POWER 12-INCH TWO-WAY
4. Basis of Design
    a. Biamp Systems IP8-1122/26B

L. AUDIO LOUDSPEAKERS TYPE 3
1. A two-way, full-range ceiling mount system
2. 60W high performance autoformer for use in 70.7V or 100V
3. A conical coverage pattern of 130 degrees from 500 Hz to 6 kHz.
4. Basis of Design
    a. Biamp Systems Desono D5

M. LIGHTING
1. DMX SPLITTER
a. A one input, twelve output DMX/RDM DIN rail mounted splitter
b. bi-directional
c. Basis of Design
a. Doug Fleenor Design 1212-DIN

2.2 CONTROL

A. TOUCH PANEL
1. RJ45 port and PoE capable
2. 16:9 aspect ratio, 1280 x 720 resolution
3. Fully customizable UCI
4. Basis of Design
a. QSC TSC-50-G3

B. VOLUME CONTROL WALL PLATE
1. Power Rating: 25W
2. Attenuation: 3dB per step (33dB total)
3. Wall Plate: 1-gang standard
4. Basis of Design
a. Lowell Manufacturing 25LVC-SW
b. Color to be verified by owner

2.3 EQUIPMENT ENCLOSURES

A. Verify size, location, and quantity on drawing floorplans and details.

B. Acceptable manufacturers
1. Middle Atlantic

2.4 FACEPLATES

A. All AV face plates to be verified for color, size, connector(s) type/quantity, and backbox type.

B. Acceptable custom plate manufacturer
1. RCI Custom

2.5 AV WALL BOXES

A. Provide floor boxes as indicated on drawings.
B. Acceptable manufacturer
1. FSR

2.6 INFRASTRUCTURE

A. Cable – Analog audio
1. Mic, line, speaker, intercom

2. Acceptable manufacture
   a. Belden
   b. West Penn
   c. Clark

B. Cable – CAT5e / CAT6
   1. Network, twisted pair transmission
   2. Acceptable manufacturer
      a. Belden
      b. West Penn

C. Connectors Audio
   1. Audio - XLRs, ¼”, speakon
   2. Acceptable manufacture
      a. Neutrik

D. Patchbays
   1. Audio and video patchbays
   2. Acceptable manufacturer
      a. Bittree
      b. ADC

2.7 BASIS OF DESIGN SCHEDULE

A. See drawing flow diagrams.

END OF SCHEDULE

PART 3 - EXECUTION

3.1 ACCURACY OF DATA

A. It shall be the sole responsibility of the Contractor to verify all dimensions, take his own field measurements, and install all work to suit conditions encountered on the job site.

B. The drawings are generally diagrammatic and except where dimensions are indicated are not intended to show exact locations of outlets, conduits, etc. All work shall be installed as nearly as possible in the locations indicated, with minor adjustments as required to avoid interferences with structure or the work of other trades.

C. Prior to beginning work, the Contractor shall carefully examine all construction drawings and the job site and report to the Owner any discrepancies or interference that may be discovered. If, during the course of construction, any such discrepancies or interferences are noted, the Contractor shall promptly report

them to the Owner. Failure to report such discrepancies or interferences shall result in the correction of the same at the Contractor's expense. All work under this specification, which either interferes with the architectural or any other work or deviates from the drawings and specifications without prior approval of the Owner, shall be altered by the Contractor at his expense. These alterations shall clear such interferences or shall comply with the drawings and specifications as directed by the Owner.

3.2 MECHANICAL

A. Except for portable equipment, all other equipment must be permanently installed. This shall include equipment racks, speakers, cables, etc. Fastenings and supports must provide a safety factor of at least three times that required for safe support. Precautions must be taken to prevent electrostatic and electromagnetic hum and radio frequency interference. All electronic equipment must be easily accessible and have adequate ventilation.

3.3 CONNECTIONS

A. All low voltage wiring connections must be made with rosin core solder or mechanical connectors as specified. Terminations on all cable must be dressed properly with shrink tubing. All low voltage control level connections to terminal blocks are to be made with crimp on spade lugs. All crimp on connectors must be fastened with the proper tool as specified by the manufacturer. Improper crimping will be cause for rejection. All "drain" wires on microphone and line level terminations are to be properly dressed using transparent shrink tubing to avoid the possibility of shorting "whiskers".

3.4 LABELS

A. All wiring is to be numbered on both ends with “EZ Code” type markers. Wire numbers are to be secured with transparent shrink tubing. Wire numbers are to follow a logical sequence and are to be listed on the proper document. “Brady” type labels are acceptable.

3.5 INSTALLATION

A. General
   1. Installation shall include the delivery to the installation site, unloading, setting in place, mounting and securing equipment to walls, floors, ceilings, cabinetry, or other structures. Also, interconnection of any cables, wires, fiber optics, or other infrastructure. Any equipment alignment, adjustments, menu settings, or other requirements to ensure the appropriate operation of the system.
   2. All installation practices shall be in accordance with, but not limited to, these specifications, drawings, and intended system performance. Installation shall

be in accordance to the AV industries best practices as outlined in Infocom CTS-I criteria. Local and National authorities having jurisdiction.

3. If in the opinion of the AV System Contractor, an installation, an installation practice is desired or required, which is contrary to these specifications and/or drawings, a written request for modification shall be made to the Consultant. Modifications shall not commence without written approval from the Consultant. Every effort will be made to respond to all written requests in a timely manner so as to not delay the installation or completion of the project.
4. During the installation, and up to the date of final acceptance, the AV Systems Contractor shall be responsible and under obligation to protect finished and unfinished work against damage and loss. In the event of damage or loss, those items shall be replaced at no cost to the Owner.

3.6 SOUND SYSTEM TEST AND MEASUREMENT

A. The contractor is to conduct a performance verification test for the Owner. The contractor must complete the installation and verify that it is in working order and conforms to the following performance criteria. These performance standards are set forth as an indication of a properly installed and functioning sound system. It is implied through his action of submitting a bid that the contractor has reviewed these documents and is in agreement with the concept and execution of the design of the specified sound system. No financial adjustments will be allowed for discrepancies discovered after bid is accepted.

1. In rooms where voice lift or voice reinforcement is required, there is a programmable DSP in the system. The contractor is expected to tune the system to eliminate any hot frequencies in the room that would cause premature feedback as well as blemish the sound quality of the microphones.
2. Microphone line resistance: Less than 1.7 Ohms with short at input jack. Measured from mixer end of microphone cable. Measure with Ohm meter.
3. Maximum amp output: 100% of rated power at less than 0.25% THD. Measure with distortion analyzer.
4. Signal to noise ratio: Better than 80 dB or an absolute noise level less than 62 dBm for systems with +18 dBm maximum line operating level. Measured at amplifier input with RMS voltmeter with dB scale.
5. Audio frequency response: +/- 1 dB 50 Hz to 15 kHz control equalizer set flat and room equalizers switched out – Microphone input to amplifier output. Measure with RTA.
6. Polarity: All microphones and source equipment are to be wired so as to be in absolute polarity with the loudspeaker systems. Measure with polarity checker.
7. Synchronize delay and fill systems to within 15 milliseconds of first arrival of primary loudspeaker system as measured on Smaart or TEF measurement systems.

8. Acoustic coverage: Maximum +/- 3 dB SPL variance front to rear / side-to-side in audience area through the 4 kHz full octave band. Measure with octave band Sound Level Meter.
9. Acoustic amplitude response: With the room equalizers switched in +/- 3 dB maximum deviation from the following curve averaged from three test positions in the audience area flat 60 Hz to 2 kHz, 10 dB at 50 Hz and 12 kHz. Measure with RTA.
10. Electroacoustic gain: No less than 15 dB from 500 Hz to 4 kHz with one microphone and 12-inch source to microphone distance. Gain is to be measured 50 feet from the source. Measure with Sound Level Meter.
11. Maximum sound level: Greater than 85 dB-C for large conference spaces when amplifier occasionally clips on program peaks. Measure with Sound Level Meter.
12. Acoustic noise floor: No audible hum, hiss, or R.F. interference shall be audible under normal room conditions in audience seating area and stage or platform areas.
13. All loudspeakers are to exhibit the same acoustic polarity. Measure with Polarity Checker (Galaxy Cricket).

3.7 AV SYSTEMS CONTRACTOR CHECKOUT

A. Before the Consultants Acceptance Tests are scheduled, the AV Systems Contractor shall perform his own system check-out. The Systems Contractor shall furnish all required test and measurement equipment needed to perform all work necessary to adjust, modify, and document the systems as it is specified to perform.
   1. Provide documentation that all digital and analog audio signal paths have been tested and verified.
   2. Provide documentation of sound system performance as outlined above.
   3. Test all systems for compliance and performance using the following equipment or equipment that provides the same testing for more current state-of-the art systems.
      a. Audio testing:
         1) Signal generator
         2) AC millivolt meter
         3) Audio test set
         4) Source media (MP3, CD’s, 1/8” stereo source)
         5) Any needed adapters
   4. Ensure all gain settings, noise floor, gain before feedback, and signal to noise measurements are acceptable and in accordance with industry best practices.
      a. Provide written documentation to support all audio adjustments and settings.
      b. DSP

1) In accordance to the specification and drawings, ensure that the DSP is programmed accordingly to deliver the intended operation. Verify all settings and programming for the proper operation of the following:
   a) All communication and IP settings.
   b) Proper or current software version
   c) Matrix routing / presets
   d) Correct input and output names, gain settings, phantom power, and phasing
   e) Correct NOM (number of open mics) and/or mix-minus settings
   f) Automatic gain control (AGC) settings
   g) Automatic mixer settings if applicable
   h) Limiters, filters, and compressor settings
   i) Equalization – Room tuning
   j) AEC settings
   k) Delay setting (if applicable)
   l) Audio teleconference settings such as Auto Answer and disconnect, VoIP settings. Control system phone number availability (speed dial list) for phone calls.
   m) Programmer to document that all DSP functions are working properly in accordance to the specifications and drawings.

5. All optical fiber runs to be certified using industry accepted test equipment. Fiber connections to have documentation supporting the follow tests:
   a. Measuring insertion loss
   b. Measurements from the OTDR
6. Adjust, balance, and align all equipment for optimum quality and to meet the manufacture's published specifications. Record all "normal" settings in the "System Operation Manual"

3.8 SYSTEM ACCEPTANCE TESTS

A. System acceptance tests shall not be performed until the AV Systems Contractor Checkout has been completed and the test results have been reviewed. The System Acceptance Test will be supervised by the consultant and will consist of the following:
   1. A physical inventory will be taken of all equipment on site and will be compared to the equipment list in the contract documents.
   2. The operation of all system equipment shall be demonstrated by the AV Systems Contractor.
   3. The AV Systems Contractor shall provide the necessary equipment for the Consultant to perform the AV tests.
   4. The AV System Contractor shall have on site and available the latest as-built drawings, equipment inventory list, and manuals. One set of these documents to have been sent to the Consultant prior to Acceptance Test.

B. Additional work by Consultant
   1. In the event of defective equipment, or other adjustments need to be made, the test may be postponed or continued later at the option of the Consultant.
   2. However if there is a return trip necessary by the consultant and/or a member of the consultants team as a result of improper installation or a failed system for performance standard, the consultant may charge the AV System Contractor directly or be deducted directly from payments (or the final payment) to the contractor. Hourly rates for the Consultant and various team members are as follows:
      a. Consultant $125
      b. Project Engineer $95
      c. Programmer $110
      d. Network Engineer $125
   3. Additional travel expenses such as a rental car or mileage will be billed as a cost plus 10% markup and would be charged along with the labor.

3.9 DOCUMENTATION

A. Upon final completion of the system a documentation package is to be turned over to the Owner and include the following items:
   1. System signal flow diagrams (for audio, video, and control) showing all components, interconnections, and connector types and wire numbers. As-built revisions are to be noted on the submittal drawings.
   2. Manufacturer instruction manuals for all electronics.
   3. Product specification sheets for all equipment without instruction manuals such as microphones, loudspeakers and lighting instruments.
   4. Copies of the proof of performance data. Provide one original (no photocopies) and one copy (photocopies are acceptable) of the total documentation package.
   5. A single copy of the system signal flow diagram with wire numbers indicated is to be laminated and posted in the door of the sound equipment rack.
   6. Special documentation is required as part of the Owner training and operation of the systems. This documentation is to consist of an instruction sheets that describe the operation of the system from the stage. Each instruction sheet is to be step by step “cookbook” with touchscreen panel screen shots with arrow indicators that describe step and function. A laminated poster version of this instruction sheet is to be mounted on the side of each equipment rack. The bullet points detailed on this sheet include:
      a. Turning on system power.
      b. Select desired source.
      c. Adjust volume levels
      d. Select lighting presets (where applicable)
      e. Recording stop/start functions (where applicable)

f. VTC calling functions (where applicable)
g. Other functions of the Owner control panel.

3.10 CLEAN UP

A. During construction periodically remove discarded containers and refuse from the job site. At the completion of the job the sound system components and equipment areas are to be left clean and neat and all refuse removed from the site.

3.11 TRAINING

A. The AV System Contractor is to provide at least fourteen hours (2 each six to eight-hour sessions) of training to person(s) selected by the Owner on operation and basic maintenance of all systems and equipment. In addition to training, a representative of the AV System Contractor knowledgeable of the system installation and operation is to be present for the first special events selected by the Owner that all or any part of the sound and video systems is used. The training and event attendance is to take place during the 30-day period after system completion.

END OF SECTION 274116

SECTION 281000

ACCESS CONTROL

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Contract drawings, specifications, and general provisions of the Contract, including General and Supplementary Conditions, apply to this section.

1.02 SUMMARY

A. This section of the specifications requires the complete installation of a new Access Control Systems (ACS). See floor plans for equipment locations. The ACS Systems shall be a centralized system, based upon the standard products of ACS System manufacturers using conventional network communication for information distribution.

B. The ACS systems shall be customized to meet the requirements of the Owner and system operators. The contractor shall be responsible for coordinating with the owner group in programming all ACS features and functions. Typical coordination items includes: User setup, card holder database, alarm messages, security schedules, video and intercom links, etc.

C. All electric door hardware is being provided and installed by the General Contractor (GC). The security contractor shall connect, power, and program all door hardware installed by the General Contractor. All door position switches shall be provided and installed by the security contractor.

D. The electronic security contractor shall be responsible for all cabling, hardware and miscellaneous equipment required to provide a fully functional residential Access Control System.

1.03 ACCEPTABLE MANUFACTURERS

A. See product section for approved manufacturers.

B. Contractor must be a Certified Installer of the access control system manufacturer in order to qualify for the project.

1.04 QUALITY ASSURANCE

A. Industry Referenced Standards. The following specifications and standards are incorporated into and become a part of this specification by reference.

1. FCC compliance
2. UL compliance
3. National Electrical Code (NFPA 70) with current Georgia Amendments.
4. Life Safety Code (NFPA 101)
5. National Electrical Safety Code (ANSI C-2)
6. Americans with Disabilities Act (ADA) with current Georgia Amendments.
7. International Building Code (IBC).

8. In the event of conflicts, the more stringent provisions shall apply.

1.05 INSTALLER'S QUALIFICATIONS:

A. Firm with at least 3 years of successful application, installation, and testing experience on specified systems and equipment. All supervisors and installers assigned to the installation of this system or any of its components shall have factory certification from each equipment manufacturer that they are qualified to install and test the provided products. General electric trade staff shall not be used for the installation of the electronic security system and associated hardware. All installers assigned to the installation of this system or any of its components shall have a minimum of 3 years of experience in the installation of the specified equipment.

B. The responsibilities of the contractor shall include but not be limited to the following: Installation of all new electronic security equipment as documented in the drawings and specifications.

1. Shop drawings for all electronic security equipment.
2. Installation of any required software updates or licensing for the existing ACS as part of this expansion.
3. Alteration of any existing IDS or ACS security equipment required as part of this expansion.
4. Wire and wiring termination for all electronic security equipment.
5. Assisting in the testing and check-out of ACS security equipment.
6. Testing and check out of IDS system.
7. Training for all electronic security equipment.
8. Warranty for all electronic security equipment.
9. As-Built drawings, operations and maintenance for the complete electronic security.

1.06 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data, including specifications and installation instructions, for each type of system equipment. Include drawings that contain complete wiring and schematic diagrams and other details required to demonstrate that the system has been coordinated and will function properly as a system. Drawings shall include floor plan layouts showing device locations, vertical riser diagrams, equipment rack details, elevation drawings of equipment racks, sizes and type of all cables and conduits.

B. Test Plan: The contractor shall submit a test plan that defines the tests required to ensure that the system meets technical, operational, and performance specifications, 30 days prior to the proposed test date. The test plan must be approved before the start of any testing. The test plan shall identify the capabilities and functions to be

tested, and include detailed instructions for the setup and execution of each test and procedures for evaluation and documentation of the results.

C. Manufacturer Certification: Submit a letter from the manufacturer's representative stating the proposed systems being submitted for review are in accordance with the recommendations of the manufacturer.

D. It is the responsibility of the contractor to meet with the appropriate Owner's representative to compare the placement and installation of proper devices with the drawings and specifications. A 100% device by device test will be conducted by the vendor under the supervision of the Architect / Engineer representative. Punch lists will be developed at that time and furnished to the contractor. All punch list items must be corrected and verified prior to acceptance of the system

1.07 CONTRACT DRAWINGS

A. The Contract Drawings indicate the arrangement of the access control system doors and electronic security devices. Coordinate installation of equipment with the structural, mechanical, and electrical equipment and access thereto. Coordinate installation of recessed equipment with concealed ductwork and piping, and wall thickness.

B. All raceways required for the electronic security System are not shown on the Contract Drawings.

1.08 RECORD DOCUMENTS

A. At the time of final inspection, provide four (4) sets of complete data on the electronic security equipment used in this project. This data shall be in bound, hard copy form and shall include all as-built drawings required for this project. One (1) CD with complete data and drawings must also be provided. This complete data shall include the following.

1. Warranty statement (include warranty start date, service provider contact phone number and address)
2. Letters of certification from system manufacturers
3. Maintenance and operating instructions on all systems
4. As-built drawings for all systems with color code to show the actual as-built conditions.

B. All record drawings shall include "as built" system interconnection diagrams with major components identified, along with number and type of interconnecting conductors. Drawings must be submitted as full-size, bound sets as well as electronic files on CD.

C. Binders with maintenance and operating instructions on all systems. These binders must incorporate a cover with project name, an index and sections for each major component.

D. Certification from system manufacturers that systems are installed in accordance with manufacturer's recommendations and are functioning correctly at the time of final inspection.
E. Submit four (4) sets of full size (30” x 42”) of as-built drawings to show wiring for all installed equipment and one (1) electronic copy on CD. Electronic drawings must be AutoCAD “DWG” files.
F. As-built drawings must incorporate point-to-point drawings for all systems with color code to show the actual as-built conditions. Copies of the contract document drawings, without modifications showing actual as-built conditions will not be accepted.
G. The final payment will not be approved until all of the aforementioned requirements for Record Documents have been satisfied.

1.09 WARRANTY

A. The Contractor shall warrant the electronic security system for one year from date of Owner’s Acceptance against defects in equipment or workmanship. Failed equipment shall be replaced by the contractor at no cost to the owner. Owner's personnel may perform initial trouble investigation but replacement of failed equipment and escalated problem support will be handled by the contractor.
B. The warranty period shall not start until the Owner has provided a written Letter of Acceptance. It shall be the Contractor’s responsibility to request and obtain the Letter of Acceptance from the Owner.
C. Once the Contractor has obtained a Letter of Acceptance from the Owner, the Contractor must provide a Warranty Letter to the Owner. The Warranty Letter must state the start date of the Warranty, instructions that explain how warranty request are to be made and contact name / phone number for service.

1.10 DESCRIPTION

A. The work included under this section of the specifications consists of the installation of a complete ACS system. Provide all labor, equipment, materials, and supervision to install, calibrate, adjust, document, and test the total system as required herein and on the drawings.
B. The contractor shall provide all documentation and shall perform all duties involved in obtaining permits and inspections as required to complete the project. All permitting shall be within the associated city or jurisdiction.
C. The work shall consist of the installation of a complete electronic security system consisting essentially of, but not limited to, the following major components:
    1. Installation of Control Panels, control modules and keypads
    2. Field Peripheral Devices (i.e., duress switches, keypads, door position switches, card readers and door sounder hardware, etc.)

3. Power supplies, Batteries & Uninterruptible Power Supplies (UPS)
4. Low Voltage Cable and Raceway
5. Access control components
6. Installation and Programming of ACS software including, but not limited to, users, groups, schedules, card holder information, holidays, etc.

PART 2 PRODUCTS

2.01 SYSTEM ARCHITECTURE

A. The Access Control System shall be a centralized system of control boards and power supplies with distributed cabling to access control hardware. The Access Control System shall provide system status reporting for all connected devices to a local workstation and shall have the capability of providing auxiliary outputs to Intrusion Detection Systems, Video Surveillance, Fire Alarm, or monitored dialer to allow remote notification of alarm activity.

B. The Access Control Management software (ACM) shall be comparable to and similar in function to existing ACM software installed at other Clayton County facilities.

C. The access control and alarm monitoring system shall be a flexible single-user, open-architecture facility management system. The system shall be designed using reliable state-of-the-art technology allowing for easy and economical expansion. The scalable design shall allow for operation from an embedded Web-based server without a dedicated server or PC workstation. The panel must also have the capability to operate in a hosted mode with centralized Access Control Management (ACM) software.

D. The system shall feature an embedded operating system that intelligently controls the reader network to provide automated data collection and configuration updates, facilitating seamless operation from controllers. All control panels shall utilize off-line distributed processing concepts including inter-controller communication if upgraded.

E. Connecting to the web-based interface shall be accomplished via USB, Ethernet through a web server hub connection or Ethernet through web server direct connection.

F. Supported browsers shall include Internet Explorer. The web browser control will allow full control to monitor, view live events and manually control doors and readers. Secure web browsing shall be SSL and SHA-1 secure socket layer encryption.

2.02 SYSTEM SOFTWARE

A. The software suite shall comprise various integrated software modules that allow for the full integration and retrieval of transactions from the hardware, as well as alarm monitoring, reporting, and scheduling capabilities. The software modules shall allow editing of personnel, access levels, system configuration, and reporting to be

controlled by a password-protected user interface. System operation for individual operators shall be possible using assigned passwords only.

B. The user shall have the ability to perform hardware configuration changes during or after the installation which shall include functions such as door open time, door contact time, location and reader names, and access rights configuration.
C. The system software shall support configuration of alarms triggering the system.
D. The system shall incorporate scheduled events activated by either time or a specific programmed event, therefore being time or event triggered.
E. Access control functions shall include validation based on time of day, day of week, holiday scheduling, and access validation based on positive verification of card or card + PIN (Personal Identification Number).
F. The city of Forest Park has standardized on Honeywell Win-Pac

2.03 DOOR CONTROL PANELS

A. The ACS system Gateway controller shall be capable of utilizing RS-485 panel loop for communication to additional door control panels. Each controller loop shall be capable of supporting at least 16 control boards allowing installation of up to (32) doors or readers. The standard controller configuration shall support 10,000 card capacity and 25,000 event capacity.
B. The terminals and remote readers supported by the controller shall be any combination of the following: card only, card and pin, card or pin, pin only, lockdown, disabled, supervisor, escort, limited use card, expire on date, first card rule, snow day rule, time zone toggle and anti-passback with local/global capability and hard and soft implementation.
C. Basis of design shall be Salto SCU4000 controllers with the following acceptable alternates:

2.04 D.C. POWER SUPPLY

A. Provide low voltage power supply units associated with Local Interface Units and Door Control Panels and as required to provide regulated, filtered D.C. power for locking controls, D.C. locks and signal devices. Output power shall be 12 or 24 volt D.C. with ampere rating not less than 150% of load imposed on power supply under most severe conditions of load. D.C. output shall be fused. Output voltage shall be regulated within plus or minus 5% from no load to full load. Power supply shall be UL listed.
B. Contractor to provide power supplies for all electric and electro-magnetic door hardware not furnished with its own power supply. Contractor responsible for coordinating with project door hardware schedule.
C. Contractor responsible for coordinating with Fire Alarm System provider for relay interface to ACS lock power supplies to effect release of all lock power in the event of a fire alarm.

D. Door Control panel power supplies basis of design shall be Altronix AL600UL series.
E. Lock power supplies basis of design shall be Altronix UL600 with ACM8.

2.05 ELECTRIC DOOR HARDWARE

A. Electrified door hardware and associated transfer hinge, adapter/ joiner plates, and door cores shall be provided and installed by the Door Hardware Contractor unless otherwise specified in contract documents.
B. Security Contractor shall be responsible for the interface with and connection to any built-in door position switches, Request to Exit functions, or latch/bond sensors within the electrified door hardware.
C. Security Contractor to make all final connections to access control hardware and provide 100% function test of all hardware. Report any defects in installation to design team and door hardware provider immediately.

2.06 ON-LINE CARD READERS

A. Contractor to provide multi-technology proximity/smart card/NFC technology cards readers that at present shall operate with SMART card technology.
B. Read range shall not be less than 5.5 inches.
C. Card readers shall be equipped with multi-color LED's and internal beeper. Control of the LED's and beeper shall be internal or from the host. LED shall be configured as follows:
D. RED LED indicates door locked.
E. GREEN LED indicates door unlocked.
F. RED Flashing LED indicates invalid card read or access denied.
G. BEEP on all card read.
H. Card reader must be housed in a weatherproof and secure potted enclosure.
I. A minimum of two (2) color bezel/faceplate options must be provided to the Owner.
J. A low profile version, as well as a surface mounted mid-range device with / without keypad and a surface mounted long range device.
K. Basis of design shall be Salto Design XS readers. Alternates must be submitted for approval at least 10 business days prior to Bid date, and must be approved prior to Bid date to be acceptable.

2.07 OFFLINE CARD READERS

A. Contractor to provide multi-technology proximity/smart card/NFC technology cards readers that at present shall operate with SMART card technology.
B. Read range shall not be less than 5.5 inches.
C. Card readers shall be equipped with multi-color LED's and internal beeper. Control of the LED's and beeper shall be internal or from the host. LED shall be configured as follows:
D. RED LED indicates door locked.

E. GREEN LED indicates door unlocked.
F. RED Flashing LED indicates invalid card read or access denied.
G. BEEP on all card read.
H. Card reader must be housed in a weatherproof and secure potted enclosure.
I. A minimum of two (2) color bezel/faceplate options must be provided to the Owner.
J. A low profile version, as well as a surface-mounted mid-range device with/without keypad and a surface-mounted long-range device.
K. Basis of design shall be Salto XS4 readers. Alternates must be submitted for approval at least 10 business days prior to Bid date and must be approved prior to the Bid date to be acceptable.

2.08 ACCESS CARDS

A. Owner to provide Access control Key Cards

2.09 DOOR POSITION SWITCH CONTACTS

A. Provide door position switches where shown on the contract drawings. All door position switches shall be UL Listed for the application. All exterior doors and doors where interface with intrusion detection or local door alarm is required shall be provided with Double Pole/Double Throw (DPDT) contacts.
B. Surface mounted door contacts shall be provided with total encapsulation to protect against moisture. Door contact shall have anodized aluminum finish, with an armored stainless steel flexible cable and be double pole/double throw. Contractor to furnish and install Sentrol 2500 series or approved equal. One set of contacts shall be reserved for future use.
C. Recessed mounted door contacts for swing or sliding door locations shall be Sentrol 1076, 1078, or equal. Door contact shall be fully potted with factory installed wire leads. Recessed magnet shall be provided for wooden or doors with pre-formed mounting holes. Metal entry/exit doors with top channel shall be provided with Rare Earth Magnet mounted in flexible housing. Housing shall be affixed in position by adhesive or mechanical fastener.
D. Door contacts mounted in locations, other than those shown in the Contract Drawing Details (hinged side of door, surface mounted when Details require recessed, etc.), will not be allowed.
E. Acceptable alternates shall be Honeywell, Bosch, or GRI.

2.10 REQUEST TO EXIT MOTION SENSOR DEVICES

A. Provide request to exit (REX) motion sensor devices where request to exit signal is not available from door hardware.
B. Door hardware shall provide free egress. REX device shall be used to shunt DPS alarm only, and shall not unlock door hardware.

C. REX (PIR) devices shall have wide angle, long range lenses (adjustable) to detect motion of personnel desiring to exit through the door. Coordinate exact field mounting location to provide best operation of (PIR) type (REX) device. (PIR) device shall operate at 9.0 to 16.0 VDC and have form-C output contacts rated at minimum 24 VDC/0.5 amps.
D. Any doors requiring magnetic locking hardware will require REX push-to-exit buttons for door release in addition to manual release stations
E. Basis of design shall be Interlogix RCR-REX. Acceptable alternates shall be Honeywell, Bosch, and Takex.

2.11 EMERGENCY EGRESS DEVICE

A. Emergency egress device shall be required at any door provided with magnetic locking hardware and where electronic locking hardware prevents exiting through a designated emergency path of egress.
B. Emergency egress device shall be a mechanically operated device to provide direct interruption of locking hardware without interface to electronic controllers or relays.
C. Emergency egress devices for this project shall be Panic push bar devices integrated with the electronic hardware, and shall be provided and installed by the door hardware contractor.
D. It shall be the responsibility of the Security Contractor to notify the design team and Owner of any access controlled door that does not meet emergency egress requirements.

2.12 SYSTEM WIRING

A. Cable must meet minimum NEC requirements for Class 2 wiring. Power wiring for door locks and sounders shall not be smaller than No. 18 AWG.
B. All wiring shall be in accordance with the manufacturers written recommendations. All cabling/wiring shall be submitted in a detailed spreadsheet including cut sheets and samples to the Owner prior to any installation.
C. All conductors within junction boxes, pull boxes, and equipment cabinets shall be grouped and laced with nylon tie straps with identification tab, for individual lock sets.
D. No cable distance shall exceed the manufacturer recommended distance for each device including risers, service loop, and patch cables.

2.13 TRANSIENT VOLTAGE SURGE SUPPRESSION

A. Protect all equipment against surges induced on all control and power cables. All copper cables and conductors that serve as 120V power and control conductors shall have surge protection circuits installed at each end and locations where conductors enter or exit a building. Fuses shall not be used for surge protection.
B. Surge suppression devices shall meet the following standards/publications:
    1. UL 497B

2. UL 1449 (must meet 330 Volt suppression rating)
3. IEEE Category B impulse and ring wave tests

C. Acceptable Manufacturers: Northern Technologies, Inc., EDCO. Product shall be warranted against defect for a period of not less than five (5) years.

D. All power connections, including 24 VDC and 24 VAC power supplies and direct wired or plug-in 120 VAC power connections, for all systems and components specified herein, shall be equipped with surge suppression devices. Devices shall be bonded to building grounding system in accordance with Article 250 of the National Electric Code.

E. Grounding: Provide a dedicated, separate No. 6 AWG copper conductor from true earth ground (grounding rod) to all security equipment rooms, security equipment cabinets, and control rooms. Connect all lightning protection devices and security equipment non-current carrying metal parts to grounding conductor in accordance with Article 250 of the National Electric Code. Provide ground bus bar in each equipment room and control room with dedicated ground conductor to each cabinet, enclosure, pull/junction box and all equipment.

F. Ground Resistance Measurement: Each signal ground system D.C. resistance shall be measured between any point on the signal ground bus and the earth ground. An instrument designed specifically to measure the resistance of a point to each earth ground shall be used. The systems subcontractor shall measure ground resistance in accordance with the procedure as outlined by the test equipment manufacturer.

PART 3 EXECUTION

3.01 WIRING SYSTEMS

A. Protect all communication and data equipment against surge induced on all control, sensor and data cables. All cables and conductors which serve as control, sensor, or data conductors shall have surge protection circuits installed at each end that meet the IEEE 472 surge withstand capability test and the electrical transient tests established in UL365. Fuses shall not be used for surge protection.

B. Access control system cabling shall not be permitted to be exposed and shall be recessed in wall, or provided in conduit stub-up above accessible ceiling. Surface mount raceways shall be hardened against cutting or breaking and shall be mechanically fastened to the building structure.

C. Exterior conduits routed underground shall be provided with galvanized rigid metal conduit sleeves or elbows where turned up from grade or shall be otherwise protected by a suitable enclosure or pedestal.

D. Devices installed in ceiling tiles shall be provided with backbox and grid span bar with additional cable support from structure.

E. Where applicable, Electrical and Low voltage cables located in shared backbox or cabinet shall be provided with mechanical separation to prevent EMF interference meeting NEC and manufacturer requirements.

3.02 SYSTEM SET-UP

A. Contractor shall be responsible for fully customizing system(s) to meet the requirements of the building operators. After all devices have been properly terminated and tested, contractor shall provide system configuration meetings and shall be responsible for fully customizing system.

B. Access Control System setup shall include coordination with Intrusion Detection, Fire Alarm System, Intercom System, and Video Surveillance system installation to provide applicable programming for outputs and inputs to connected system. Programming to include, but shall not be limited to, the following:

C. Lock Power supply connection to Fire Alarm System for deactivation upon alarm.

D. Remote lock/unlock operation by Intercom System

E. Alarm detection triggering to Intrusion Detection system.

F. Event triggered output to Video Surveillance system.

3.03 TESTING

A. Testing requirements apply to all new construction.

B. Materials and documentation to be furnished under this specification are subject to inspections and tests. All components shall be terminated prior to testing. Equipment and systems will not be accepted until the required inspections and tests have been made, demonstrating that the access control system conforms to the specified requirements, and that the required equipment, systems, and documentation have been provided.

C. 100% system function test shall be required prior to final approval. Security Contractor to schedule system function test with design team and Owner 10 business days in advance and shall provide a minimum of two representatives knowledgeable of the facility and installed systems with the ability to escort design team to all device and panel locations. System test shall require one representative to accompany design team for field testing devices, and one representative to provide reporting and verification of signals from the ACM. System test shall include, but not be limited to the following items:

D. Card Reader operation for valid & invalid card read.

E. Lock hardware operation.

F. DPS function, Door force alarm, and door prop alarm.

G. Request to exit functions.

H. Emergency egress functions.

I. Lock power supply functions including release upon Fire Alarm activation.

3.04 TRAINING

A. The Contractor shall include in the base Contract all costs required to train Owner designated operating and maintenance personnel in the use and maintenance of systems provided under this section of the Specifications. Training sessions shall be conducted by instructors certified in writing by the manufacturer of the specific system.

B. Sessions shall be conducted for not more than four hour periods during normal working hours, i.e., Monday through Friday, 8:00 AM to 5:00 PM. Training session schedules shall conform to the requirements of the Owner; therefore such schedules shall be submitted to the Owner for approval not less than two weeks prior to the training session. All training sessions shall be video-taped and saved to digital media as well as the server hard drive for future reference.

C. Time to be included in base Contracts for the Access Control System shall be 8 hours.

END OF SECTION 281000

SECTION 28 1000

VIDEO SURVEILLANCE SYSTEM

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Contract drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this Section and shall be considered a part of this section and shall have the same force as if specified herein full.

1.02 DESCRIPTION:

A. This project includes complete supply and installation of a network based, IP Video Surveillance System for Forest Park Starr Park. Reference contract drawings and specifications for specific requirements.

B. The requirements of the IP Based Security Surveillance System shall include all raceway, cabling, devices, software and hardware required to provide a fully functional system.

C. Security Contractor shall provide all, patch panels and programming to establish a dedicated security network. Provide all labor to, install, check out, adjust, and calibrate the total system. Reference contract drawings for complete requirements.

D. The Security Contractor shall be responsible for providing ON-SITE MANUFACTURER'S SUPPORT to assist with the installation of the Video Surveillance System if the OWNER determines that the Security Contractor is unable to properly program, start-up and commission the Video Surveillance System. The Security Contractor shall bear all cost related to the ON-SITE Manufacturer's Support.

E. The requirements of the IP Based Security Surveillance System shall include an overall site plan and maps for each level of the facility, that display active camera location ICONS (active meaning that if the USER selects the camera ICON, the screen will automatically show the view from that camera location). Also, maps must show camera viewing angle. The Security Contractor is responsible for all the necessary programming and development of map screens in order to meet the aforementioned requirements.

F. The requirements of the IP Based Security Surveillance System shall include all application or database management software for the VMS Server, Storage and Clients.

G. The requirements of the IP Based Security Surveillance System shall include all application, operating system and drivers as well as all computer hardware to provide display monitors / workstations as noted in the contract documents.

H. The requirements of the IP Based Security Surveillance System shall include all power supplies, proper sizing of power conductors, connection to existing electrical panels

for power circuits, conduit for power circuits and step down transformers as necessary for complete and fully operational system.

I. The requirements of the IP Based Security Surveillance System include all necessary programming. The IP Based Security Surveillance System shall be programmed to archive all cameras in continuously at a frame rate of 1 frame per second for 30 days and at a minimum of 1280x720 HD resolution. Retention shall be established based on "FIRST IN – FIRST OUT" functionality. The IP Based Security Surveillance System shall be programmed to record, when activity is detected in the camera's field of view, at 15 frames per second and at the full resolution of the camera viewing the event. During alarm recording mode, cameras are to be recorded at full resolution so that full zoom capabilities are available when viewing archived alarm events. This level of programming has been difficult for most Security Contractors. Obtaining Manufacturer's on-site / phone support and all associated cost are the full responsibility of the Security Contractor. All programming must be completed prior to Final Inspection.

J. This division of the Specifications covers the complete IP Based Security Surveillance system as indicated on the Drawings and specified herein. The Security Contractor shall provide all labor, materials, equipment, and supervision to install the specified system. The installation of all equipment and raceways shall be the full responsibility of the Security Contractor for this project.

K. As part of the scope of this contract, the Security Contractor shall install and configure client monitoring software on up to two (2) Owner provided work stations. The location of the Owner provided workstations is to be determined by the Owner.

L. A minimum of one (1) CD with client monitoring software and one (1) Operating Instruction Manual (for the software) must be provided with each Client Workstation software application that is loaded onto Owner provided computer hardware. Additional copies of client monitoring software with loading and operating instructions on CD must be available upon Owner's request at no charge for the duration of the warranty period.

M. All conflicts between the drawings and specifications shall be brought to the attention of the owner as soon as possible. In general, specification requirements shall take precedence over drawing requirements.

1.03 QUALITY ASSURANCE

A. Industry Referenced Standards. The following specifications and standards are incorporated into and become a part of this Specification by reference.

1. NFPA 70 National Electric Code.
2. UL 50 Enclosures for Electrical Equipment.
3. UL 1590.

4. FCC Part 15, Class B.
5. ICEA S-83-596 ICEA Standard for Fiber Optic Premises Distribution Cabling – Current Edition.
6. IEEE802.3at PoE.
7. IEEE802.3af PoE.
8. EN 60950-1.
9. EN 55022 Class B (Emissions).
10. EN 55024 (Immunity), VCCI.

1.04 INSTALLER'S QUALIFICATIONS:

A. Firm with at least 5 years of successful application, installation, and testing experience on specified systems and equipment. All supervisors and installers assigned to the installation of this system or any of its components shall have factory certification from each equipment manufacturer that they are qualified to install and test the provided products. General electric trade staff shall not be used for the installation of the Video Surveillance System and associated hardware. All installers assigned to the installation of this system or any of its components shall have a minimum of 3 years experience in the installation of the specified equipment.

B. Security Contractor must be a Certified Installer of the manufacturer of the Video Management System (VMS) software. Certification must be provided, in the form of a letter from the VMS Manufacturer or training certificate indicating that the Security Contractor (not an employee) is a Certified Installer.

C. The Security Contractor must be licensed in the State of Georgia as a Low Voltage Telecommunications (LV-T) or Low Voltage Unlimited (LV-U) class certification.

D. The responsibilities of the Security Contractor shall include but not be limited to the following:
   1. Shop drawings on all IP Based Security Surveillance Systems and equipment.
   2. Installation of all new IP Based Security Surveillance Systems and equipment as documented in the drawings and specifications.
   3. Set up and programming of all motion detection, alarm event and recording parameters for all cameras.
   4. Coordination with Owner to establish at list of common camera names. Then programming of all camera names into all Video Surveillance System displays.
   5. Wire and wiring termination for all IP Based Security Surveillance and control systems and equipment.
   6. Testing and check-out of all IP Based Security Surveillance systems and equipment.
   7. Training for all IP Based Security Surveillance systems and equipment.

8. Warranty for all IP Based Security Surveillance systems and equipment with the exception of OWNER PROVIDED and VOICE /DATA CONTRACTOR PROVIDED items.
9. As-Built drawings, operations and maintenance for the complete IP Based Security Surveillance System.

1.05 SUBMITTALS:

A. The Security Contractor shall provide shop drawings on company title block with device locations, one-line diagrams, large scales of rooms where equipment will be located and equipment rack configurations.

B. Product Data: Submit manufacturer's technical product data, including specifications and installation instructions, for each type of system equipment. Include drawings which contain complete wiring and schematic diagrams and other details required to demonstrate that the system has been coordinated and will function properly as a system. Drawings shall include floor plan layouts showing device locations, vertical riser diagrams, equipment rack details, elevation drawings of equipment racks, sizes and type of all cables and conduits.

C. Test Plan: Security Contractor shall submit a test plan which defines the tests required to ensure that the system meets technical, operational, and performance specifications, 30 days prior to the proposed test date. The test plan must be approved before the start of any testing. The test plan shall identify the capabilities and functions to be tested, and include detailed instructions for the setup and execution of each test and procedures for evaluation and documentation of the results.

D. Manufacturer Certification: Submit a letter from the manufacturer's representative stating the proposed systems being submitted for review are in accordance with the recommendations of the manufacturer.

E. It is the responsibility of the Security Contractor to meet with the appropriate Owner representative to compare the placement and installation of proper devices with the drawings and specifications. A 100% device-by-device test will be conducted by the vendor under the supervision of an Owner representative. Punch lists will be developed at that time by the owner representative and furnished to the Security Contractor. All punch list items must be corrected and verified prior to acceptance of the system.

F. Written documentation, in the form of a Letter from the Manufacturer or Certificate must be provided with Submittal Package demonstrating that the Security Contractor is a certified and authorized Dealer and Installer of the approved Video Management System.

1.06 DRAWINGS:

A. The Drawings indicate the arrangement of security and IP Based Security Surveillance equipment. Coordinate installation of equipment with the structural, mechanical and electrical equipment and access thereto.
B. Raceway home runs as shown on the security and IP Based Security Surveillance System shall be installed as shown on the Drawings, and as required by the associated equipment manufacturers.
C. AutoCAD drawings (floor plans only) in electronic DWG format shall be provided to the Security Contractor for the production of shop drawings and As-built drawings. The Security Contractor is totally responsible for the conversion, if necessary, of the electronic files to whatever in house CAD program the Security Contractor utilizes for the production of the as-built drawings.

1.07 FINAL CLOSEOUT DOCUMENTS:

A. Original content, taken directly from the Contract Drawings, shall be refused. As-built drawings must show true as-built conditions and must be prepared using the Security Contractors title block, symbols and notes explaining specific details of the installation.
B. The following are minimum requirements for close out documents. Final payment shall not be issued until all requirements have been met.
    1. Prior to project closeout, provide two (2) sets of complete data on equipment used for the school in this project. This data shall be in bound form and shall include 11 x 17 as built drawings. The documentation shall be forwarded to J & A Engineering for review and approval, prior to delivery to OWNER.
    2. All as built drawings shall include system interconnection diagrams with major components identified and number and type of interconnecting conductors. Drawings must show actual as built conditions and point-to-point diagrams.
    3. Two (2) full size sets of as built drawings shall be provided in hard copy format. Copies shall be delivered to J & A Engineering for review and approval, prior to delivery to the OWNER.
    4. As built drawings shall be provided on CD and in electronic format (PDF and AutoCAD - DWG). Drawings shall be delivered to J & A Engineering.
    5. Letter of Certification from the VMS Manufacturer stating that the application software is installed in accordance with manufacturer's recommendations and is functioning correctly at the time of final inspection.
    6. Operating and Maintenance (O & M) Manuals shall be provided (total of 2 copies). The documentation shall be forwarded to J & A Engineering for review and approval, prior to delivery to OWNER.
    7. Certificate of Acceptance. The documentation shall be forwarded to J & A Engineering for review and approval, prior to delivery to OWNER.

8. Training Sign-In Sheets. The documentation shall be forwarded to J & A Engineering for review and approval, prior to delivery to OWNER.
9. Document and provide two (2) copies of network configuration (such as a list of IP addresses and the devices the addresses belong to, line diagram demonstrating network topology, etc.). The documentation shall be forwarded to J & A Engineering for review and approval, prior to delivery to OWNER.
10. Laminated QUICK START INSTRUCTIONS for each Video Surveillance System Workstation at each school that provide simple directions for:
    a. Logging into the system and viewing live video images at the workstation.
    b. Logging into the system, searching and reviewing recorded video images at the workstation.
    c. Copying recorded events onto CD, DVD, USB Storage Devices and External Hard drives.
11. Completed (meaning open items have been cleared) Construction Observation Report generated by Consulting A/E and signed by Principals and Security Contractor. The documentation shall be forwarded to J & A Engineering for review and approval, prior to delivery to OWNER.
12. Security Contractor Warranty Form / Letter providing detailed description of warranty provisions, duration and start date. The documentation shall be forwarded to J & A Engineering for review and approval, prior to delivery to OWNER.
13. Manufacturer's Warranty Form / Letter providing detailed description of warranty provisions, duration and start date. The documentation shall be forwarded to J & A Engineering for review and approval, prior to delivery to OWNER.
14. All related documents required for substantial completion, system acceptance and final payments.

1.08 ACCEPTABLE MANUFACTURERS:

A. Reference products section of specifications for acceptable manufacturers.

1.09 WARRANTY:

A. The Security Contractor shall warrant the IP Based Security Surveillance System for one year from date of start-up against defects in equipment or workmanship. Failed equipment shall be replaced by the Security Contractor at no cost to the owner. Owner's personnel may perform initial trouble investigation but replacement of failed equipment and escalated problem support will be handled by the Security Contractor.

B. The one year warranty shall include Software Maintenance Agreements for all display workstation operating system software, all VMS application software, all VMS

database software, all VMS device driver software and any other software required for proper operation of the IP Based Security Surveillance System.

C. The one year warranty shall include Hardware Maintenance Agreements for all displays and workstations driving the displays required for proper operation of the IP Based Security Surveillance System.

D. The Security Contractor shall provide a Warranty Letter indicating the start date of the warranty. The Warranty Letter shall also provide contact information (Company name, Service Supervisor's name and phone numbers for normal working hours and Emergency Service request). The warranty period will not start until Warranty Letter has been reviewed, approved and agreed upon by the Owner. Also Warranty Letter shall provide a brief description of the items covered under the warranty.

PART 2 PRODUCTS

2.01 MATERIALS:

A. Materials or equipment specified by manufacturer's name shall be provided, unless approval of other manufacturers is listed in addendum to these Specifications. Any materials or equipment approved in addendum shall function the same as the equipment specified.

2.02 VIDEO SURVEILLANCE CAMERAS

A. All cameras shall be U.L. listed and shall be the standard product of one manufacturer complying with not less than the specifications contained herein. Installation of each camera shall include mounting brackets and/or camera housings fully compatible with the camera provided and as required by Security Surveillance System camera schedule.

B. All camera installations shall be securely attached to the mounting surface. Use lead shields on solid masonry, toggle bolts for hollow masonry, and machine bolts for steel. All anchoring devices shall be rated to support not less than five times the total equipment weight. Reference mounting details in contract documents

C. Indoor Fixed Dome, 5 Megapixel Cameras:

1. All cameras, in this category, shall be equipped with variable focal (3-9mm) lenses.
2. The camera shall provide corridor format feature.
3. It shall be the Security Contractor's responsibility to ensure that the latest version of firmware, that is compatible with the Video Management System, is downloaded to all cameras prior to Final Inspection.

D. Outdoor Fixed Dome, 5 Megapixel Cameras:

1. All cameras, in this category, shall be equipped with variable focal (3 to 9mm) lenses.

2. It shall be the Security Contractor's responsibility to ensure that the latest version of firmware, that is compatible with the Video Management System, is downloaded to all cameras prior to Final Inspection.

E. Network Specifications (All IP Cameras):
   1. Network: 100BASE-TX
   2. Cabling: CAT6
   3. Connector: RJ-45
   4. Security: SSL
   5. Protocols: UDP, TCP, SOAP, DHCP, Zeroconf

F. All cameras shall include a 36 month warranty.

G. Acceptable camera manufacturers shall include AVTECH. NO SUBSTITUTIONS.

2.03 NETWORK VIDEO MANAGEMENT SOFTWARE (NVMS)

A. General
   1. The Video Management Systems approved for this project is AVTECH.

B. Configuration
   1. Connection to the existing AVTECH Video Management Platform to be accomplished via registration to the owner's existing licensing structure. All camera hardware and licensing to be registered to ONLY the owner. Registration to the contractor, vendor or installer is not allowed.

C. Support
   1. The system shall be supported by the manufacturer via a 5 year Enterprise License and Support agreement.
   2. Basis of design is AVTECH. NO SUBSTITUTIONS.

2.04 VIDEO STORAGE REQUIREMENTS

A. Storage for video shall be sized for a minimum of 90 days

2.05 FLAT PANEL SECURITY SURVEILLANCE COLOR MONITORS:

A. Monitors shall be 50" and shall be rated for 24/7 continuous operation.

B. Monitors shall be the standard products of one manufacturer and compatible with the total system specified, herein, and complying with these specifications. Monitors shall be UL Listed, CSA Certified, and GS approved.

C. Monitors shall be mounted as indicated in contract documents. The Contractor to coordinate flat panel mounting requirements with General Contractor. The constructor to ensure that wall surface will accommodate display weight and installation requirements.

D. Flat Panel Display Specifications of equipment shall include:
   1. Video
      a. Screen Size: Diagonal length of TV screen 46" class or larger
      b. Native Resolution: 1920 X 1080 Progressive Scan

c. Contrast Ratio: 4000:1
d. Backlight Type: LED Edge-lit
e. Aspect Ratio: 16:9
f. Refresh Rate: 60Hz

2. Connectors:
   a. Inputs: HDMI,PC input(D-sub), PC input Audio(Mini-Jack) RF Input
   b. Control: Accepts RS-232C control.

3. Electrical Specifications:
   a. Supply Voltage: 120 VAC, 60 Hz (108 VAC to 132 VAC).
   b. Power: 120 watts, nominal, with current requirements not to exceed 1.5 amps.

E. Acceptable manufacturers shall include NEC P463 or comparable from Samsung or Panasonic
   1. Accessories shall include:
      a. Flat Panel Wall Mount (Medium): wall mount type, low profile mount for Flat Panel up to 175ibs. And in the size range from 42”-63” diagonal. Capable of 8 degrees of downward tilt. Wall mount must provide mounting locations for small form factor PC and UPS Unit.

2.06 KVM EXTENDER (KEYBOARD, VIDEO & MOUSE)

A. Minimum requirements shall be:
   1. Supports low and high speed USB
   2. Uses Data Industry Standard CAT-6 cable
   3. Operates USB peripherals up to 330 feet (100m) from computer
   4. Supports DVI resolutions up to 1920 x 1200 or 1080p at 330 feet(100m)
   5. Unit shall be wall mountable
B. Preferred manufacturers shall be Gefen. Substitutions shall be allowed with prior approval.

2.07 WORK STATIONS

A. The following are minimum requirements for the display monitor workstations:
   1. The minimum configuration for all workstations utilized shall be a Dell with Core i7 (Latest gen) Windows 10 Pro 64 bit, Logitech wireless unified keyboard and mouse, 32 GB RAM minimum, 1 TB Solid State Hard Drive and two (2) hdmi video outputs, Dell Support and Hardware Warranty.
B. Acceptable manufacturers shall be Dell, HP or Lenovo.

2.08 COPPER WIRING REQUIREMENTS

A. See Telecom requirements.

2.09 CAT 6 PATCH PANELS

A. All patch panels shall be provided and installed by the Telecom Contractor.

2.10 CATEGORY 6 CONNECTIVITY AND TERMINATIONS

A. See DIV 27

2.11 SURFACE MOUNT BOXES "BISCUIT"

A. Items specified in the section are to be provided and installed by the Telecom Contractor.
B. Surface mount boxes shall house two jacks.
C. Bases shall be installed with two screws to building structure.
D. Boxes shall be compatible with connectivity.
E. Blanks shall be provided for each unused port.

2.12 CATEGORY 6 PATCH CORDS

A. All patch cords shall be provided and installed by the Security Contractor.
B. Color shall be White.

2.13 UNINTERRUPTIBLE POWER SUPPLY (UPS)

A. Uninterruptible power supply (UPS) Units shall be provided and installed for all active Video Surveillance System equipment including:
    1. Wall or rack mounted video monitors in Main Control Room, Remote Control Rooms and Administrative Offices where viewing monitors might be installed.
    2. All locations where Video Surveillance System viewing and archiving workstations are installed.
    3. All locations where Video Surveillance System servers and archiving equipment / hardware is installed.
    4. All locations where Video Surveillance System network switches, routers, fiber optic receivers and transmitters are installed.
    5. VIDEO SURVEILLANCE SYSTEM head end equipment in the VIDEO SURVEILLANCE SYSTEM Equipment Rack must be powered by UPS.
B. All UPS Units must be sized adequately to support the complete load of the VIDEO SURVEILLANCE SYSTEM equipment and to provide battery backup for a minimum of 30 minutes.
C. The UPS Units at the remote PoE Extender locations shall be provided and installed by the Security Contractor and shall have the following minimum features:
    1. Audible Alarms.
    2. Automatic Self Test.
    3. Automatic Voltage Regulation (AVR).
    4. Building wiring fault indicator.
    5. Lightning and Surge Protection.

6. Network-grade line conditioning.
7. Overload Indicator.
8. Replace Battery Indicator.
9. Status Indicator LED's.
10. UPS shall have the ability to handle crest factor ratios of 2.5 or above.
11. UPS shall provide continuous (no-break power) during momentary or complete blackouts.
12. UPS shall have the ability to recharge the battery to 90 percent capacity within a reasonable period of time (5 to 10 times the discharge time).
13. The UPS output shall be regulated with maximum deviations from nominal of +6 percent to –13 percent over the full input range, both AC and DC.
14. UPS shall meet ANSI C84.1 requirements.

D. UPS batteries shall be valve regulated (sealed or maintenance free) lead-acid cell type. Batteries shall be installed within the UPS enclosure or in a standard enclosure provided for that purpose by the UPS manufacturer.

E. Furnish calculations with shop drawings verifying UPS sizing in compliance with these specifications.

2.14 TRANSIENT VOLTAGE SURGE SUPPRESSION (TVSS)

A. All equipment must be protected against surges induced on all control, video, and power cables.

B. At all exterior camera locations, copper cables and conductors which serve as 120V power, control, or video conductors shall have surge protection circuits installed at each end (at device locations and where connections are made to network equipment). Fuses shall not be used for surge protection.

C. Surge suppression devices shall meet the following standards/publications:
1. UL 497B.
2. UL 1449 (must meet 330 Volt suppression rating).
3. IEEE Category B impulse and ring wave tests.

D. Acceptable Manufacturers: Northern Technologies, Inc., EDCO. Product shall be warranted against defect for a period of not less than five (5) years.

E. All power connections, including 24 VDC and 24 VAC power supplies and direct wired or plug-in 120 VAC power connections, for all systems and components specified herein, shall be equipped with surge suppression devices. Devices shall be bonded to building grounding system in accordance with Article 250 of the National Electric Code.

F. Grounding: Provide a dedicated, separate No. 6 AWG copper conductor from building grounding system to the security equipment room, security equipment cabinets, and central control room. Connect all lightning protection devices and security equipment

non-current carrying metal parts to grounding conductor in accordance with Article 250 of the National Electric Code. Provide ground bus bar in equipment room and control room with dedicated ground conductor to each cabinet, enclosure, pull/junction box and all equipment.

G. Ground Resistance Measurement: Each signal ground system D.C. resistance shall be measured between any point on the signal ground bus and the earth ground. An instrument designed specifically to measure the resistance of a point to each earth ground shall be used. The systems subcontractor shall measure ground resistance in accordance with the procedure as outlined by the test equipment manufacturer. Instrument shall be Biddle earth resistance test instrument, or approved equal.

PART 3 EXECUTION

3.01 INSTALLATION

A. System components and appurtenances shall be installed in accordance with NFPA 70, manufacturer's instructions, and as shown. Necessary interconnections, services, and adjustments required for a complete and operable signal distribution system shall be provided. Penetrations in fire-rated construction shall be fire-stopped in accordance with contract documents. Conduits and raceways shall be installed in accordance with the National Electric Code (NEC). Cables shall not be installed in the same cable tray, utility pole compartment, or floor trench compartment with AC power cables. Metal conduits shall not be continuous between buildings. Security Contractor to provide ground isolation between buildings by breaking continuous copper cabling and metal conduit runs.

B. Equipment: All monitor and camera mount support brackets shall be securely attached to mounting surfaces. Use lead shields on solid masonry, wood screws on wood, and machine bolts on structural steel. All anchoring devices shall be rated to support not less than five times the total equipment weight. See installation details for mounting to gypsum board and lay-in ceilings.

C. Surge Protection:

1. All copper cables and conductors which serve as control, power, or data conductors shall have surge protection devices installed at each end that complies with electrical and security specifications.
2. Protect all video and data equipment from surges induced on all control, power and data cables. All cooper cables and conductors which serve as control, power, or data conductors shall have surge protection circuits installed at each end that meet the IEEE 472 surge withstand capability test. Fuses shall not be used for surge protection.

D. Power: All interior cameras shall be powered by POE network switches. All exterior cameras shall be powered by POE inserters located in IDF / MDF Rooms.

3.02 TESTING

A. Materials and documentation to be furnished under this specification are subject to inspections and tests. All components shall be terminated prior to testing. Equipment and systems will not be accepted until the required inspections and tests have been made, demonstrating that the video distribution system conforms to the specified requirements, and that the required equipment, systems, and documentation have been provided.

B. Testing shall be performed by the Low Voltage Engineer, the Owner's Representative, the Security Contractor's Project Manager and Lead Installer.

C. Testing shall include a device-by-device inspection, an evaluation of each device's performance and quality of installation, overall review of equipment and cable installation to ensure Installation Standards are being maintained, review of programming of device identification and functional perimeters, review of recording settings and display views as well as the system's compliance with the Specifications and all requirements noted on the Construction Drawings. The Low Voltage Engineer shall document all observations and provide a Construction Observation Report. The Security Contractor shall be responsible for clearing the open items noted in the report.

3.03 TRAINING

A. The Security Contractor shall include in the base Contract all costs required to train the operating and maintenance personnel in the use and maintenance of systems provided under this section of the Specifications.

B. Training session schedules shall conform to the requirements of the owner; therefore such schedules, agendas and outlines shall be submitted to the owner for approval not less than two weeks prior to starting the training sessions.

C. Training sessions shall be conducted by instructors certified in writing by the manufacturer of the specific system.

D. The Security Contractor shall be responsible for the following:

1. Coordination with the Owner for the training date, starting time and duration of the training session.
2. Prior to training, provide all Attendees with the following documentation:
    a. Training Agenda (include introductions, estimated start / end times and topics to be covered)
    b. Training Outline (include topics and sub-topics to be covered with instructional bullet points).
    c. Hard copy of User's Manual (one for each attendee)
    d. Laminated Quick Reference Card(s) for routine task.

E. Training sessions shall be provided individually and on-site for each school. Sessions shall be provided in two or four hour increments.
F. Training shall be provided on-site at the Headquarters Building for Administrative Staff.
G. Time to be included in base Contracts for specific systems shall be as follows:
    1. The total number of hours shall be twenty four (24). Sixteen hours shall be provided at substantial completion. The other eight hours shall be provided after the system has been completely turned over to the OWNER and has been in use for a minimum of 30 days.

END OF SECTION 281000

SECTION 31 1000
SITE CLEARING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

2.01 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, removing site utilities and abandoning site utilities in place.
   7. Temporary erosion and sedimentation control.

B. Related Requirements:
   1. Section 312500 "Erosion and Sedimentation Controls" for temporary erosion and sedimentation control measures.

3.01 DEFINITIONS

A. Subsoil: Soil beneath the level of subgrade; soil beneath the topsoil layers of a naturally occurring soil profiles, typified by less than 1 percent organic matter or fewer soil organisms.

B. Surface Soil: Soil that is present at the top layer of the existing soil profile. In undisturbed areas, surface soil is typically called "topsoil," but in disturbed areas such as urban environments, the surface soil can be subsoil.

C. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil; the zone where plant roots grow. Its appearance is generally friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects larger than 2 inches in diameter; and free of weeds, roots, toxic materials, or other nonsoil materials.

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

E. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction as indicated on Drawings.

F. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

4.01 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

5.01 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.

6.01 INFORMATIONAL SUBMITTALS

A. Existing Conditions: Documentation of existing trees and plantings, adjoining construction, and site improvements that establishes preconstruction conditions that might be misconstrued as damage caused by site clearing.
   1. Use sufficiently detailed photographs or video recordings.
   2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plant designated to remain.

B. Topsoil stripping and stockpiling program.

C. Record Drawings: Identifying and accurately showing locations of capped utilities and other subsurface structural, electrical, and mechanical conditions.

D. Burning: Documentation of compliance with burning requirements and permitting of authorities having jurisdiction. Identify location(s) and conditions under which burning will be performed.

7.01 QUALITY ASSURANCE

A. Topsoil Stripping and Stockpiling Program: Prepare a written program to systematically demonstrate the ability of personnel to properly follow procedures and handle materials and equipment during the Work. Include dimensioned diagrams for placement and protection of stockpiles.

8.01 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. Improvements on Adjoining Property: Authority for performing site clearing indicated on property adjoining Owner's property will be obtained by Owner before award of Contract.
   1. Do not proceed with work on adjoining property until directed by Owner.

C. Salvageable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated by owner.

D. Utility Locator Service: Notify utility locator service for area where Project is located before site clearing.

E. Do not commence site clearing operations until temporary erosion and sedimentation control and plant protection measures are in place.

F. Tree and Plant Protection Zones: Protect according to requirements in Section 015639 "Temporary Tree and Plant Protection." The following practices are prohibited within tree and plant protection zones:

1. Storage of construction materials, debris, or excavated material.
2. Parking vehicles or equipment.
3. Foot traffic.
4. Erection of sheds or structures.
5. Impoundment of water.
6. Excavation or other digging unless otherwise indicated.
7. Attachment of signs or wrapping materials around trees or plants unless otherwise indicated.

G. Do not direct vehicle or equipment exhaust towards protection zones.

H. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

I. Soil Stripping, Handling, and Stockpiling: Perform only when the soil is dry or slightly moist at the direction of the on-site testing agency.

PART 2 - PRODUCTS

1.01 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.

PART 3 - EXECUTION

1.01 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Verify that trees, 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 Tree and 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.

2.01 TEMPORARY EROSION AND SEDIMENTATION CONTROL

A. Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil bearing water runoff or airborne dust to adjacent properties and walkways, according to erosion and sedimentation control Drawings and

requirements of authorities having jurisdiction.

B. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.

C. Inspect, maintain, and repair erosion and sedimentation control measures during construction until permanent vegetation has been established.

D. Remove erosion and sedimentation controls, and restore and stabilize areas disturbed during removal.

3.01 TREE AND PLANT PROTECTION

A. Protect trees and plants remaining on-site according to requirements in Section 015639 "Temporary Tree and Plant Protection."

B. Damage to trees located within designated tree save areas is cause for monetary penalty.

C. Throughout construction, properly protect existing trees which are to remain or which over-hang the property line.

D. Fence existing trees to remain with Tenax 4' x 1 ½" x 3" orange mesh barrier fence or 4 x 4 posts and double 2 x 4 rails at the tree drip line, or as required by local jurisdiction.

E. Do not cut low hanging branches on trees to be saved, unless approved by the Owner. Use a tree surgeon to cut branches which must be cut to eliminate obstructions. Immediately and properly trim any cuts, or accidental injuries to the bark or trunk, and properly trim and paint with a protective tree wound and sealing compound.

F. Warp up or down between existing grades of root areas and new finished grades surrounding trees to remain. Where fill under 2' occurs, fill with broken stone or washed gravel to full fill depth for a distance of 3' from the trunk in all directions, the remaining fill being of light, friable topsoil. Leave any trees in the graded area that are at grade level or where the fill is not over two feet (2'-0") at the option of the Owner.

G. Permit no stripping of topsoil, cutting or filling, burning of trash, dumping of materials, storage of materials or equipment of any kind, or use by personnel for any activities, whether on or off duty, within the spread of branches of trees to remain.

H. Repair or replace trees, shrubs and other vegetation indicated to remain or be relocated that are damaged by construction operations according to requirements in Section 015639 "Temporary Tree and Plant Protection."

4.01 EXISTING UTILITIES

A. Coordinate with owner to arrange for disconnecting and sealing indicated utilities that serve existing structures before site clearing.

1. Verify that utilities have been disconnected and capped before proceeding with site clearing.

B. 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.

C. Locate, identify, and disconnect utilities indicated to be abandoned in place.

D. 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 7 days in advance of proposed utility interruptions.
   2. Do not proceed with utility interruptions without Owner's written permission.

E. Excavate for and remove underground utilities indicated to be removed.

F. 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 "Site Demolition" and Section 024119 "Selective Structure Demolition."

5.01 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction.
   1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
   2. Grind down stumps and remove roots, obstructions, and debris to a depth to be specified by the Geotechnical Engineer of record on the project.
   3. Use only hand methods or air spade for grubbing within utility or tree protection zones.
   4. Chip removed tree branches and stockpile in areas approved by Owner or dispose of off-site.

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 as specified by the Geotechnical Engineer of record on this project.

C. Disposition: Remove from the site and dispose of individual trees, shrubs and stumps, along with other rubbish materials cleanly and completely in approved manners so as not to injure trees to remain. Comply with local ordinances and obtain the necessary permits for disposing of trees, stumps and other debris.

D. Burning: Burning will only be allowed with written approval from local issuing authority and the Owner.

E. Coordination: Complete clearing of the site before topsoil stripping operations begin. Do not leave loose sticks, roots, branches or any other debris on the site. Avoid mixing of foreign matter with the topsoil.

6.01 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.

B. Strip topsoil 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 larger 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 or other materials. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.
   1. Limit height of topsoil stockpiles to 72 inches. To exceed 72 inches, coordinate with on-site Testing Agency.
   2. Do not stockpile topsoil within protection zones.
   3. Dispose of surplus topsoil, if required.
   4. Stockpile surplus topsoil for use in planned landscaped areas.

7.01 STOCKPILING ROCK

A. Stockpile rock in accordance with specifications provided by the Geotechnical Engineer of Record on project.

8.01 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.

9.01 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. Burning tree, shrub, and other vegetation waste may be allowed by authorities having jurisdiction. Contractor to obtain burning permit if required.

C. 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

SECTION 31 2000
EARTH MOVING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:

1. Excavation, filling, compacting and grading in the areas shown on the drawings to obtain the required finished ground surface properly prepared to receive pavements, walks, building floor slabs, utilities, and drainage structures.
2. Ditching in soil areas of high moisture content to allow the soil to drain prior to making excavations.
3. Adjustment of moisture content up or down by discing of soils placed in fills if soil tests show drying to be necessary to meet compaction requirements.
4. Spreading topsoil in sufficient quantities to backfill islands, medians, and roadway shoulders and open graded areas.
5. Undercutting unsuitable soil materials and replacing with compacted approved soils.
6. Stockpiling approved soil material in convenient location and in sufficient quantity for use in backfill of walls.
7. Removal from the job of unsuitable, excess materials.
8. Importing material, if required, from offsite.
9. Preparing subgrades for slabs-on-grade, walks, pavements, turf and grasses, and plants.
10. Excavating and backfilling.
11. Drainage course for concrete slabs-on-grade.
12. Subbase course for concrete walks and pavements.
13. Subbase and base courses for asphalt paving.
14. Subsurface drainage backfill for walls and trenches.

1.03 UNIT PRICES

A. Work of this Section may be affected by unit prices for earth moving.

B. Rock Excavation Volume: Volume of rock actually removed, measured in original position, but not to exceed the following measurements. Unit prices for rock excavation include replacement with approved materials.

1. Measure Rock Excavation volume as follows:

a. Mass Rock:

1. Quantity of rock excavation will be established from cross sections taken by a representative chosen by the Owner. Prior to any rock excavation, expose the rock to be removed which has not been cross sectioned by the Owner’s representative or no payment will be made. Prior to payment for rock excavation, the Owner's representative will prepare final cross sections and verify that the rock has been removed to the proper elevation.
2. Rock removed before measurement will not receive compensation.

3. Calculate the quantity of rock using the following limits:
a. Top of rock;
b. To 6" below bottom of base course and 12” beyond edge of paving for uncurbed paved areas;
c. To vertical line one foot behind back of curb;
d. To 6" below foundations and footings;
e. To vertical faces located 12" horizontal distance from each footing or foundation face;
f. To 6" below bottom of slabs on grade;
g. To finish grade in cut where rock is removed to finish grade. Where it is not so removed, to the finish rock surface.
h. To 12” outside forms for concrete work requiring forms.
i. To neat outside dimensions for concrete work with no forms.

b. Trench Rock:
1. Measure trench rock by taking level reading at reasonable intervals but not more than ten feet along the exposed trench length before removal of rock.
2. Rock removed before measurement will not receive compensation.
3. Calculate the quantity of rock using the following limits:
a. Top of rock:
b. To vertical faces 12" beyond the outside of pipe barrel, each side;
c. To 6" below the pipe barrel for the full trench width;
d. To vertical faces 12" horizontal distance beyond structures and manholes;
e. To 6" below bottom of slab for structures.

C. Include in the bid submittal unit costs to purchase and place or perform as specified on the jobsite the following items:
1. Surge stone, Type 1 and Type 3 rip-rap (per ton placed)
2. #57 stone (per ton placed)
3. Graded Aggregate Base, GAB (per ton placed)
4. Geotextile fabric, Mirafi 500 X or equivalent (stabilization) (per sq.ft. installed)
5. Rock excavation and backfill complete (mass) (per cu.yd.)
6. Rock excavation and backfill complete (trench) (per cu.yd.)

1.04 DEFINITIONS

A. Backfill: Soil material or controlled low-strength material used to fill an excavation.
1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: Aggregate layer placed between the subgrade and hot-mix asphalt paving, concrete paving or walks.

C. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.

D. Borrow Soil: Suitable 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 Owner. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.

2. Bulk Excavation: Excavation more than 10 feet in width and more than 30 feet in length.

3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Owner. Unauthorized excavation, as well as remedial work directed by Owner, shall be without additional compensation.

G. Fill:

1. Structural Fill is defined as fill supporting retaining wall footings or any structure whatsoever and extending for a distance of ten feet (10') on each side of said structure measured at the finished grade, thereafter tapering away at a 45-degree angle.

2. Paving Area Fill is defined as fill supporting any asphalt, concrete paving, or special paving for parking of cars, or trucks, or concrete walks and extending for a distance of five feet (5') on each side of said area measured at the finished grade, thereafter tapering away at a 45-degree angle.

3. General Area Fill is defined as fill in the general grading area covering banks, lawns, hollows, drainage ditches.

H. "General earth excavation" is defined as follows:

1. Materials regardless of its nature or composition that can be removed by scrapers, loaders, pans, dozers, backhoes, or graders up to and including that material which requires the use of a single tooth ripper mounted on a crawler tractor having a minimum draw bar pull rated not less than 80,000 pounds. Boulders & Partially Weathered Rock as defined in the geotechnical report are included.

I. “Mass rock” as used herein is defined as follows:

1. Material which cannot be excavated except by drilling or blasting;

2. Material which is hard enough to ring when struck with a hammer, and the amount is greater than one (1) cubic yard of solid stone in volume; and

3. Any material that cannot be excavated with a single-tooth ripper mounted on a crawler tractor having a minimum draw bar pull rated no less than 80,000 pounds (Caterpillar D-8 or equivalent) and having an original volume of at least one (1) cubic yard.

J. "Trench rock" is defined as follows:

1. Material which occurs in a utility trench;

2. Material which is greater than 2 cubic yards in volume; and

3. Any material that cannot be excavated with a large backhoe having a curling force of no less than 40,000 pounds (John Deer or equivalent) and having an original volume of at least one-half (1/2) cubic yard.

K. "Muck" is defined as highly organic or plastic material which cannot support fill, footings, slabs, and pavements and requires removal by power shovels or draglines. Excessively wet or dry materials are not considered unsuitable.

L. 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.

M. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below base course, drainage fill, drainage course, or topsoil materials.

N. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

P. Protection zones: Areas that include undisturbed buffers, tree protection zones, rights of way, wetlands, state waters, utility easements, adjacent properties and any other environmental sensitive areas.

1.05 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site. At minimum, Owner, General Contractor, Site Contractor, Testing Agency and Local Inspector should be in attendance.

1.06 ACTION SUBMITTALS

A. Product Data: For each type of the following manufactured products required, if requested:

1. Geotextiles.
2. Controlled low-strength material, including design mixture.
3. Warning tapes.

B. Samples for Verification: For the following, in sizes indicated below, if requested provide to Geotechnical Engineer:

1. Geotextile: 12 by 12 inches.
2. Warning Tape: 12 inches long; of each color.
3. Fifty pound sample of each class fill material encountered as directed by the Geotechnical Engineer using care that samples are representative.
4. Fifty pound sample of proposed offsite source fill material.

1.07 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. Material Test Reports: For each on-site and borrow soil material proposed for fill and backfill.

C. Blasting plan approved by authorities having jurisdiction.

D. Seismic survey report from seismic survey agency.

E. Classification according to ASTM D 2487.

F. Laboratory compaction curve according to ASTM D 698.

G. Pre-excavation Photographs or Videotape: Show existing conditions of adjoining construction property site improvements and downstream bodies of water including finish surfaces that might be misconstrued as damage caused by earth moving operations. Submit before earth moving begins.

H. Submit certification by a Geotechnical Engineer to the Owner that materials imported to the site meet the definition of suitable soils and contain no hazardous substances.

1.06 QUALITY ASSURANCE

A. Blasting: Comply with applicable requirements in NFPA 495, "Explosive Material Code, "and prepare a blasting plan reporting the following:

1. Types of explosive and sizes of charge to be used in each area of rock removal, types of blasting mats, sequence of blasting operations, and procedures that will prevent damage to site improvements and structures on Project site and adjacent properties.

2. Seismographic monitoring during blasting operations.

B. Seismic Survey Agency: An independent testing agency, acceptable to authorities having jurisdiction, experienced in seismic surveys and blasting procedures to perform the following services.

1. Report types of explosive and sizes of charge to be used in each area of rock removal, types of blasting mats, sequence of blasting operations, and procedures that will prevent damage to site improvements and structures on Project site and adjacent properties.

2. Seismographic monitoring during blasting operations.

C. Geotechnical Testing Agency Qualifications: Qualified according to ASTM E 329 and ASTM D 3740 for testing indicated.

D. Soils Report:

1. Obtain a copy of available reports and become familiar with their contents. The Owner makes no assurances as to the contents of the reports. Any claims based on the contents of the reports are disallowed.

E. Adjacent to buildings and in parking lots and roads, grade to within five hundredths (5/100) of a foot of the elevations and contours shown on the Drawings. In open areas, grade to within one-tenth (1/10) of a foot of those shown on the Drawings. Hand dress grades under buildings, slabs, walks, and steps to obtain the required elevation as shown on the Drawings.

F. Perform no unauthorized or unnecessary grading. This consists of removal of materials beyond the plan limits of grading and removal of materials beyond indicated subgrade elevation or dimensions without specific direction of the Owner's representative. Provide necessary remedial work at no cost to the Owner.

1.07 FIELD CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth moving operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and Local Authority Having Jurisdiction.

2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or Authority Having Jurisdiction.

B. Improvements on Adjoining Property: Confirm Authority for performing earth moving indicated on property adjoining Owner's property will be obtained by Owner before award of Contract.

1. Do not proceed with work on adjoining property until directed by Owner.

C. Utility Locator Service: Notify utility locator service for area where Project is located no less than 10 days before beginning earth moving operations. Notify Engineer of Record and cease work if any utilities located in the field differ from locations provided in project survey.

D. Do not commence earth moving operations until initial erosion and sedimentation control measures and plant protection measures are in place and 7 day letter has been issued.

E. The following practices are prohibited within protection zones:

1. Storage of construction materials, debris, or excavated material.
2. Parking vehicles or equipment.
3. Foot traffic.
4. Erection of sheds or structures.
5. Impoundment of water.
6. Excavation or other digging.
7. Attachment of signs to or wrapping materials around trees or plants.

F. Do not direct vehicle or equipment exhaust towards protection zones.

G. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

1.08 MODULAR RETAINING WALLS

A. Design, construct, test, guarantee, and warrant modular unit retaining walls under the complete and total responsibility of a single entity.

B. Submit to the Owner with the BID a complete design for the walls, including plan view, sections, and elevations, sealed by a registered Structural Engineer licensed to practice in the project jurisdiction. Submit stamped calculations supporting the design, based on wall specific geotechnical information obtained under the direction of the wall design engineer of record.

C. Where walls are installed in cut slopes give particular attention to adequate drainage systems designed to relieve hydrostatic pressure accumulation behind the walls.

D. Submit color and unit type for Owner approval.

E. Warrant the walls and indemnify the Owner against liability related to the design, testing, installation and performance of the walls.

F. Retain the services of a Geotechnical Engineer and submit certified documentation that the soils encountered are consistent with soil values and all testing requirements used in the wall design. Meet manufacturer's requirements for soils testing.

G. Construction trailers, batch plants, fueling stations, and all other construction related structures, vehicles and materials must be located outside of public or privately owned rights-of-way and within the project limits of construction.

PART 2 – PRODUCTS

2.01 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient suitable soil materials are not available from excavations.

B. Suitable Soils: Soil Classification Groups GW, GP, GM, SW, SP, ML, CL, SC and SM according to ASTM D 2487, or a combination of these groups approved by the Geotechnical Engineering testing agency; free of rock or gravel larger than 2 inches in any dimension, debris, waste, frozen materials, vegetation, organics, and other deleterious matter.

1. Use soils for structural backfill having a minimum dry density of 97 pounds per cubic foot unless otherwise approved by the Geotechnical Engineer.

C. Unsuitable Soils: Soil Classification Groups GC, OL, CH, MH, OH, and PT according to ASTM D 2487, or a combination of these groups, unless approved for use by the Geotechnical Engineer.

1. Existing undisturbed soils which are determined by the Geotechnical Engineer or Design Professional to be unsuitable for use as fill, in a particular application, for reasons other than moisture or water content.

a. Water saturated soils, regardless of the source of water (rainfall, storm runoff, ground water or other sources) shall not be considered unsuitable.

b. Unsuitable soil quantities will be determined by the Geotechnical Engineer by measuring in-place quantities.

D. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 95 percent passing a 1-1/2-inch sieve and not more than 8 percent passing a No. 200 sieve.

F. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.

H. Drainage Course: Narrowly graded mixture of washed crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size #57; with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.

I. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size #67; with 100 percent passing a 1-inch sieve and 0 to 5 percent passing a No. 4 sieve.

J. Sand: ASTM C 33; fine aggregate.

2.02 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. Grab Tensile Strength: 157 lbf ; ASTM D 4632.
3. Sewn Seam Strength: 142 lbf ; ASTM D 4632.
4. Tear Strength: 56 lbf ; ASTM D 4533.
5. Puncture Strength: 56 lbf ; ASTM D 4833.
6. Apparent Opening Size: No. 60 sieve, maximum; ASTM D 4751.
7. Permittivity: 0.2 per second, minimum; ASTM D 4491.
8. 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. Grab Tensile Strength: 247 lbf ; ASTM D 4632.
3. Sewn Seam Strength: 222 lbf ; ASTM D 4632.
4. Tear Strength: 90 lbf ; ASTM D 4533.
5. Puncture Strength: 90 lbf; ASTM D 4833.
6. Apparent Opening Size: No. 60 sieve, maximum; ASTM D 4751.
7. Permittivity: 0.02 per second, minimum; ASTM D 4491.
8. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

2.03 CONTROLLED LOW-STRENGTH MATERIAL

A. Controlled Low-Strength Material: Self-compacting, flowable concrete material produced from the following:

1. Portland Cement: ASTM C 150, Type I.
2. Fly Ash: ASTM C 618, Class C or F.
3. Normal-Weight Aggregate: ASTM C 33, 3/4-inch nominal maximum aggregate size.
4. Foaming Agent: ASTM C 869.
5. Water: ASTM C 94.
6. Air-Entraining Admixture: ASTM C 260.

B. Produce low-density, controlled low-strength material with the following physical properties:

1. As-Cast Unit Weight: 30 lb/cu. ft. minimum at point of placement, when tested according to ASTM C 138.
2. Compressive Strength: 80 psi, when tested according to ASTM C 495.

C. Produce conventional-weight, controlled low-strength material with 80-psi compressive strength when tested according to ASTM C 495.

2.04 MODULAR UNIT RETAINING WALLS

A. Use units of standard quality, free of chips and cracks, and consistent in color and tone chosen by Owner.

B. Remove defective units from the site.

2.05 ACCESSORIES

A. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored as follows:

1. Red: Electric.
2. Yellow: Gas, oil, steam, and dangerous materials.
3. Orange: Telephone and other communications.
4. Blue: Water systems.
5. Green: Sewer systems.

PART 3 - EXECUTION

3.01 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.

D. Protection of Existing Trees Remaining:

1. Protect tops, trunks, and roots of trees to remain; box, fence or otherwise protect trees which are subject to site work or construction damage. See the Section SITE CLEARING for tree protection and removal of any interfering branches. Immediately and properly trim and paint with a protective tree wound and sealing compound any cuts, or accidental injury to the bark or trunk. Remove protection only when danger from operations no longer exists.

E. Protection of Adjacent Property:

1. For the duration of the construction and until release, protect adjoining property from any excessive drainage and debris. Do not enter upon adjoining property without the permission of the property owner.

3.02 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.

3.03 EXPLOSIVES

A. Explosives: Obtain written permission from authorities having jurisdiction before bringing explosives to project site or using explosives on Project site.

1. Perform blasting without damaging adjacent structures, property, or site improvements.

2. Perform blasting without weakening the bearing capacity of rock subgrade and with the minimal disturbance of rock to remain.

3.04 PROCEDURES

A. After clearing and disposal is complete, strip from the top of the existing ground topsoil in all areas to be graded. Stockpile in approved locations where it will not interfere with building or utility operations. Use topsoil free from subsoil, debris and stones larger than 2" in diameter. Locate stockpiles as designated by the Owner. At the completion of the work, distribute topsoil over the grounds to form a minimum cover of 4 inches loose measure on graded areas to receive vegetation and other areas indicated by the Owner. Scarify subgrade prior to spreading topsoil. Form berms as directed to dispose of excess topsoil and haul off topsoil remaining. Import topsoil to meet the minimum coverage if onsite topsoil is insufficient.

B. Perform exterior grading in accordance with the drawings to ensure minimum 2% slope away from building in all directions.

C. Graded Areas: Repair and reestablish grades to the required elevations and slopes if any settlement or washing occurs prior to the acceptance of the work. Fill to required subgrade levels any areas where settlement occurs.

D. Temporary Grading and Drainage: Provide additional temporary drainage measures to prevent ponding and maintain effective drainage for the entire site through all phases of construction.

E. Excavating: Make no footing excavations to the full depth indicated when freezing temperatures or rain is expected. When full depths are reached, protect bottoms from frost or rain if placing of concrete is delayed.

1. Excavate material of every description and whatever substance encountered, to dimensions and levels shown on the Drawings. Excavate work to be clean-cut and true with bottoms level and sound.

2. Lab Testing: The Geotechnical Engineer will make necessary tests for required soil bearing values, and soil compaction.

3. Existing Site Conditions: Excavate any existing depressions or trenches that are encountered and are entirely within the new building walls, or within 5 feet of walls, to solid sub-grade and fill with compacted gravel or concrete to underside of new foundation or floor slab.

4. Unsuitable Bearing Material: Place the bottom of trenches, foundations and footings and base for paving on compacted suitable material. Remove loose materials, surface vegetation, debris and existing fill before any fill is placed. Proof roll the subgrade in the presence of the Geotechnical Engineer. Fill operations can then take place. Do not place footings until the Geotechnical Engineer and the Owner have examined and approved the soil upon which they will rest. If the bearing capacity at the levels indicated are found by the Testing Laboratory to be insufficient, the Owner may order the excavations carried to proper bearing capacity. Provide a minimum of twelve (12) inches compacted graded aggregate base stone between bottom of footings and any rock encountered. Compact fill in accordance with requirements for backfill.

5. Extend excavation to the depths and dimensions required by the drawings, including removal of rock.

3.05 EXCAVATION, GENERAL

A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials include rock, trash, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for conditions encountered.

1. If excavated materials intended for fill and backfill include unsuitable soil materials and rock, replace with suitable soil materials.

2. Remove rock to lines and grades to permit installation of permanent construction to dimensions required for rock excavation measurement and payment is a minimum.

B. Classified Excavation: Excavate to subgrade elevations. Material to be excavated will be classified as earth and rock. Do not excavate rock until it has been classified and measured. The Contract Sum will be adjusted for rock excavation according to the Contract Documents. Changes in the Contract Time may be authorized for rock excavation.

1. Earth excavation includes excavating pavements and obstructions visible on surface; underground structures, utilities, and other items indicated to be removed; together with soil, boulders, and other materials not classified as rock or unauthorized excavation.

a. Intermittent drilling; blasting, if permitted; ram hammering; or ripping of material not classified as rock excavation will be considered earth excavation.

2. Rock excavation includes removal and disposal of rock. Measure rock excavation for payment to lines and subgrade elevations indicated to permit installation of permanent construction.

3.06 ROCK EXCAVATION

A. When rock is encountered, clear away earth and notify the Owner. Owner will inspect material and issue written instructions. Do not excavate rock without written instructions.

B. Blast in accordance with local ordinances, and obtain permits where required by law. Complete blasting before any building footing is poured.

C. Remove excavated rock from the site or bury as directed by the Geotechnical Engineer, if allowed.

D. Excavated or blast rock is not allowed to be used for rip-rap or erosion control BMPs. Meet the specifications for rip-rap.

E. Excavate rock to below bottom of building slabs and footing, pavement, and piping to dimensions specified for measurement as a minimum.

3.07 EXCAVATION FOR MUCK

A. When muck is encountered, notify Owner immediately. The Owner or Geotechnical Engineer will inspect the material and issue written instructions.

B. Quantity of muck will be established from taking level reading by a representative chosen by the Owner or Geotechnical Engineer. Take the readings at reasonable intervals to identify the contours of the area, including the existing condition and the final excavated condition.

C. Muck removed before measurement will not receive compensation.

D. Calculate the quantity of muck by making surveys before and after removal. Base payment on the quantity of muck removed as calculated using the surveys.

E. Stockpile muck on site and reuse as allowed by the Geotechnical Engineer. Remove material which is not reused from the site. Provide settling ponds, dikes, piping, and appurtenances to prevent stockpile runoff from discoloring nearby streams.

3.08 EXCAVATION EMBANKMENT AND BRACING

A. Accept full responsibility for excavations. Protect excavation embankments against collapse. Where possible, make embankments over 5'-0" high at a slope not greater than 2:1 unless a steeper slope is recommended by a Registered Geotechnical Engineer.

B. Where it is not possible to provide a safe environment for slopes, temporarily support banks and maintain securely until permanent support has been provided.

C. Provide cross bracing and shoring to prevent collapse, where ditches or trenches are over 5'-0" deep.

D. Provide bracing system drawings designed and sealed by a Registered Engineer experienced in such designs. Use these design drawings to show the work and sequence in its entirety and submit to the Owner prior to commencing the work.

E. To prevent caving or settlement of earth adjacent to excavations, and for the protection of persons as well as property, provide shoring, bracing, and other similar material to meet the conditions in each particular case encountered. Leave in place until construction has reached a point where backfills behind walls or in ditches have been made and the need for shoring and bracing has been eliminated.

3.09 FOUNDATION BEARING TEST

A. The Geotechnical Testing Lab shall inspect the bearing surface prior to the contractor placing reinforcing steel/concrete.

3.10 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 placement and removal of concrete formwork for inspections, and for installation and other construction.

1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.

2. Pile Foundations: Stop excavations 6 to 12 inches above bottom of pile cap before piles are placed. After piles have been driven, remove loose and displaced material. Excavate to final grade, leaving solid base to receive concrete pile caps.

3. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch. Do not disturb bottom of excavations intended as bearing surfaces.

B. Excavations at Edges of Tree- and Plant-Protection Zones:

1. Excavate by hand to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots. Protect any exposed roots.

3.11 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.12 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.

1. All utility trenches must have clearances provided of 12 inches each side of pipe or conduit.

2. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.

B. Excavate trenches to uniform widths to provide 12 inches 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.

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. All utility trenches must have bedding provided that meets the requirements of the local jurisdiction and the geotechnical engineer's recommendations.

2. Excavate trenches to an elevation required in rock or other unyielding bearing material to allow for bedding course as directed by geotechnical engineer.

D. Trenches in Tree- and Plant-Protection Zones:

1. Hand-excavate to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.

2. Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities.

3. Protect any exposed roots.

3.13 EXCAVATION FOR ELEVATOR CYLINDER

A. Drill well hole plumb in elevator pit to accommodate installation of elevator-cylinder assembly. Coordinate with applicable requirements for diameter and tolerances in Division 14.

B. Provide well casing as necessary to retain walls of well hole.

3.14 SUBGRADE INSPECTION

A. Notify Owner when excavations have reached required subgrade.

B. If Geotechnical Testing Agency determines that unsuitable soil is present, continue excavation and replace with compacted backfill or fill material as directed.

C. Proofrolling

1. Contact the Owner's representative and the Geotechnical Engineer at least 48 hours in advance of proofrolling.

2. Clear and strip as herein specified areas to receive controlled structural and paving area fill. After removal of existing structures and topsoil, and before placement of any structural and paving area fill, proofroll that portion of the footing area and paved areas to receive fill to a distance of ten feet (10') beyond the limits. Accomplish proofrolling with a loaded twenty (20) ton minimum dump truck with two (2) complete coverages in each of two (2) perpendicular directions unless otherwise allowed. Accomplish proofrolling under the observation of the Geotechnical Engineer.

3. For any areas that "pump" under the wheels of the loaded truck, follow remediation measures as directed by the Geotechnical Engineer.

D. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Geotechnical Testing Agency, without additional compensation.

3.15 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Concrete fill to be used if approved by Geotechnical Engineer.

1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Owner and the Geotechnical Engineer.

3.16 ADDED EXCAVATIONS

A. Should the bearings at the levels indicated be found by the Geotechnical Engineer to be insufficient, the Owner may order the excavations carried to proper bearing or implementation of additional remedial work as recommended by the Geotechnical Engineer.

3.17 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated suitable 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.

3.18 FILLING AND BACKFILL

A. Provide grading required for subgrade, under floor slabs, paved walks, drives, parking areas and against walls. Construct fills as herein specified.

B. Clear and grub vegetation from areas to be filled. Scarify the ground to insure bond between the fill and the original surface. For fill to be placed on hillsides, plow deeply or, where existing ground is steeper than 3:1 or as directed by Geotechnical Report, bench the existing ground surface before beginning the filling operations.

C. Place fill material in uniform, horizontal layers as indicated in Geotechnical Report. Moisten each layer as necessary to insure a proper bond and maximum compaction. Use suitable equipment to mix the material and insure uniform moisture content. Fully and uniformly compact each layer with a sheep’s foot roller or vibratory roller of the proper size and weight to achieve specification.

D. Fill slopes in excess of 20’ of vertical height should include a minimum 5’ slope bench for every 15’-20’ of vertical on the slope, and the slope should not be steeper than 2:1 or a global stabilization analysis must be provided by a licensed structural engineer.

3.19 BACKFILL

A. Place and compact backfill in excavations promptly, but not before completing the following:

1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
2. Surveying locations of underground utilities for Record Documents.
3. Testing and inspecting underground utilities.
4. Removing concrete formwork.
5. Removing trash and debris.
6. Removing temporary shoring and bracing, and sheeting.
7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.20 BACKFILL AGAINST FOUNDATION WALLS, IN TRENCHES AND EXCAVATIONS, AND OTHER NECESSARY LOCATIONS

A. Do not place backfill against foundation walls until foundation walls are braced and have cured sufficiently to develop the strength necessary to withstand, without damage, the pressures that will result from backfilling and compacting operations. Secure approval of the Geotechnical Engineer before commencing backfilling.

B. Placing Backfill: Place backfill material in uniform, approximately horizontal layers, not exceeding recommendation from Geotechnical Engineer. Compact each layer with pneumatic tampers or sheepsfoot roller to optimum moisture to produce a minimum of 95% of the standard proctor maximum dry density (ASTM D-698), with the upper 12" compacted to 98%. Coordinate with the Geotechnical Engineer to perform tests of fill density in place for every lift. Submit reports of tests to the Owner.

C. Surplus Materials: Dispose of excess or unsuitable materials.

3.21 UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

C. Trenches under Footings: Backfill trenches excavated under footings and within 18 inches of bottom of footings as directed by Geotechnical Engineer; fill with concrete to elevation of bottom of footings. Concrete is specified in Division 03.

D. Shallow Trenches under Roadways: Unless indicated by Local Jurisdiction, provide 4-inch thick, concrete-base slab support for piping or conduit less than 30 inches below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of 4 inches of concrete before backfilling or placing roadway subbase course. Concrete is specified in Division 03.

E. Backfill voids with suitable soil while removing shoring and bracing.

F. Place and compact initial backfill of subbase material or suitable soil, free of particles larger than 2 inches in any dimension, to a height of 12 inches over the pipe or conduit.

1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

G. Controlled Low-Strength Material: Place initial backfill of controlled low-strength material to a height of 12 inches over the pipe or conduit. Place final backfill of controlled low-strength material to final subgrade elevation. Coordinate backfilling with utilities testing.

H. Place and compact final backfill of suitable soil to final subgrade elevation.

I. Install warning tape directly above utilities, 18 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.22 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 suitable soil material.
2. Under walks and pavements, use suitable soil.
3. Under steps and ramps, use suitable soil.
4. Under building slabs, use suitable soil.
5. Under footings and foundations, use suitable soil.

C. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.23 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 3 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 suitable soil material that exceeds optimum moisture content by 3 percent and is too wet to compact to specified dry unit weight.

3.24 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, or as directed by Geotechnical Engineer.

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 re-compact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 95 percent, with the upper 12 inches compacted to 98 percent.
2. Under walkways, scarify and re-compact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 95 percent, with the upper 12 inches compacted to 98%.
3. Under turf or unpaved areas, scarify and re-compact top 6 inches below subgrade and compact each layer of backfill or fill soil material to 90 percent.
4. For utility trenches, compact each layer of initial and final backfill soil material at 95 percent.

3.25 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 1/10th of a foot of design elevation.

C. Grading:

1. Place fill as specified for backfill except as noted herein. Accomplish compaction by traversing with a sheepsfoot roller or other approved heavy grading machinery. Compact fill to a minimum of 95% of the standard proctor maximum dry density (ASTM specifications D-698) to 12 inches below subgrade for structural fill areas for a minimum distance of ten feet outside of structure perimeter and for locations for future buildings. Compact parking area fill soils to 95% of the soil's standard density to 12 inches below subgrade. Compact general fill areas to 90% of the standard density.

2. Compact the upper 12 inches of fill in structural fill areas and paving areas to 98% standard proctor density.

3. Preparation of sub-grade for slabs: Remove roots and debris subject to termite attack, rot or corrosion and other material not suitable for fill. Fill holes and minor depressions and compact fillings as specified herein including re-compaction of sub-grade. Place subgrade soils within +/-3% of the soils optimum moisture content per ASTM 698, contain no deleterious material and no rock fragments over 2” (inches) in diameter.

3.26 SUBSURFACE DRAINAGE

A. Subdrainage Pipe: Specified in Division 33.

B. Subsurface Drain: Place subsurface drainage geotextile material around perimeter of subdrainage trench. Place a 6-inch course of filter material on subsurface drainage geotextile to support subdrainage pipe. Encase subdrainage pipe in a minimum of 6 inches of filter material, and wrap in subsurface drainage geotextile, overlapping sides and ends at least 9 inches.

1. Compact each filter material layer with a minimum of two passes of a plate-type vibratory compactor.

C. Drainage Backfill: Place and compact filter material over subsurface drain, in width indicated, to within 12 inches of final subgrade, in compacted layers 6 inches thick. Overlay drainage backfill with one layer of subsurface drainage geotextile, overlapping sides and ends at least 9 inches.

1. Compact each filter material layer with a minimum of two passes of a plate-type vibratory compactor.

2. Place and compact fill over drainage backfill in 6-inch thick compacted layers to final subgrade or as indicated by Geotechnical Engineer.

3.27 SUBBASE AND BASE COURSES UNDER PAVEMENTS AND WALKS

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. Where specified, install separation geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.

2. Place base course material over subbase course under hot-mix asphalt pavement.

3. Shape subbase course and base course to required crown elevations and cross-slope grades.

4. Place subbase course and base course 6 inches or less in compacted thickness in a single layer, or as indicated by Geotechnical Engineer.

5. Place subbase course and base 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, or as indicated by Geotechnical Engineer.

6. Compact subbase course and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 98 percent of maximum dry unit weight according to ASTM D 698, or as indicated by Geotechnical Engineer.

C. Pavement Shoulders: Place shoulders along edges of subbase course and base course to prevent lateral movement. Construct shoulders, at least 12 inches wide, of suitable soil materials and compact simultaneously with each subbase and base layer to not less than 98 percent of maximum dry unit weight according to ASTM D 1557.

3.28 DRAINAGE COURSE UNDER CONCRETE SLABS-ON-GRADE

A. Place drainage course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:

1. Where specified, install subdrainage geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.

2. Place drainage course 6 inches or less in compacted thickness in a single layer.

3. Place drainage course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.

4. Compact each layer of drainage course to required cross sections and thicknesses to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

3.29 MODULAR UNIT RETAINING WALLS

A. See Section 323223

B. Construct walls to clean, straight horizontal and vertical lines in accordance with manufacturer's instructions.

C. Place backfill to meet design specifications.

D. Submit sufficient documentation by the modular Wall Geotechnical Engineer to show that construction conditions are consistent with design parameters for soils.

E. Mix units to minimize color tone variations in the wall. The Owner may require reconstruction of wall sections where noticeable color variation occurs due to lack of or inappropriate mixing.

3.30 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified geotechnical engineering testing agency to perform tests and observations during Earthmoving operations.

B. 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.

C. 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. Structural Fill and Paving Area Fill: At subgrade and at each two feet of compacted fill and backfill, at least one test for every 5,000 sq. ft. or less of paved area or building slab, but in no case fewer than three tests.

2. Foundation Wall Backfill: At each two feet of compacted backfill layer, at least one test for every 50 feet or less of wall length, but no fewer than two tests.

3. Trench Backfill: At each two feet of compacted initial and final backfill layer, at least one test for every 150 feet or less of trench length, but no fewer than two tests.

4. General Area Fill: At each two feet of compacted fill layout for every 10,000 sq.ft. of area.

D. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; re-compact and retest until specified compaction is obtained, at no cost to the Owner. Contractor to pay for all failed tests.

3.31 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace soil material to depth as directed by Owner or Geotechnical Engineer; reshape and recompact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing under guidance of the Geotechnical Engineer.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.32 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus suitable soil and waste materials, including unsuitable soil, trash, and debris, and legally dispose of them off Owner's property, unless otherwise directed by the Owner. Acquire all necessary permits.

B. During the construction and clean-up, do not dump debris on any part of the property or in any unauthorized place. Remove debris, construction material, equipment, logs, stumps, boulders, or any other extraneous material deposited during construction from the site. Remove existing debris or other extraneous material from undisturbed areas. Material that is removed from the site is the property of the Contractor.

END OF SECTION

SECTION 31 2319
DEWATERING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

2.01 SUMMARY

A. Section includes construction dewatering.

B. Related Requirements:

1. Section 013233 "Photographic Documentation" for recording pre-existing conditions and dewatering system progress.
2. Section 312000 "Earth Moving" for excavating, backfilling, site grading and controlling surface water runoff and ponding.

3.01 PRE-INSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Verify availability of Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Review condition of site to be dewatered, including coordination with temporary erosion-control measures and temporary controls and protections.
3. Review geotechnical report.
4. Review proposed site clearing and excavations.
5. Review existing utilities and subsurface conditions.
6. Review observation and monitoring of dewatering system.

4.01 ACTION SUBMITTALS

A. Shop Drawings: For dewatering system, prepared by or under the supervision of a qualified professional engineer.

1. Include plans, elevations, sections, and details.
2. Show arrangement, locations, and details of wells and well points; locations of risers, headers, filters, pumps, power units, and discharge lines; and means of discharge, control of sediment, and disposal of water.
3. Include layouts of piezometers and flow-measuring devices for monitoring performance of dewatering system.
4. Include written plan for dewatering operations, including sequence of well and well-point placement, coordinated with excavation shoring and bracings, and control procedures to be adopted if dewatering problems arise.

5.01 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

6.01 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer that is specialized in design of dewatering systems and dewatering work.

7.01 FIELD CONDITIONS

A. Project Site Information: A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of a Geotechnical Engineer and represent interpretations of subsoil conditions, tests, and

results of analyses conducted by a Geotechnical Engineer. Owner is not responsible for interpretations or conclusions drawn from this data.

1. Make additional test borings and conduct other exploratory operations necessary for dewatering according to the performance requirements.

B. Survey Work: Engage a qualified Land Surveyor or Professional Engineer to survey adjacent existing buildings, structures, and site improvements. Establish exact elevations at fixed points to act as benchmarks and clearly identify benchmarks and record existing elevations.

PART 2 - PRODUCTS

1.01 PERFORMANCE REQUIREMENTS

A. Dewatering Performance: Design, furnish, install, test, operate, monitor and maintain dewatering system of sufficient scope, size and capacity to control hydrostatic pressures and to lower, control, remove and dispose of ground water and permit excavation and construction to proceed on dry, stable subgrades.

1. Design dewatering system, including comprehensive engineering analysis by a qualified Professional Engineer.
2. Continuously monitor and maintain dewatering operations to ensure erosion control, stability of excavations and constructed slopes, prevention of flooding in excavation and prevention of damage to subgrades and permanent structures.
3. Prevent surface water from entering excavations by grading, dikes, or other means.
4. Accomplish dewatering without damaging existing buildings, structures, and site improvements adjacent to excavation.
5. Remove dewatering system when no longer required for construction after approval by dewatering system design professional.

B. Regulatory Requirements: Comply with governing EPA and Authority having jurisdiction notification regulations before beginning dewatering. Comply with water and debris-disposal regulations of authorities having jurisdiction.

PART 3 - EXECUTION

1.01 PREPARATION

A. Protect structures, utilities, sidewalks, pavements and other facilities from damage caused by settlement, lateral movement, undermining, washout and other hazards created by dewatering operations.

1. Prevent surface water and subsurface or ground water from entering excavations, from ponding on prepared subgrades, and from flooding site or surrounding area.
2. Protect subgrades and foundation soils from softening and damage by rain or water accumulation.

B. Install dewatering system to ensure minimum interference with roads, streets, walks and other adjacent occupied and used facilities.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and Authorities having jurisdiction. Provide

alternate routes around closed or obstructed traffic ways, if required by Authorities having jurisdiction.

C. Provide temporary grading to facilitate dewatering and control of surface water.

D. Protect and maintain temporary erosion and sedimentation controls, which are specified in Section 312500 "Erosion and Sedimentation Controls," during dewatering operations.

2.01 INSTALLATION

A. Install dewatering system as directed by the dewatering system Engineer utilizing wells, well points, or similar methods complete with pump equipment, standby power and pumps, filter material gradation, valves, appurtenances, water disposal, and surface water controls.

1. Space well points or wells at intervals required to provide sufficient dewatering.
2. Use filters or other means to prevent pumping of fine sands or silts from the subsurface.

B. Place dewatering system into operation to lower water to specified levels before excavating below ground-water level.

C. Provide sumps, sedimentation tanks, and other flow-control devices as required by Authorities having jurisdiction.

D. Provide standby equipment on-site, installed and available for immediate operation, to maintain dewatering on continuous basis if any part of system becomes inadequate or fails.

3.01 OPERATION

A. Operate system continuously until drains, sewers and structures have been constructed and fill materials have been placed or until dewatering is no longer required.

B. Operate system to lower and control ground water to permit excavation, construction of structures and placement of fill materials on dry subgrades. Drain water-bearing strata above and below bottom of foundations, drains, sewers and other excavations.

1. Do not permit open-sump pumping that leads to loss of fines, soil piping, subgrade softening and slope instability.

C. Dispose of water removed by dewatering in a manner that avoids endangering public health, property, and portions of work under construction or completed. Dispose of water and sediment in a manner that avoids inconvenience to others.

D. Remove dewatering system from Project site on completion of dewatering. Plug or fill well holes with sand or cut off and cap wells a minimum of 36 inches below overlying construction, or as directed by the Dewatering System Engineer.

4.01 FIELD QUALITY CONTROL

A. Observation Wells: Provide observation wells or piezometers, take measurements, and maintain at least the minimum number indicated; additional observation wells may be required by Authorities having jurisdiction.

1. Observe and record daily elevation of ground water and piezometric water levels in observation wells.
2. Repair or replace, within 24 hours, observation wells that become inactive, damaged, or destroyed. In areas where observation wells are not functioning properly,

suspend construction activities until reliable observations can be made. Add or remove water from observation well risers to demonstrate that observation wells are functioning properly.

3. Fill observation wells, remove piezometers and fill holes when dewatering is completed.

B. SurveyWork Benchmarks: Re-survey benchmarks weekly during dewatering and maintain an accurate log of surveyed elevations for comparison with original elevations. Promptly notify Owner and Design Professional if changes in elevations occur or if cracks, sags, or other damage is evident in adjacent construction.

C. Provide continual observation to ensure that subsurface soils are not being removed by the dewatering operation.

D. Prepare reports of observations.

5.01 PROTECTION

A. Protect and maintain dewatering system during dewatering operations.

B. Promptly repair damages to adjacent facilities caused by dewatering.

END OF SECTION

SECTION 31 2500
EROSION AND SEDIMENTATION CONTROLS

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Provide labor, material, and equipment for temporary and permanent management practices as shown on the plans, as contained in the Erosion, Sedimentation, and Pollution Control Plan (ES&PC), and as directed by the Owner during the life of the Contract to control erosion, storm water runoff, and pollution through the use of berms, dikes, dams, sediment basins, fiber mats, netting, mulches, grasses, slope drains, temporary silt fences, and other best management practices (BMPs).

B. Coordinate temporary erosion control provisions with permanent erosion control features to assure economical, effective, and continuous erosion, sedimentation, and pollution control throughout the construction and stabilization period.

C. Management practices required are not limited to the measures shown on the plans. Provide additional practices necessitated by actual conditions and methods.

D. Silt and pollution leaving the site and any effects of the release are the sole and total responsibility of the Contractor as Primary, Secondary or Tertiary Permittee or Operator.

E. Provide Subcontractors with a copy of the ES & PC Plan. Post notices requiring Subcontractors to review and comply with the ES & PC Plan.

F. Owner or Contractor to engage a Testing Agency to perform the required NPDES monitoring for the project. Contractor to coordinate with Owner.

2.01 RELATED DOCUMENTS

A. Conform to the Georgia Water Quality Act, the Federal Clean Water Act, the rules and regulations promulgated to each of these Acts and the Georgia NPDES General Permit No. GAR 100001 and 100002.

B. Conform, at a minimum, to the "Manual for Erosion and Sediment Control in Georgia" (MESCG), latest edition, published by the Georgia Soil Conservation Service (GASWCC).

C. Maintain a copy of the MESCG on site throughout construction.

3.01 DEFINITIONS

A. Refer to the Georgia NPDES General Permit and the Manual for Sediment Control in Georgia for a complete list of definitions.

B. The partial list of definitions is provided for the Contractor’s convenience only. Obtain copies of the reference documents and learn appropriate terms required to fully implement the ES & PC Plan.

C. Terms Defined:

1. Best Management Practices (BMPs): schedules of activities, prohibitions of practices, maintenance procedures, and other management practices to prevent or reduce the pollution of waters of Georgia. BMPs include treatment requirements, operating procedures, and practices to control site runoff, spillage or leaks, sludge or waste disposal, or drainage from raw material storage.
2. Comprehensive Monitoring Plan (CMP): The plan for monitoring of turbidity in receiving waters or outfalls.

3. Final Stabilization: 100% of the soil surface is covered in permanent vegetation with a density of 70% or greater or landscaped according to the plan and all temporary BMPs removed).
4. Permanent vegetation: planted trees, shrubs, perennial vines; a crop of perennial vegetation appropriate for the time of year and region; or a crop of annual vegetation and a seeding of target crop perennials appropriate for the region, so that within the growing season a 70% coverage by perennial vegetation shall be achieved. Final stabilization applies to each phase of construction.
5. General Contractor: The Operator of the common development or site.
6. Nephelometric Turbidity Unit (NTU): a numerical unit of measure based upon photometric analytical techniques for measuring the light scattered by fine particles of a substance in suspension.
7. NOI: Notice of Intent.
8. NOT: Notice of Termination.
9. NPDES: National Pollution Discharge Elimination System.
10. Operator: the entity that has the primary day-to-day operational control of those activities at the facility necessary to ensure compliance with Erosion, Sedimentation and Pollution Control Plan, Comprehensive Monitoring Program requirements and permit conditions.
11. Primary Permittee: The Owner and/or the Operator of a tract of land for a common development, or of a stand-alone facility that is not part of a common development; or a utility company when it is the only entity conducting a construction activity on a piece of property.
12. Qualified Personnel: a person who has successfully completed an erosion and sediment control course, minimum level 1A or an equivalent course approved by EPD and the State Soil and Water Conservation Commission.
13. Sediment: solid material, both organic and inorganic, that is in suspension, is being transported, or has been moved from its site of origin by, wind, water, ice, or gravity as a product of erosion.
14. Waters of Georgia or Waters of the State: any and all rivers, streams, creeks, branches, lakes, reservoirs, ponds, drainage systems, springs, wells, and other bodies of surface or subsurface water, natural and artificial, lying within or forming a part of the boundaries of the State which are not entirely confined and retained completely upon the property of a single individual, partnership, or corporation, except as may be defined in O.C.G.A. 12-7-17(8) (O.C.G.A. 12-7-3(16).

4.01 QUALITY ASSURANCE CRITERIA

A. Project Review: Prior to the preconstruction conference, review in detail the approved for construction ES&PC Plan.

B. Preconstruction Conference: At the preconstruction conference submit for acceptance a detailed schedule for accomplishment of temporary and permanent erosion control work and installation of BMPs, for clearing and grubbing, grading, structures at

watercourses, construction, paving and other job activities. Submit for acceptance a proposed method of erosion control for haul roads and borrow pits and a plan for disposal of waste materials. Do not start work until the erosion control schedules and methods of operations have been accepted by the Owner.

C. Provide qualified personnel to supervise provision and maintenance of BMPs.

D. Contractor to schedule the 7 Day ESPC Site Visit with the Design Professional at least 72 hours in advance to perform a site inspection of the installed initial sediment storage requirements and perimeter control BMPs within 7 days after installation. The design professional shall determine if these BMPs have been installed and are being maintained as designed. The design professional shall report the results of the inspection to the primary permittee within seven (7) days and the permittee must correct all deficiencies within two (2) business days of receipt of the inspection report from the design professional unless weather related site conditions are such that additional time is required.

PART 2 - PRODUCTS

1.01 Silt Fence

A. Filter Fabrics:

1. Synthetic Fabric: Use filter fabric composed of strong rot-proof synthetic fibers formed into a fabric of either woven or non-woven type. Use fabric free of any treatment or coating which might significantly alter its physical properties. Use fabric containing stabilizers or inhibitors to make the filaments resistant to deterioration resulting from exposure to sunlight or heat. Use a pervious sheet of synthetic fibers oriented into a stable network so that the fibers retain their relative position with respect to each other. Finish the edges of the fabric to prevent the outer yarn from pulling away from the fabric. Use fabric free of defects or flaws which significantly affect its physical and/or filtering properties. Use fabric with a minimum width of 36 inches. Sew or bond sheets of fabric together. No deviation from any physical requirements will be permitted due to the presence of the seam.

B. Posts: Meet MESCG requirements, Type Sensitive application per table 6-27.2.

C. Woven Wire Fence: Wire fence fabric at least 32 inches high, with at least 6 horizontal wires. Vertical wires spaced 6 inches apart. Top and bottom wires at least 10 gage. Other wires at least 14 gage.

D. Fasteners: Meet MESCG requirements per table 6-27.3.

2.01 Downdrains and Storm Drain Pipes:

A. Downdrains: HDPE Pipe or Corrugated Plastic Pipe per Section 334200 “STORM DRAINAGE”.

B. Storm Drains: Per the Section 334200 “STORM DRAINAGE”.

3.01 Stone:

A. Rip Rap: Quarried solid stone showing no quarrying marks, minimum size per the plans.

B. Stabilization Stone: Cleaned, crushed stone, #57, meeting Georgia Dept. of Transportation specifications.

4.01 Concrete Lined Channel:

A. Portland Cement, minimum 3000 psi compressive strength at 28 days.

B. Coarse aggregate crushed stone meeting ASTM C33.

5.01 Mats and Blankets:

A. Meet MESCG requirements, Slope Stabilization, page 6-69 through 6-71.

6.01 Polymers:

A. Meet MESCG requirements, Tackifiers, page 6-73 and 6-74.

PART 3 - PART 3 - EXECUTION

1.01 GENERAL REQUIREMENTS

A. Install BMPs in accordance with the ES & PC Plan, the MESCG, and the NPDES General Permit.

B. Maintain management practices throughout construction and until the site is finally stabilized.

C. Implement or assist the Owner with implementation of the Comprehensive Monitoring Program.

D. Submit reports as required by the NPDES General Permit.

E. Retain records as required by the NPDES General Permit.

F. Submit or assist the Owner with submittals of the Notice of Intent and Notice of Termination.

2.01 LIMITS OF CONSTRUCTION

A. The Owner has the authority to limit the surface area of erodible earth material exposed by clearing and grubbing, excavation, borrow and fill operations. Provide immediate permanent or temporary erosion control measures to prevent contamination of adjacent watercourses, lakes, ponds, other water impoundments and other State Waters. Such work may involve the construction of temporary berms, dikes, dams, sediment basins, slope drains, and use of temporary mulches, mats, seeding, or other control devices or methods as necessary to control erosion. Seed and mulch cut and fill slopes as the excavation proceeds to the extent shown on the ES & PC Plan and as directed by the Owner.

B. Incorporate all permanent BMPs into the project at the earliest practicable time as outlined in the activity schedule. Use temporary BMPs to correct conditions that develop during construction; that are needed prior to installation of permanent pollution control features; or that are needed temporarily to control erosion that develops during normal construction practices, but are not associated with permanent control features on the project.

C. Schedule and perform clearing and grubbing operations so that grading operations and permanent BMPs can be installed before or immediately thereafter; install BMPs between successive construction stages as needed.

D. The Owner may limit the area of excavation, borrow and embankment operations in progress commensurate with the capability and progress of the Contractor in keeping the finish grading, mulching, seeding, and other such permanent BMPs current in accordance with the schedule.

E. Under no conditions is the amount of surface area or erodible earth material exposed at one time by excavation or fill within the project area to exceed 50 acres without written approval from GA EPD.
F. The Owner may increase or decrease the amount of surface area or erodible earth material to be exposed at one time by clearing and grubbing, excavation, borrow and fill operations as determined by analysis of project conditions.
G. In the event of conflict between these requirements and erosion, sedimentation and pollution control laws, rules, or regulations or other Federal or State or local agencies, the more restrictive laws, rules, or regulations apply.
H. Do not grade/disturb areas outside of limits of disturbance as approved by the state GASWCC or Local Issuing Authority.

3.01 CONSTRUCTION OF STRUCTURES

A. Temporary Berms:
   1. Construct a temporary berm of compacted soil, with a minimum width of 24 inches at the top and a minimum height of 12 inches with or without a shallow ditch, constructed at the top of fill slopes or transverse to centerline on fills. Grade temporary berms so as to drain to a compacted outlet at a slope drain. The area adjacent to the temporary berm in the vicinity of the slope drain must be properly graded to enable the inlet to function efficiently and with minimum ponding.
   2. Extend transverse berms required on the downstream side of a slope drain across the grade to the highest point at approximately a 10-degree angle perpendicular to centerline. When practical and until final elevations are approached, construct embankments with a gradual slope to one side of the embankment to permit the placement of temporary berms and slope drains on only one side of the embankment.
B. Temporary Slope Drains
   1. Use temporary slope drains consisting of stone gutters, fiber mats, plastic sheets, concrete or asphalt gutters, half-round pipe, metal pipe, plastic pipe, flexible rubber, or other materials which can be used as temporary measures to carry water accumulating in the cuts and on the fills down the slopes prior to provision of permanent facilities or growth of adequate ground cover on the slopes.
   2. Do not use fiber matting and plastic sheeting on slopes steeper than 4:1 except for distances of 20 feet or less.
   3. Adequately anchor temporary slope drains to the slope to prevent disruption by the force of the water flowing in the drains. Compact and concavely form the base for temporary slope drains to channel the water and hold the slope drain in place. Properly construct the inlet end to channel water into the temporary slope drain. Construct energy dissipators, sediment basins, or other devices at the outlet end of the slope drains to reduce erosion downstream. Remove temporary slope drains when no longer necessary and restore the site to match the surroundings.
C. Sediment Control Structures

1. Utilize sediment control structures to control sediment at the foot of embankments where slope drains outlet; at the bottom as well as in the ditchlines atop waste sites; in the ditchlines or borrow pits. Use sediment control structures in most drainage situations to prevent excessive siltation of pipe structures. Use sediment structures at least twice as long as they are wide.
2. When the use of temporary sediment control structures is discontinued, remove sediment accumulation and excavation backfill and properly compact. Restore the existing ground to its natural or intended condition.

D. Check Dams:
1. Utilize check dams to retard stream flow and catch small sediment loads.
2. Key check dams into the sides and bottom of the channel a minimum depth of 2 feet.

E. Temporary Seeding and Mulching
1. Perform seeding and mulching in accordance with the approved drawings.

F. Brush Barriers
1. Use brush barriers consisting of brush, tree trimmings, shrubs, plants, and other approved refuse from the clearing and grubbing operation. Construct the brush barriers approximately parallel to original ground contour. Compress the brush to an approximate height of 3 to 5 feet and approximate width of 5 to 10 feet. Do not support the embankment by the construction of brush barriers.

G. Temporary Silt Fences
1. Place temporary silt fences on the natural ground, at the bottom of fill slopes, or other areas as shown or needed.
2. Maintain the silt fence in a satisfactory condition for the duration of the project. Distribute the silt accumulation at the fence to conform to the grading plan. Remove silt fence from the site after final stabilization.
3. Remove silt fence and mulch filter berms from the site after final stabilization.

H. Floating Surface Skimmers
1. Remove floating surface skimmer only after approval from the Local Erosion Inspector or Entity after final stabilization.
2. Pond drain valve to be closed after removal of floating surface skimmer.

I. Temporary Construction Exit
1. Temporary Construction Exit to be removed prior to final demobilization.

4.01 MAINTENANCE

A. Maintain temporary BMPs until no longer needed or permanent BMPs are provided and the site is stabilized. Remove temporary materials.

B. In the event that temporary BMPs are required due to negligence, carelessness, or failure to provide permanent BMPs as a part of work as scheduled, provide at no cost to the Owner.

C. When silt deposited in sediment basins occupies more than 30% of the basin capacity, remove the silt. Remove the silt from the site unless otherwise permitted by the Owner. Restore the basin to the conditions and grades as shown on the Drawings as required during construction and at the completion of all construction activities.

D. Provide dust control as required meeting requirements of the Manual for Sediment Control in Georgia to control the surface and air movements of dust on the construction site.

5.01 EROSION CONTROL OUTSIDE PROJECT AREA

A. Use temporary management practices for construction work outside the project area.

END OF SECTION

SECTION 313116
TERMITE CONTROL

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

2.01 SUMMARY

A. Section Includes:
   1. Soil treatment.

3.01 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include the EPA-Registered Label for termiticide products.

4.01 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Product Certificates: For each type of termite control product.

C. Soil Treatment Application Report: After application of termiticide is completed, submit report for Owner's records and include the following:
   1. Date and time of application.
   2. Moisture content of soil before application.
   3. Termiticide brand name and manufacturer.
   4. Quantity of undiluted termiticide used.
   5. Dilutions, methods, volumes used, and rates of application.
   6. Areas of application.
   7. Water source for application.

D. Sample Warranties: For special warranties.

5.01 QUALITY ASSURANCE

A. Installer Qualifications: A specialist who is licensed according to regulations of authorities having jurisdiction to apply termite control treatment and products in jurisdiction where Project is located.

6.01 FIELD CONDITIONS

A. Soil Treatment:
   1. Environmental Limitations: To ensure penetration, do not treat soil that is water saturated or frozen. Do not treat soil while precipitation is occurring. Comply with requirements of the EPA-Registered Label and requirements of authorities having jurisdiction.
   2. Related Work: Coordinate soil treatment application with excavating, filling, grading, and concreting operations. Treat soil under footings, grade beams, and ground-supported slabs before construction.

7.01 WARRANTY

A. Soil Treatment Special Warranty: Manufacturer's standard form, signed by Applicator and Contractor, certifying that termite control work consisting of applied soil termiticide treatment will prevent infestation of subterranean termites. If subterranean termite activity or damage is discovered during warranty period, re-treat soil and repair or replace damage caused by termite infestation.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

1.01 MANUFACTURERS

A. Source Limitations: Obtain termite control products from single source and single manufacturer.

2.01 SOIL TREATMENT

A. Termiticide: EPA-Registered termiticide acceptable to authorities having jurisdiction, in an aqueous solution formulated to prevent termite infestation.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. BASF Corporation.
   b. Bayer Environmental Science.
   c. Ensystex, Inc.
   d. Syngenta.
2. Service Life of Treatment: Soil treatment termiticide that is effective for not less than five years against infestation of subterranean termites.

PART 3 - EXECUTION

1.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for moisture content of soil per termiticide label, interfaces with earthwork, slab and foundation work, landscaping, utility installation, and other conditions affecting performance of termite control.

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

2.01 PREPARATION

A. General: Prepare work areas according to the requirements of authorities having jurisdiction and according to manufacturer's written instructions before beginning application and installation of termite control treatment(s). Remove extraneous sources of wood cellulose and other edible materials, such as wood debris, tree stumps and roots, stakes, formwork, and construction waste wood from soil within and around foundations.

B. Soil Treatment Preparation: Remove foreign matter and impermeable soil materials that could decrease treatment effectiveness on areas to be treated. Loosen, rake, and level soil to be treated, except previously compacted areas under slabs and footings. Termiticides may be applied before placing compacted fill under slabs if recommended in writing by termiticide manufacturer.
   1. Fit filling hose connected to water source at the site with a backflow preventer, according to requirements of authorities having jurisdiction.

3.01 APPLYING SOIL TREATMENT

A. Application: Mix soil treatment termiticide solution to a uniform consistency. Distribute treatment uniformly. Apply treatment at the product's EPA-Registered Label volume and rate for maximum specified concentration of termiticide to the following so that a continuous horizontal and vertical termiticidal barrier or treated zone is established around and under building construction.
   1. Slabs-on-Grade and Basement Slabs: Underground-supported slab construction, including footings, building slabs, and attached slabs as an overall treatment. Treat soil materials before concrete footings and slabs are placed.
   2. Foundations: Soil adjacent to and along the entire inside perimeter of foundation walls; along both sides of interior partition walls; around plumbing pipes and electric conduit penetrating the slab; around interior column footers, piers, and chimney bases; and along the entire outside perimeter, from grade to bottom of footing.
   3. Crawlspaces: Soil under and adjacent to foundations. Treat adjacent areas, including around entrance platform, porches, and equipment bases. Apply overall treatment only where attached concrete platform and porches are on fill or ground.
   4. Masonry: Treat voids.
   5. Penetrations: At expansion joints, control joints, and areas where slabs and below-grade walls will be penetrated.
B. Post warning signs in areas of application.
C. Reapply soil treatment solution to areas disturbed by subsequent excavation, grading, landscaping, or other construction activities following application.

4.01 PROTECTION

A. Avoid disturbance of treated soil after application. Keep off treated areas until completely dry.
B. Protect termiticide solution dispersed in treated soils and fills from being diluted by exposure to water spillage or weather until ground-supported slabs are installed. Use waterproof barrier according to EPA-Registered Label instructions.

END OF SECTION

SECTION 31 5000
EXCAVATION SUPPORT AND PROTECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

2.01 SUMMARY

A. Section includes temporary excavation support and protection systems.

B. Related Requirements:

1. Section 312000 "Earth Moving" for excavating and backfilling, for controlling surface-water runoff and ponding, and for dewatering excavations.

3.01 PERFORMANCE REQUIREMENTS

A. Design, furnish, install, monitor and maintain excavation support and protection system capable of supporting excavation sidewalls and of resisting soil and hydrostatic pressure and superimposed and construction loads.

1. Delegated Design: Design excavation support and protection system, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
2. Prevent surface water from entering excavations by grading, dikes, or other means.
3. Install excavation support and protection systems without damaging existing buildings, structures, and site improvements adjacent to excavation.
4. Monitor vibrations, settlements, and movements.

4.01 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review geotechnical report.
2. Review existing utilities and subsurface conditions.
3. Review coordination for interruption, shutoff, capping, and continuation of utility services.
4. Review proposed excavations.
5. Review proposed equipment.
6. Review monitoring of excavation support and protection system.
7. Review coordination with waterproofing.
8. Review abandonment or removal of excavation support and protection system.

5.01 ACTION SUBMITTALS

A. Shop Drawings: For excavation support and protection system, prepared by or under the supervision of a qualified professional engineer.

B. Delegated-Design Submittal: For excavation support and protection systems, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

6.01 INFORMATIONAL SUBMITTALS

A. Contractor Calculations: For excavation support and protection system. Include analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

B. Existing Conditions: Using photographs, show existing conditions of adjacent construction and site improvements that might be misconstrued as damage caused by inadequate performance of excavation support and protection systems. Submit before Work begins.

7.01 CLOSEOUT SUBMITTALS

A. Record Drawings: Identify locations and depths of capped utilities, abandoned-in-place support and protection systems, and other subsurface structural, electrical, or mechanical conditions.

8.01 FIELD CONDITIONS

A. Interruption of Existing Utilities: Do not interrupt any utility-serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility connections according to requirements indicated:

1. Notify Owner no fewer than two days in advance of proposed interruption of utility.
2. Do not proceed with interruption of utility without Owner's written permission.

B. Survey Work: Engage a qualified land surveyor to survey adjacent existing buildings, structures, and site improvements; establish exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks, and record existing elevations.

C. Project-Site Information: A geotechnical report may have been prepared for this Project and is, if prepared, available for information only. The opinions expressed in this report are those of geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by geotechnical engineer. Owner is not responsible for interpretations or conclusions drawn from the data.

PART 2 - PRODUCTS

1.01 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer to design excavation support and protection systems to resist all lateral loading and surcharge, including but not limited to, retained soil, groundwater pressure, adjacent building loads, adjacent traffic loads, construction traffic loads, material stockpile loads, and seismic loads, based on the following:

1. Compliance with OSHA Standards and interpretations, 29 CFR 1926, Subpart P.
2. Compliance with AASHTO Standard Specification for Highway Bridges or AASHTO LRFD Bridge Design Specification, Customary U.S. Units.
3. Compliance with requirements of authorities having jurisdiction.
4. Compliance with utility company requirements.
5. Compliance with railroad requirements.

2.01 MATERIALS

A. Provide materials that are either new or in serviceable condition.

B. Structural Steel: ASTM A 36/A 36M, ASTM A 690/A 690M, or ASTM A 992/A 992M.

C. Steel Sheet Piling: ASTM A 328/A 328M, ASTM A 572/A 572M, or ASTM A 690/A 690M; with continuous interlocks.

D. Wood Lagging: Lumber, mixed hardwood, nominal rough thickness of size and strength required for application.
E. Shotcrete: Comply with Section 033713 "Shotcrete" for shotcrete materials and mixes, reinforcement, and shotcrete application.
F. Cast-in-Place Concrete: ACI 301, of compressive strength required for application.
G. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.
H. Tiebacks: Steel bars, ASTM A 722/A 722M.
I. Tiebacks: Steel strand, ASTM A 416/A 416M.

PART 3 - EXECUTION

1.01 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards that could develop during excavation support and protection system operations.
   1. Shore, support, and protect utilities encountered.

2.01 INSTALLATION - GENERAL

A. Locate excavation support and protection systems clear of permanent construction, so that construction and finishing of other work is not impeded.
B. Install excavation support and protection systems to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.
   1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
   2. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
C. Install excavation support and protection systems without damaging existing buildings, structures, and site improvements adjacent to excavation.

3.01 MAINTENANCE

A. Monitor and maintain excavation support and protection system.
B. Prevent surface water from entering excavations by grading, dikes, or other means.
C. Continuously monitor vibrations, settlements, and movements to ensure stability of excavations and constructed slopes and to ensure that damage to permanent structures is prevented.

4.01 FIELD QUALITY CONTROL

A. Survey-Work Benchmarks: Resurvey benchmarks regularly during installation of excavation support and protection systems, excavation progress, and for as long as excavation remains open.
   1. Maintain an accurate log of surveyed elevations and positions for comparison with original elevations and positions.
   2. Promptly notify Architect if changes in elevations or positions occur or if cracks, sags, or other damage is evident in adjacent construction.
B. Promptly correct detected bulges, breakage, or other evidence of movement to ensure that excavation support and protection system remains stable.

C. Promptly repair damages to adjacent facilities caused by installation or faulty performance of excavation support and protection systems.

5.01 REMOVAL AND REPAIRS

A. Remove excavation support and protection systems when construction has progressed sufficiently to support excavation and earth and hydrostatic pressures.
   1. Remove in stages to avoid disturbing underlying soils and rock or damaging structures, pavements, facilities, and utilities.
   2. Remove excavation support and protection systems to a minimum depth of **48** inches below overlying construction, and abandon remainder.
   3. Fill voids immediately with approved backfill compacted to density specified in Section 312000 "Earth Moving."
   4. Repair or replace, as approved by Owner, adjacent work damaged or displaced by removing excavation support and protection systems.

B. Leave excavation support and protection systems permanently in place.

END OF SECTION

SECTION 32 1216
ASPHALT PAVING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

2.01 SUMMARY

A. Section Includes:
   1. Hot-mix asphalt paving.
   2. Hot-mix asphalt overlay.
   3. Cold milling of existing asphalt pavement.
   4. Hot-mix asphalt patching.
   5. Asphalt traffic-calming devices.

B. Related Requirements:
   1. Section 024116 "Site Demolition" for demolition and removal of existing asphalt pavement.
   2. Section 312000 "Earth Moving" for subgrade preparation, fill material, separation geotextiles, unbound-aggregate subbase and base courses, and aggregate pavement shoulders.
   3. Section 321313 "Concrete Paving" for concrete pavement and for separate concrete curbs, gutters, and driveway aprons.
   4. Section 321373 "Concrete Paving Joint Sealants" for joint sealants and fillers at pavement terminations.
   5. Section 321400 "Unit Paving" for bituminous setting bed for pavers and for stone and precast concrete curbs.
   6. Section 321723 “Painted Pavement Markings”

3.01 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
   1. Review methods and procedures related to hot-mix asphalt paving including, but not limited to, the following:
      a. Review proposed sources of paving materials, including capabilities and location of plant that will manufacture hot-mix asphalt.
      b. Review requirements for protecting paving work, including restriction of traffic during installation period and for remainder of construction period.
      c. Review requirements for protecting paving work, including restriction of traffic during installation period and for remainder of construction period.

d. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

4.01 ACTION SUBMITTALS

A. Product Data: Include technical data and tested physical and performance properties.
   1. Herbicide.
   2. Paving geotextile.
   3. Joint sealant.

B. Hot-Mix Asphalt Designs:
   1. Certification, by authorities having jurisdiction, of approval of each hot-mix asphalt design proposed for the Work.
   2. For each hot-mix asphalt design specific to the paving sections proposed for the Work.

C. Samples for Verification: For the following product, in manufacturer's standard sizes unless otherwise indicated:
   1. Paving Geotextile: 12 by 12 inches minimum, if requested.

5.01 INFORMATIONAL SUBMITTALS

A. Qualification Data: For paving-mix manufacturer.

B. Material Certificates:
   1. Aggregates.
   2. Asphalt binder.
   3. Asphalt cement.
   4. Cutback prime coat.
   5. Emulsified asphalt prime coat.
   6. Tack coat.

C. Field quality-control reports, if requested by Owner.

6.01 QUALITY ASSURANCE

A. Manufacturer Qualifications: A paving-mix manufacturer registered with and approved by authorities having jurisdiction or the DOT of state in which Project is located.

B. Testing Agency Qualifications: Qualified in accordance with ASTM D3666 and the State Department of Transportation (DOT) for testing indicated.

C. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of the State Department of Transportation and local Authorities Having Jurisdiction of for asphalt paving work.
   1. Where the requirements of the State Department of Transportation reference specifications conflict with the requirements of this Section, the State Department of Transportation reference specifications shall govern.

2. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.

D. Visual Inspection: Conduct a visual inspection. The opinion of the Owner is final. Raveling, loose aggregate, insufficient liquid asphalt coverage, unsightly and rough seams, poor craftsmanship, and indications of poor quality control on the part of the Contractor are causes for rejection of the work and remedial action.

7.01 FIELD CONDITIONS

A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp, if rain is imminent or expected before time required for adequate cure, or if the following conditions are not met:
   1. Prime Coat: Minimum surface temperature of 60 deg F.
   2. Tack Coat: Minimum surface temperature of 60 deg F.
   3. Slurry Coat: Comply with weather limitations in ASTM D3910.
   4. Asphalt Base Course: Minimum surface temperature of 40 deg F and rising at time of placement.

B. Asphalt Surface Course: Minimum surface temperature of 60 deg F at time of placement.

PART 2 - PRODUCTS

1.01 AGGREGATES

A. General: Use materials and gradations per State DOT requirements.

B. Coarse Aggregate: ASTM D692/D692M, sound; angular crushed stone, crushed gravel.

C. Fine Aggregate: ASTM D1073 or AASHTO M 29, sharp-edged natural sand or sand prepared from stone, gravel or combinations thereof.
   1. For hot-mix asphalt, limit natural sand to a maximum of 20 percent by weight of the total aggregate mass.

D. Mineral Filler: ASTM D242/D242M or AASHTO M 17, rock, hydraulic cement, or other inert material.

2.01 ASPHALT MATERIALS

A. Asphalt Binder: AASHTO M 320 binder designation PG 64-22.

B. Asphalt Cement: ASTM D3381/D3381M for viscosity-graded material or ASTM D946/D946M for penetration-graded material.

C. Cutback Prime Coat: ASTM D2027/D2027M, medium-curing cutback asphalt, RC-30, RC-70, RC-250, MC-30 or MC-70 or MC-250.

D. Tack Coat: ASTM D977 or AASHTO M 140 emulsified asphalt, or ASTM D2397/D2397M or AASHTO M 208 cationic emulsified asphalt, slow setting, diluted in water, of suitable grade and consistency for application. PG 58-22, PG 64-20 or PG67-22 or as specified by local jurisdiction.

E. Water: Potable.

3.01 AUXILIARY MATERIALS

A. Herbicide: Commercial chemical for weed control, registered by the EPA, and not classified as "restricted use" for locations and conditions of application. Provide in granular, liquid, or wettable powder form.

B. Sand: ASTM D1073 or AASHTO M 29, Grade No. 2 or No. 3.

C. Paving Geotextile: AASHTO M 288 paving fabric; nonwoven polypropylene; resistant to chemical attack, rot, and mildew; and specifically designed for paving applications.

D. Joint Sealant: ASTM D6690 or AASHTO M324, hot-applied, single-component, polymer-modified bituminous sealant.

4.01 MIXES

A. Hot-Mix Asphalt: Dense-graded, hot-laid, hot-mix asphalt plant mixes approved by State DOT and authorities having jurisdiction; designed in accordance with procedures in AI MS-2, "Asphalt Mix Design Methods"; and complying with the following requirements:

1. Provide mixes complying with State DOT and Authorities having jurisdiction requirements.
2. Base Course: 1 inch Maximum aggregate size.
3. Surface Course: 3/4 inch maximum aggregate size.

B. Emulsified-Asphalt Slurry: ASTM D3910.

PART 3 - EXECUTION

1.01 EXAMINATION

A. Verify that subgrade is dry and in suitable condition to begin paving.

B. Proceed with paving only after unsatisfactory conditions have been corrected and approval is granted by on-site testing agency.

C. Verify that utilities, traffic loop detectors, and other items requiring a cut and installation beneath the asphalt surface have been completed and that asphalt surface has been repaired flush with adjacent asphalt prior to beginning installation of imprinted asphalt.

2.01 PREPARATION

A. Protection: Provide protective materials, procedures, and worker training to prevent asphalt materials from spilling, coating, or building up on curbs, driveway aprons, manholes, and other surfaces adjacent to the Work.

B. Proof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.
2. Proof-roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons.
3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.

3.01 COLD MILLING

A. Clean existing pavement surface of loose and deleterious material immediately before cold milling. Remove existing asphalt pavement by cold milling to grades and cross sections indicated.
   1. Mill to a minimum depth of **1-1/2 inches or** as indicated on plans.
   2. Mill to a uniform finished surface free of excessive gouges, grooves, and ridges.
   3. Control rate of milling to prevent tearing of existing asphalt course.
   4. Repair or replace curbs, driveway aprons, manholes, and other construction damaged during cold milling.
   5. Excavate and trim unbound-aggregate base course, if encountered, and keep material separate from milled hot-mix asphalt.
   6. Patch surface depressions deeper than 1 inch after milling, before wearing course is laid.
   7. Handle milled asphalt material in accordance with State DOT and Local requirements.
   8. Keep milled pavement surface free of loose material and dust.
   9. Do not allow milled materials to accumulate on-site.

4.01 PATCHING

A. Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches into perimeter of adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new subgrade.

B. Portland Cement Concrete Pavement: Break cracked slabs and roll as required to reseat concrete pieces firmly.
   1. Remove disintegrated or badly cracked pavement. Excavate rectangular or trapezoidal patches, extending into perimeter of adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Recompact existing unbound-aggregate base course to form new subgrade.

C. Tack Coat: Before placing patch material, apply tack coat uniformly to vertical asphalt surfaces abutting the patch. Apply at a rate of 0.05 to 0.15 gal./sq. yd.
   1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
   2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

D. Placing Single-Course Patch Material: Fill excavated pavement areas with hot-mix asphalt base mix for full thickness of patch and, while still hot, compact flush with adjacent surface.

E. Placing Two-Course Patch Material: Partially fill excavated pavements with hot-mix asphalt base course mix and, while still hot, compact. Cover asphalt base course with compacted layer of hot-mix asphalt surface course, finished flush with adjacent surfaces.

5.01 REPAIRS

A. Leveling Course: Install and compact leveling course consisting of hot-mix asphalt surface course to level sags and fill depressions deeper than 1 inch in existing pavements.
   1. Install leveling wedges in compacted lifts not exceeding 3 inches thick.

B. Crack and Joint Filling: Remove existing joint filler material from cracks or joints to a depth of 1/4 inch.
   1. Clean cracks and joints in existing hot-mix asphalt pavement.
   2. Use emulsified-asphalt slurry to seal cracks and joints less than 1/4 inch wide. Fill flush with surface of existing pavement and remove excess.
   3. Use hot-applied joint sealant to seal cracks and joints more than 1/4 inch wide. Fill flush with surface of existing pavement and remove excess.

6.01 SURFACE PREPARATION

A. Ensure that prepared subgrade has been proof-rolled and is ready to receive paving. Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces.

B. Herbicide Treatment: Apply herbicide in accordance with manufacturer's recommended rates and written application instructions. Apply to dry, prepared subgrade or surface of compacted-aggregate base before applying paving materials.
   1. Mix herbicide with prime coat if formulated by manufacturer for that purpose.

C. Cutback Prime Coat: Apply uniformly over surface of compacted unbound-aggregate base course at a rate of 0.15 to 0.50 gal./sq. yd. Apply enough material to penetrate and seal, but not flood, surface. Allow prime coat to cure.
   1. If prime coat is not entirely absorbed within 24 hours after application, spread sand over surface to blot excess asphalt. Use enough sand to prevent pickup

under traffic. Remove loose sand by sweeping before pavement is placed and after volatiles have evaporated.

2. Protect primed substrate from damage until ready to receive paving.

D. Emulsified Asphalt Prime Coat: Apply uniformly over surface of compacted unbound-aggregate base course at a rate of 0.10 to 0.30 gal./sq. yd. per inch depth. Apply enough material to penetrate and seal, but not flood, surface. Allow prime coat to cure.

1. If prime coat is not entirely absorbed within 24 hours after application, spread sand over surface to blot excess asphalt. Use enough sand to prevent pickup under traffic. Remove loose sand by sweeping before pavement is placed and after volatiles have evaporated.
2. Protect primed substrate from damage until ready to receive paving.

E. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq. yd.

1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

7.01 INSTALLATION OF PAVING GEOTEXTILE

A. Apply tack coat uniformly to existing pavement surfaces at a rate of 0.20 to 0.30 gal./sq. yd.

B. Place paving geotextile promptly in accordance with manufacturer's written instructions. Broom or roll geotextile smooth and free of wrinkles and folds. Overlap longitudinal joints 4 inches and transverse joints 6 inches.

C. Protect paving geotextile from traffic and other damage, and place hot-mix asphalt overlay the same day.

8.01 HOT-MIX ASPHALT PLACEMENT

A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand in areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.

1. Place hot-mix asphalt base course in number of lifts and thicknesses indicated.
2. Place hot-mix asphalt surface course in single lift.
3. Spread mix at a minimum temperature of 250 deg F.
4. Begin applying mix along centerline of crown for crowned sections and on high side of one-way slopes unless otherwise indicated.
5. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.

B. Place paving in consecutive strips not less than 10 feet wide unless infill edge strips of a lesser width are required.
   1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Overlap mix placement about 1 to 1-1/2 inches from strip to strip to ensure proper compaction of mix along longitudinal joints.
   2. Complete a section of asphalt base course before placing asphalt surface course.

C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

9.01 JOINTS

A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions, with same texture and smoothness as other sections of hot-mix asphalt course.
   1. Clean contact surfaces and apply tack coat to joints.
   2. Offset longitudinal joints, in successive courses, a minimum of 6 inches.
   3. Offset transverse joints, in successive courses, a minimum of 24 inches.
   4. Construct transverse joints at each point where paver ends a day's work and resumes work at a subsequent time. Construct these joints using either "bulkhead" or "papered" method in accordance with AI MS-22, for both "Ending a Lane" and "Resumption of Paving Operations."
   5. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.
   6. Compact asphalt at joints to a density within 2 percent of specified course density.

10.01 COMPACTION

A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot hand tampers or with vibratory-plate compactors in areas inaccessible to rollers.
   1. Complete compaction before mix temperature cools to 185 deg F.

B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.

C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:

1. Average Density, Marshall Test Method: 96 percent of reference laboratory density in accordance with ASTM D6927 or AASHTO T 245, but not less than 94 percent or greater than 100 percent.
2. Average Density, Rice Test Method: 92 percent of reference maximum theoretical density in accordance with ASTM D2041/D2041M, but not less than 90 percent or greater than 96 percent.

D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.

E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.

F. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.

G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

H. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

11.01 ASPHALT TRAFFIC-CALMING DEVICES

A. Construct hot-mix asphalt speed bumps humps cushions and tables over compacted pavement surfaces. Apply a tack coat unless pavement surface is still tacky and free from dust. Spread hot-mix asphalt at a minimum temperature of 250 deg F.

1. Tack Coat Application: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq. yd.
2. Hot-Mix Asphalt: Same as pavement surface-course mix.
3. Before installation, mill pavement that will be in contact with bottom of traffic-calming device. Mill to a depth of 1 inch from top of pavement to a clean, rough profile.

B. Place and compact hot-mix asphalt to cross section indicated, by machine or by hand in wood or metal forms. Tamp hand-placed materials and screed to smooth finish. Remove forms after hot-mix asphalt has cooled.

12.01 INSTALLATION TOLERANCES

A. Pavement Thickness: Compact each course to produce thickness indicated within the following tolerances:

1. Base Course: Plus or minus 1/2 inch.
2. Surface Course: Plus 1/4 inch, no minus.

B. Pavement Surface Smoothness: Compact each course to produce surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:
   1. Base Course: 1/4 inch.
   2. Surface Course: 1/8 inch.
   3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch.

C. Asphalt Traffic-Calming Devices: Compact and form asphalt to the shapes indicated and within a tolerance of plus or minus 1/8 inch of height indicated above pavement surface.

13.01 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections. Contractor to ensure coordination with Testing Agency prior to installation.

B. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined in accordance with ASTM D3549/D3549M.

C. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.

D. Asphalt Traffic-Calming Devices: Finished height of traffic-calming devices above pavement will be measured for compliance with tolerances.

E. In-Place Density: Testing agency will take samples of uncompacted paving mixtures and compacted pavement in accordance with ASTM D979/D979M or AASHTO T 168.
   1. Reference maximum theoretical density will be determined by averaging results from four samples of hot-mix asphalt-paving mixture delivered daily to site, prepared in accordance with ASTM D2041/D2041M, and compacted in accordance with job-mix specifications.
   2. In-place density of compacted pavement will be determined by testing core samples in accordance with ASTM D1188 or ASTM D2726/D2726M.
      a. One core sample will be taken for every 1000 sq. yd. or less of installed pavement, with no fewer than three cores taken.
      b. Field density of in-place compacted pavement may also be determined by nuclear method in accordance with ASTM D2950/D2950M and coordinated with ASTM D1188 or ASTM D2726/D2726M.

F. Replace and compact hot-mix asphalt where core tests were taken.

G. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

14.01 WASTE HANDLING

A. General: Handle asphalt-paving waste in accordance with approved waste management plan required in Section 017419 "Construction Waste Management and Disposal."

B. Except for material indicated to be recycled, remove excavated materials from Project site and legally dispose of them in an EPA-approved landfill.

1. Do not allow milled materials to accumulate on-site.

END OF SECTION

SECTION 32 1313
CONCRETE PAVING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

2.01 SUMMARY

A. Section Includes Concrete Paving
   1. Driveways.
   2. Roadways.
   3. Parking lots.
   4. Curbs and gutters.
   5. Walks.

B. Related Requirements:
   1. ACI Publications.
   2. Section 033053 "Miscellaneous Cast-in-Place Concrete" for general building applications of concrete.
   3. Section 321316 "Decorative Concrete Paving" for stamped concrete other than stamped detectable warnings.
   4. Section 321373 "Concrete Paving Joint Sealants" for joint sealants in expansion and contraction joints within concrete paving and in joints between concrete paving and asphalt paving or adjacent construction.
   5. Section 321713 "Parking Bumpers."
   6. Section 321723 "Pavement Markings."
   7. Section 321726 "Tactile Warning Surfacing" for detectable warning tiles mats and pavers.
   8. Section 321729 "Manufactured Traffic-Calming Devices."

3.01 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash, slag cement, and other pozzolans.

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

4.01 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
   1. Review methods and procedures related to concrete paving, including but not limited to, the following:
      a. Concrete mixture design.

b. Quality control of concrete materials and concrete paving construction practices.

2. Require representatives of each entity directly concerned with concrete paving to attend, including the following:
   a. Contractor's superintendent.
   b. Independent testing agency responsible for concrete design mixtures.
   c. Ready-mix concrete manufacturer.
   d. Concrete paving Subcontractor.
   e. Manufacturer's representative of stamped concrete paving system used for stamped detectable warnings.

5.01 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:
   1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost, if required for LEED Credit.
   2. Environmental Product Declaration (EPD): For each product, if required for LEED Credit.
   3. Laboratory Test Reports: For concrete paving mixtures, documentation indicating that cured concrete complies with Solar Reflectance Index requirements, if required for LEED Credit.

C. Samples for Initial Selection: For each type of product, ingredient, or admixture requiring color selection.

D. Samples for Verification: For each type of product or exposed finish, prepared as Samples of size indicated below:
   1. Exposed Aggregate: 10-lb Sample of each mix.

E. 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.

6.01 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified ready-mix concrete manufacturer.

B. Material Certificates: For the following, from manufacturer:
   1. Cementitious materials.
   2. Steel reinforcement and reinforcement accessories.
   3. Fiber reinforcement.
   4. Admixtures.
   5. Curing compounds.
   6. Applied finish materials.

7. Bonding agent or epoxy adhesive.
8. Joint fillers.

C. Material Test Reports: For each of the following:
1. Aggregates.

D. Field quality-control reports.

7.01 QUALITY ASSURANCE

A. Stamped Detectable Warning Installer Qualifications: An employer of workers trained and approved by manufacturer of stamped concrete paving systems.

B. Ready-Mix-Concrete 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.
1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities" (Quality Control Manual - Section 3, "Plant Certification Checklist").

C. Testing Agency Qualifications: 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.

D. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
1. Build mockups of full-thickness sections of concrete paving to demonstrate typical joints; surface finish, texture, and color; curing; and standard of workmanship.
2. Build mockups of concrete paving in the location and of the size indicated or, if not indicated, build mockups where directed by Owner and not less than **96 inches** by **96 inches**.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner 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.

8.01 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Owner to engage a qualified independent testing agency to perform preconstruction testing on concrete paving mixtures. Contractor to coordinate with testing agency and Owner.

9.01 FIELD 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, 330.1 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.

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.

D. Pavement Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature meeting manufacturer’s specifications.

PART 2 - PRODUCTS

1.01 CONCRETE, GENERAL

A. ACI Publications: Comply with ACI 301, 330.1 and 330.2 unless otherwise indicated.

2.01 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.

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.

3.01 STEEL REINFORCEMENT

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **25** percent.

B. Plain-Steel Welded-Wire Reinforcement: ASTM A 1064/A 1064M, fabricated from steel wire into flat sheets.

C. Deformed-Steel Welded-Wire Reinforcement: ASTM A 1064/A 1064M, flat sheet.

D. Epoxy-Coated Welded-Wire Reinforcement: ASTM A 884/A 884M, Class A, plain steel.

E. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420); deformed.

F. Galvanized Reinforcing Bars: ASTM A 767/A 767M, Class II zinc coated, hot-dip galvanized after fabrication and bending; with ASTM A 615/A 615M, Grade 60 (Grade 420) deformed bars.

G. Epoxy-Coated Reinforcing Bars: ASTM A 775/A 775M or ASTM A 934/A 934M; with ASTM A 615/A 615M, Grade 60 (Grade 420) deformed bars.

H. Steel Bar Mats: ASTM A 184/A 184M; with ASTM A 615/A 615M, Grade 60 (Grade 420) deformed bars; assembled with clips.

I. Plain-Steel Wire: ASTM A 1064/A 1064M, as drawn galvanized.

J. Deformed-Steel Wire: ASTM A 1064/A 1064M.

K. Epoxy-Coated-Steel Wire: ASTM A 884/A 884M, Class A; coated, plain deformed.

L. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 (Grade 420) plain-steel bars. Cut bars true to length with ends square and free of burrs.

M. Epoxy-Coated, Joint Dowel Bars: ASTM A 775/A 775M; with ASTM A 615/A 615M, Grade 60 (Grade 420) plain-steel bars.

N. Tie Bars: ASTM A 615/A 615M, Grade 60 (Grade 420); deformed.

O. Hook Bolts: ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6), internally and externally threaded. Design hook-bolt joint assembly to hold coupling against paving form and in position during concreting operations, and to permit removal without damage to concrete or hook bolt.

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

1. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.

2. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.

Q. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating, compatible with epoxy coating on reinforcement.

R. Zinc Repair Material: ASTM A 780/A 780M.

4.01 CONCRETE MATERIALS

A. Regional Materials: If required for LEED Credit, verify concrete is manufactured within 100 miles of Project site from aggregates and cementitious materials that have been extracted, harvested, or recovered, as well as manufactured, within 100 miles of Project site.

B. Cementitious Materials: Use the following cementitious materials, of same type, brand, and source throughout Project:

1. Portland Cement: ASTM C 150/C 150M, gray portland cement Type I or Type III.
2. Fly Ash: ASTM C 618, Class C or Class F.
3. Slag Cement: ASTM C 989/C 989M, Grade 100 or 120.
4. Blended Hydraulic Cement: ASTM C 595/C 595M.

C. Normal-Weight Aggregates: ASTM C 33/C 33M, uniformly graded. Provide aggregates from a single source with documented service-record data of at least 10 years' satisfactory service in similar paving applications and service conditions using similar aggregates and cementitious materials.

1. Maximum Coarse-Aggregate Size: Per State Department of Transportation requirements.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

D. Exposed Aggregate: Selected, hard, and durable; washed; free of materials with deleterious reactivity to cement or that cause staining; from a single source, with gap-graded coarse aggregate as follows:

1. Aggregate Sizes: Per State Department of Transportation requirements.

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

F. 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.

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.

G. Water: Potable and complying with ASTM C 94/C 94M.

5.01 FIBER REINFORCEMENT

A. Synthetic Fiber: Monofilament polypropylene fibers engineered and designed for use in decorative concrete paving, complying with ASTM C 1116/C 1116M, Type III, 1/2 to 1-1/2 inches long.

B. Synthetic Fiber: Fibrillated polypropylene fibers engineered and designed for use in decorative concrete paving, complying with ASTM C 1116/C 1116M, Type III, 1/2 to 1-1/2 inches long.

6.01 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 3, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. dry or cotton mats.

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

C. Water: Potable.

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

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

F. White, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 2, Class B, dissipating.

7.01 RELATED MATERIALS

A. Joint Fillers: ASTM D 1751, asphalt-saturated cellulosic fiber in preformed strips.

B. Slip-Resistive Aggregate Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of fused aluminum-oxide granules or crushed emery aggregate containing not less than 50 percent aluminum oxide and not less than 20 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials.

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

D. Epoxy-Bonding Adhesive: ASTM C 881/C 881M, two-component epoxy resin capable of humid curing and bonding to damp surfaces; of class suitable for application temperature, of grade complying with requirements, and of the following types:

1. Types I and II, nonload bearing or Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

E. Chemical Surface Retarder: Water-soluble, liquid, set retarder with color dye, for horizontal concrete surface application, capable of temporarily delaying final hardening of concrete to a depth of 1/8 to 1/4 inch.

F. Mineral Dry-Shake Hardener: Factory-packaged, dry combination of portland cement, graded quartz aggregate, and plasticizing admixture.

G. Rock Salt: Sodium chloride crystals, kiln dried, coarse gradation with 100 percent passing 3/8-inch sieve and 85 percent retained on a No. 8 sieve.

8.01 STAMPED DETECTABLE WARNING MATERIALS

A. Detectable Warning Stamp: Semirigid polyurethane mats with formed underside capable of imprinting detectable warning pattern on plastic concrete; perforated with a vent hole at each dome.

1. Size of Stamp: One piece, matching detectable warning area shown on Drawings.

B. Liquid Release Agent: Manufacturer's standard, clear, evaporating formulation designed to facilitate release of stamp mats.

9.01 CONCRETE MIXTURES

A. Prepare design mixtures, proportioned according to ACI 301, for each type and strength of normal-weight concrete, and as determined by either laboratory trial mixtures or field experience.

1. Use a qualified independent testing agency for preparing and reporting proposed concrete design mixtures for the trial batch method.
2. When automatic machine placement is used, determine design mixtures and obtain laboratory test results that comply with or exceed requirements.

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

1. Fly Ash or Pozzolan: 25 percent.
2. Slag Cement: 50 percent.
3. Combined Fly Ash or Pozzolan, and Slag Cement: 50 percent, with fly ash or pozzolan not exceeding 25 percent.

C. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:

1. Air Content: 4.0 to 7.0 percent.

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

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

1. Use 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.

F. Synthetic Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than 1.0 lb/cu. yd.

G. Concrete Mixtures: Normal-weight concrete.

1. Compressive Strength (28 Days): 4000 psi.
2. Maximum W/C Ratio at Point of Placement: 0.50.
3. Slump Limit: 5 inches, plus or minus 1 inch.
4. Solar Reflectance (SR): Three-year-aged SR value of at least 0.28 or initial SR of at least 0.33, if required for LEED Credit.

10.01 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M and ASTM C 1116/C 1116M. Furnish batch certificates for each batch discharged and used in the Work.

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.

PART 3 - EXECUTION

1.01 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 subbase in one direction and repeat in perpendicular 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. Correct subbase with soft spots and areas of pumping or rutting exceeding depth of 1/2 inch according to requirements in Section 312000 "Earth Moving."

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

2.01 PREPARATION

A. Remove loose material from compacted subbase surface immediately before placing concrete.

3.01 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.

4.01 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, or other bond-reducing materials.

C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.

D. Install welded-wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

E. Zinc-Coated Reinforcement: Use galvanized-steel wire ties to fasten zinc-coated reinforcement. Repair cut and damaged zinc coatings with zinc repair material.

F. Epoxy-Coated Reinforcement: Use epoxy-coated steel wire ties to fasten epoxy-coated reinforcement. Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D 3963/D 3963M.

G. Install fabricated bar mats in lengths as long as practicable. Handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities, or replace units as required before placement. Set mats for a minimum 2-inch overlap of adjacent mats.

5.01 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. Butt Joints: Use bonding agent or epoxy-bonding adhesive at joint locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
   4. Keyed Joints: Provide preformed keyway-section forms or bulkhead forms with keys unless otherwise indicated. Embed keys at least 1-1/2 inches into concrete.
   5. 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. 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 50 feet unless otherwise indicated.
   2. Extend joint fillers full width and depth of joint.
   3. Terminate joint filler not less than 1/2 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 at maximum spacing of 15 feet on center each way. Complete contraction jointing within twelve hours of concrete placement. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows:
   1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with grooving tool to a 3/8-inch radius. Repeat grooving of contraction joints after applying surface finishes.

a. Tolerance: Ensure that grooved joints are within 3 inches either way from centers of dowels.

2. 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.
   a. Tolerance: Ensure that sawed joints are within 3 inches either way from centers of dowels.
3. 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.

6.01 CONCRETE PLACEMENT

A. Before placing concrete, inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast-in.

B. Remove snow, ice, or frost from subbase surface and steel reinforcement before placing concrete. Do not place concrete on frozen surfaces.

C. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.

D. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.

E. Do not add water to concrete during delivery or at Project site. Do not add water to fresh concrete after testing.

F. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.

G. Consolidate concrete according to ACI 301 by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.
   1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating reinforcement dowels and joint devices.

H. Screed paving surface with a straightedge and strike off.

I. Commence initial floating using bull floats or darbies to impart an open-textured and uniform surface plane before excess moisture or bleedwater appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.

J. Curbs and Gutters: Use design mixture for automatic machine placement. Produce curbs and gutters to required cross section, lines, grades, finish, and jointing.

K. Slip-Form Paving: Use design mixture for automatic machine placement. Produce paving to required thickness, lines, grades, finish, and jointing.

1. Compact subbase and prepare subgrade of sufficient width to prevent displacement of slip-form paving machine during operations.

7.01 FLOAT FINISHING

A. General: Do not add water to concrete surfaces during finishing operations.

B. Float Finish: Begin the second floating operation when bleedwater sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.

1. Burlap Finish: Drag a seamless strip of damp burlap across float-finished concrete, perpendicular to line of traffic, to provide a uniform, gritty texture.
2. 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.
3. Medium-to-Coarse-Textured Broom Finish: Provide a coarse finish by striating float-finished concrete surface 1/16 to 1/8 inch deep with a stiff-bristled broom, perpendicular to line of traffic.

8.01 SPECIAL FINISHES

A. Monolithic Exposed-Aggregate Finish: Expose coarse aggregate in paving surface as follows:

1. Immediately after float finishing, spray-apply chemical surface retarder to paving according to manufacturer's written instructions.
2. Cover paving surface with plastic sheeting, sealing laps with tape, and remove when ready to continue finishing operations.
3. Without dislodging aggregate, remove mortar concealing the aggregate by lightly brushing surface with a stiff, nylon-bristle broom. Do not expose more than one-third of the average diameter of the aggregate and not more than one-half of the diameter of the smallest aggregate.

4. Fine-spray surface with water and brush. Repeat cycle of water flushing and brushing until cement film is removed from aggregate surfaces to depth required.

B. Seeded Exposed-Aggregate Finish: Immediately after initial floating, spread a single layer of aggregate uniformly on paving surface. Tamp aggregate into plastic concrete and float finish to entirely embed aggregate with mortar cover of 1/16 inch.
   1. Spray-apply chemical surface retarder to paving according to manufacturer's written instructions.
   2. Cover paving surface with plastic sheeting, sealing laps with tape, and remove sheeting when ready to continue finishing operations.
   3. Without dislodging aggregate, remove mortar concealing the aggregate by lightly brushing surface with a stiff, nylon-bristle broom. Do not expose more than one-third of the average diameter of the aggregate and not more than one-half of the diameter of the smallest aggregate.
   4. Fine-spray surface with water and brush. Repeat cycle of water flushing and brushing until cement film is removed from aggregate surfaces to depth required.

C. Slip-Resistive Aggregate Finish: Before final floating, spread slip-resistive aggregate finish on paving surface according to manufacturer's written instructions and as follows:
   1. Uniformly spread at manufacturer's recommended rate of dampened, slip-resistive aggregate over paving surface in two applications. Tamp aggregate flush with surface using a steel trowel, but do not force below surface.
   2. Uniformly distribute approximately two-thirds of slip-resistive aggregate over paving surface with mechanical spreader, allow to absorb moisture, and embed by power floating. Follow power floating with a second slip-resistive aggregate application, uniformly distributing remainder of material at right angles to first application to ensure uniform coverage, and embed by power floating.
   3. Cure concrete with curing compound recommended by slip-resistive aggregate manufacturer. Apply curing compound immediately after final finishing.
   4. After curing, lightly work surface with a steel-wire brush or abrasive stone and water to expose nonslip aggregate.

D. Rock-Salt Finish: After initial floating, uniformly spread rock salt over paving surface at the rate of 5 lb/100 sq. ft.
   1. Embed rock salt into plastic concrete with roller or magnesium float.
   2. Cover paving surface with 1-mil- thick polyethylene sheet and remove sheet when concrete has hardened and seven-day curing period has elapsed.

3. After seven-day curing period, saturate concrete with water and broom-sweep surface to dissolve remaining rock salt, thereby leaving pits and holes.

E. Pigmented Mineral Dry-Shake Hardener Finish: After initial floating, apply dry-shake materials to paving surface according to manufacturer's written instructions and as follows:

1. Uniformly spread 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 a hand-troweled finish followed by a broom finish.
4. Cure concrete with curing compound recommended by dry-shake hardener manufacturer. Apply curing compound immediately after final finishing.

9.01 DETECTABLE WARNING INSTALLATION

A. Blockouts: Form blockouts in concrete for installation of detectable paving units specified in Section 321726 "Tactile Warning Surfacing."

1. Tolerance for Opening Size: Plus 1/4 inch, no minus.

B. Stamped Detectable Warnings: Install stamped detectable warnings as part of a continuous concrete paving placement and according to stamp-mat manufacturer's written instructions.

1. Before using stamp mats, verify that the vent holes are unobstructed.
2. Apply liquid release agent to the concrete surface and the stamp mat.
3. Stamping: While initially finished concrete is plastic, accurately align and place stamp mats in sequence. Uniformly load, gently vibrate, and press mats into concrete to produce imprint pattern on concrete surface. Load and tamp mats directly perpendicular to the stamp-mat surface to prevent distortion in shape of domes. Press and tamp until mortar begins to come through all of the vent holes. Gently remove stamp mats.
4. Trimming: After 24 hours, cut off the tips of mortar formed by the vent holes.
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.

10.01 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. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. 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.

D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

E. Curing Methods: Cure concrete by moisture curing moisture-retaining-cover curing curing compound or a combination of these as follows:

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 lap over adjacent absorptive covers.
2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Immediately repair any holes or tears occurring during installation or 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.

11.01 PAVING TOLERANCES

A. Comply with tolerances in ACI 117 and as follows:

1. Elevation: 3/4 inch.
2. Thickness: Plus 3/8 inch, minus 1/4 inch.
3. Surface: Gap below 10-feet- long; unleveled straightedge not to exceed 1/2 inch.
4. Alignment of Tie-Bar End Relative to Line Perpendicular to Paving Edge: 1/2 inch per 12 inches of tie bar.

5. Lateral Alignment and Spacing of Dowels: 1 inch.
6. Vertical Alignment of Dowels: 1/4 inch.
7. Alignment of Dowel-Bar End Relative to Line Perpendicular to Paving Edge: 1/4 inch per 12 inches of dowel.
8. Joint Spacing: 3 inches.
9. Contraction Joint Depth: Plus 1/4 inch, no minus.
10. Joint Width: Plus 1/8 inch, no minus.

12.01 PAVEMENT MARKING

A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Owner.

B. Allow asphalt paving or concrete surfaces to age for 30 days before starting pavement marking.

C. Sweep and clean surface to eliminate loose material and dust.

D. Apply paint with mechanical equipment to produce 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, firmly secured to concrete surface. Mask an extended area beyond edges of each stencil to prevent paint ap-plication beyond stencil. Apply paint so that it cannot run beneath stencil.
2. Broadcast glass beads uniformly into wet markings at a rate of 6 lb/gal.

13.01 WHEEL STOPS

A. Install wheel stops in accordance with manufacturer’s written instructions unless otherwise indicated.

B. Securely anchor wheel stops to substrate with hardware in each preformed vertical hole in wheel stop as recommended in writing by manufacturer. Recess head of hardware beneath top of wheel stop.

14.01 FIELD QUALITY CONTROL

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

B. Testing Services: Testing and inspecting 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 at least one composite sample for each **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/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; 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 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/C 31M; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
6. Compressive-Strength Tests: ASTM C 39/C 39M; 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.

C. Strength of each concrete mixture will be satisfactory if 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.

D. Test results shall be reported in writing to Architect, 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.

E. 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.

F. 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.

G. Concrete paving will be considered defective if it does not pass tests and inspections.

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

I. Prepare test and inspection reports.

15.01 REPAIR 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 Architect.

B. Drill test cores, where directed by Architect, 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

SECTION 32 1373
CONCRETE PAVING JOINT SEALANTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

2.01 SUMMARY

A. Section Includes:
   1. Cold-applied joint sealants.
   2. Hot-applied joint sealants.
   3. Cold-applied, fuel-resistant joint sealants.
   4. Hot-applied, fuel-resistant joint sealants.
   5. Joint-sealant backer materials.
   6. Primers.

3.01 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

4.01 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Verification: If requested by Owner or Architect, for each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch- wide joints formed between two 6-inch- long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

C. Paving-Joint-Sealant Schedule: Include the following information:
   1. Joint-sealant application, joint location, and designation.
   2. Joint-sealant manufacturer and product name.
   3. Joint-sealant formulation.
   4. Joint-sealant color.

5.01 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: For each type of joint sealant and accessory.

6.01 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by sealant manufacturer.

B. Product Testing: Test joint sealants using a qualified testing agency.

7.01 FIELD CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:
   1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer.

2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

PART 2 - PRODUCTS

1.01 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.

2.01 COLD-APPLIED JOINT SEALANTS

A. Single-Component, Nonsag, Silicone Joint Sealant: ASTM D 5893/D 5893M, Type NS.

B. Single-Component, Self-Leveling, Silicone Joint Sealant: ASTM D 5893/D 5893M, Type SL.

C. Multicomponent, Nonsag, Urethane, Elastomeric Joint Sealant: ASTM C 920, Type M, Grade NS, Class 25, for Use T.

D. Single Component, Pourable, Urethane, Elastomeric Joint Sealant: ASTM C 920, Type S, Grade P, Class 25, for Use T.

E. Multicomponent, Pourable, Urethane, Elastomeric Joint Sealant: ASTM C 920, Type M, Grade P, Class 25, for Use T.

3.01 HOT-APPLIED JOINT SEALANTS

A. Hot-Applied, Single-Component Joint Sealant: ASTM D 6690, Type I, II, or III.

4.01 COLD-APPLIED, FUEL-RESISTANT JOINT SEALANTS

A. Fuel-Resistant, Single-Component, Pourable, Modified-Urethane, Elastomeric Joint Sealant: ASTM C 920, Type S, Grade P, Class 25, for Use T.

B. Fuel-Resistant, Multicomponent, Pourable, Modified-Urethane, Elastomeric Joint Sealant: ASTM C 920, Type M, Grade P, Class 12-1/2 or 25, for Use T.

5.01 HOT-APPLIED, FUEL-RESISTANT JOINT SEALANTS

A. Hot-Applied, Fuel-Resistant, Single-Component Joint Sealants: ASTM D 7116, Type I or Type II.

B. Hot-Applied, Fuel-Resistant, Single-Component Joint Sealants: ASTM D 7116, Type III.

6.01 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. Round Backer Rods for Cold- and Hot-Applied Joint Sealants: ASTM D 5249, Type 1, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.

C. Round Backer Rods for Cold-Applied Joint Sealants: ASTM D 5249, Type 3, of diameter and density required to control joint-sealant depth and prevent bottom-side adhesion of sealant.

D. 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.

7.01 PRIMERS

A. Primers: Product recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated.

PART 3 - EXECUTION

1.01 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.

2.01 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.

3.01 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.

4.01 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.

5.01 PAVING-JOINT-SEALANT SCHEDULE

A. Joint-Sealant Application: Joints within concrete paving.
1. Joint Location:
a. Expansion and isolation joints in concrete paving.
b. Contraction joints in concrete paving.
c. Other joints as indicated.
2. Joint Sealant:
a. Single-component, nonsag, silicone joint sealant
b. Single-component, self-leveling, silicone joint sealant

c. Multicomponent, nonsag, urethane, elastomeric joint sealant
d. Single component, pourable, urethane, elastomeric joint sealant
e. Multicomponent, pourable, urethane, elastomeric joint sealant
f. Hot-applied, single-component joint sealant.

3. Joint-Sealant Color: As selected by Owner from manufacturer's full range.

B. Joint-Sealant Application: Joints within concrete paving and between concrete and asphalt paving.
1. Joint Location:
a. Joints between concrete and asphalt paving.
b. Joints between concrete curbs and asphalt paving.
c. Other joints as indicated.
2. Joint Sealant: Hot-applied, single-component joint sealant.
3. Joint-Sealant Color: As selected by Owner from manufacturer's full range.

C. Joint-Sealant Application: Fuel-resistant joints within concrete paving.
1. Joint Location:
a. Expansion and isolation joints in concrete paving.
b. Contraction joints in concrete paving.
c. Other joints as indicated.
2. Joint Sealant:
a. Fuel-resistant, single-component, pourable, modified-urethane, elastomeric joint sealant
b. Fuel-resistant, multicomponent, pourable, modified-urethane, elastomeric joint sealant
c. Hot-applied, fuel-resistant, single-component joint sealant.
3. Joint-Sealant Color: As selected by Owner from manufacturer's full range.

END OF SECTION

SECTION 32 1723
PAVEMENT MARKINGS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

2.01 SUMMARY

A. Section Includes:
   1. Painted markings applied to asphalt paving.
   2. Painted markings applied to concrete surfaces.

B. Related Requirements:
   1. Section 321216 “Asphalt Paving”.
   2. Section 321313 “Concrete Paving”.

3.01 ACTION SUBMITTALS

A. Product Data: Include technical data and tested physical and performance properties.
   1. Pavement-marking paint, latex.
   2. Glass beads.

4.01 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of the Jurisdiction having authority for pavement-marking work.
   1. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.

5.01 FIELD CONDITIONS

A. Environmental Limitations: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature meeting manufacturer’s specifications.

PART 2 - PRODUCTS

1.01 MANUFACTURERS

A. Source Limitations: Obtain pavement-marking paints from single source from single manufacturer.

2.01 PERFORMANCE REQUIREMENTS

A. Accessibility Standard: Comply with applicable provisions in the USDOJ's "ADA Standards for Accessible Design, latest edition".

3.01 PAVEMENT-MARKING PAINT

A. Pavement-Marking Paint, Latex: MPI #97, latex traffic-marking paint.
   1. Roadway Markings: As required by authorities having jurisdiction.
   2. Parking Lots: White or yellow, as indicated on drawings.
   3. Handicapped Symbols: Blue.

B. Paint For Obliterating Existing Markings: FS TT-P-1952; black for bituminous pavements, gray for portland cement pavements.
C. Glass Beads: AASHTO M 247, Type 1 or FS TT-B-1325D, Type 1, made of 100 percent recycled glass.
    1. Roundness: Minimum 80 percent true spheres by weight.

PART 3 - EXECUTION

1.01 EXAMINATION

A. Verify that pavement-marking substrate is dry and in suitable condition to begin pavement marking in accordance with manufacturer's written instructions.
B. Proceed with pavement marking only after unsatisfactory conditions have been corrected.

2.01 PAVEMENT MARKING

A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Owner.
B. Allow asphalt paving or concrete surfaces to age for a minimum of 30 days before starting pavement marking.
C. Sweep and clean surface to eliminate loose material and dust.
D. 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, firmly secured to asphalt paving or concrete surface. Mask an extended area beyond edges of each stencil to prevent paint application beyond stencil. Apply paint so that it cannot run beneath stencil.
    2. Broadcast glass beads uniformly into wet markings at a rate of 6 lb/gal.

3.01 PROTECTING AND CLEANING

A. Protect pavement markings from damage and wear during remainder of construction period.
B. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION

SECTION 32 1813
ARTIFICIAL GRASS FIELD TURF

PART 1 GENERAL

1.01 WORK INCLUDED

A. Furnish all labor, materials, tools and equipment necessary to install all artificial grass field turf as indicated on the plans and as specified herein. The installation of all new materials shall be performed in strict accordance with the manufacturer's installation instructions and in accordance with all approved shop drawings.

B. Perimeter edge details required for the system shall be as detailed and recommended by the Manufacturer, and as approved by the Owner. Supply and installation of these details will be under the scope of work of the base contractor (see Section 32 11 23 - Aggregate Base Course: Sub-base material), not that of the artificial grass field turf Installer.

2.01 REFERENCES

A. FM P7825 - Approval Guide; Factory Mutual Research Corporation; current edition

B. ASTM Standard Test Methods:

1. D1577 - Standard Test Method for Linear Density of Textile Fiber
2. D5848 - Standard Test Method for Mass Per Unit Area of Pile Yarn Floor Covering
3. D418 - Standard Test Method for Testing Pile Yarn Floor Covering Construction
4. D1338 - Standard Test Method for Tuft Bind of Pile Yarn Floor Coverings
5. D1682 - Standard Method of Test for Breaking Load and Elongation of Textile Fabrics
6. D5034 - Standard Test Method of Breaking Strength and Elongation of Textile Fabrics (Grab Test)
7. F1015 - Standard Test Method for Relative Abrasiveness of Synthetic Turf Playing Surfaces
8. D4491 - Standard Test Methods for Water Permeability of Geotextiles by Permittivity
9. D2859 - Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials
10. F355 - Standard Test Method for Shock-Absorbing Properties of Playing Surfaces.

10. F1936 - Standard Test Method for Shock-Absorbing Properties of North American Football Field Playing Systems as Measured in the Field
11. D1557 - Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort.

C. 2001 NCAA Football Rules and Interpretations / National High School Federation Rules and Standards

3.01 SUBMITTALS

A. See Section 01 33 00 - Administrative Requirements for submittal procedures.

B. Prior to the Architect approval of a specified artificial turf system, the Manufacturer shall specify in writing that their turf system does not violate any other manufacturer's patents, patents allowed or patents pending.

C. Submit the following with the Bid/Proposal:

1. Submit two samples, 6x6 inch in size, illustrating details of finished product.
2. A letter and specification sheet certifying that the products of this section meet or exceed specified requirements.
3. Certified copies of independent (third-party) laboratory reports on ASTM tests as follows:
    a. Pile Height, Face Width & Total Fabric Weight, ASTM D418 or D5848
    b. Primary & Secondary Backing Weights, ASTM D418 or D5848
    c. Tuft Bind, ASTM D1335
    d. Grab Tear Strength, ASTM D1682 or D5034
    e. Pill Burn Test ASTM D2859
4. List of existing installations, including Owner representative and telephone number.
5. Lists providing specific contacts and telephone numbers of the following existing installations:
    a. A football field of 65,000 sq. ft or more of the exact specified material, including the infill material and fiber, in play for at least 5 years. These installations must have used the same manufacturer, product and company they are proposing for this field.
    b. A softball or baseball field of the exact specified material, including the infill material and fiber, in play for at least 5

years. These installations must have used the same manufacturer, product and company they are proposing for this field.

c. A list of NCAA division 1 football fields in play for at least four seasons.

d. A list of NCAA division 1 baseball or softball fields in play for at least four seasons.

e. A list of high school football and soccer fields in play for at least four seasons

f. A list of at least of 10 fields of 65,000 sq. ft or more in the United States in the past two years with the same manufacturer, product and company, including the exact same infill system, fiber and fiber manufacturer being proposed for this field.

g. A sand/rubber infill field in play for at least 5 years in the United States. This installation must have used the same manufacturer, product and company being proposed for this field.

6. Resumé of Installation Supervisor who will be present on site during installation.

7. The Turf Contractor and the turf Manufacturer (if different from the company) shall provide a current audited company financial statement

8. *The Turf Contractor and turf Manufacturer (if different from the company) shall provide evidence that their turf system does not violate any other manufacturer's patents, patents allowed or patents pending.*

9. The Turf Contractor and the turf Manufacturer (if different from the company) shall provide a sample copy of insured, non-prorated warranty and insurance policy information.

D. Prior to ordering of materials:

1. The Contractor shall submit Shop Drawings indicating:

a. Field Layout to include school/district logo

b. Field Marking Plan and details for the specified sports;(i.e., NHF Football).

c. Roll/Seaming Layout

d. Methods of attachment, field openings and perimeter conditions.

2. The turf Manufacturer must submit the fiber manufacturer's name, type of fiber and composition of fiber.

E. Prior to Final Acceptance, the Contractor shall submit to the Owner:

1. Three (3) copies of Maintenance Manuals, which will include all necessary instructions for the proper care and preventative maintenance of the synthetic turf system, including painting and markings.
2. Project Record Documents: Record actual locations of seams, drains or other pertinent information. Submit electronic documentation in latest AutoCad format.
3. Warranty: Submit Manufacturer Warranty and ensure that forms have been completed in Owner's name and registered with Manufacturer.

4.01 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section. The Turf Contractor and/or the turf Manufacturer:

1. Must be experienced in the manufacture and installation of this specific type of synthetic infill grass system for at least 5 years with the same manufacturer, product and company they are proposing for this field. This
includes the tuft fiber, the backing, the backing coating, and the installation method
2. Must have a NCAA division 1/high school football field in play for at least four seasons.
3. Must have a NCAA division 1/high school softball or baseball field in play for at least four seasons.
4. Must have a football field of 65,000 sq. ft or more of the exact specified material, including the infill material and fiber, in play for at least 5 years with the same manufacturer and company they are proposing for this field.
5. Must have a softball or baseball field of the exact specified material, including the infill material and fiber, in play for at least 5 years with the same manufacturer and company they are proposing for this field.
6. Must have a sand/rubber infill field in play for at least 5 years in the United States.
7. Must have installed a minimum of 10 fields of 65,000 sq. ft or more in the

United States in the past two years with the same manufacturer, product and company, including the exact same infill system, fiber and fiber manufacturer that is being proposed for this field

B. Installer Qualifications: Company specializing in performing the work of this section.
   1. The Turf Contractor must provide competent workmen skilled in this specific type of synthetic grass installation.
   2. 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. The Manufacturer shall have a representative on site to certify the installation and Warranty compliance.

C. Prior to the beginning of installation, the Installer of the synthetic turf shall inspect the sub-base and accept in writing the sub-base surface planarity and compaction. The Installer shall have the dimensions of the field and locations for markings 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. The Turf Contractor shall provide the necessary testing data to the owner that the finished field meets the required shock attenuation, as per ASTM F1936.

5.01 PRE-INSTALLATION MEETING

A. Convene one week before starting work of this section.

6.01 DELIVERY, STORAGE, AND PROTECTION

A. Deliver products to project site in wrapped condition.

B. Store products under cover and elevated above grade.

7.01 WARRANTIES

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. The turf Manufacturer shall provide a Warranty to the owner that covers defects in materials and workmanship of the turf for a period of 8 years from the date of Substantial Completion. The turf manufacturer must verify that their onsite representative has inspected the installation and that the work conforms to the manufacturer’s requirements.

C. The Manufacturer’s Warranty shall include general wear and damage caused from UV degradation. The warranty shall specifically exclude vandalism, and acts of God beyond the control of the owner or the

manufacturer.

D. The turf Manufacturer's Warranty must be supported by an pre-paid in advance insurance policy for the full eight (8) year period.

E. The Turf 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 onsite representative.

F. All turf warranties shall be non prorated, limited to repair or replacement of the affected areas, at the option of the Manufacturer, and shall include all necessary materials, labor, transportation costs, etc. to complete said repairs. All warranties are contingent on the full payment by the Owner of all pertinent invoices.

G. The artificial grass field turf must maintain an ASTM 355 G-max of between 125- 200 for the life of the Warranty.

8.01 MAINTENANCE SERVICE

A. The Turf Contractor will train the Owner's facility maintenance staff in the use of the turf Manufacturer's recommended groomer.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Approved manufacturers are as follows:

1. FieldTurf International Inc.; 5211 Mitchell Bridge Road; Dalton, GA 30721;
   USA; Tel: (800)724-2969
   a. Model: Field Turf Pro Series
   b. Model: FieldTurf Double Play Classic for Baseball and Softball Field
2. Shaw Sports Turf.; 185 South Industrial Boulevard, Calhoun, GA 30701;
   USA; Tel: (866)703-4004
   a. Model: Legion Pro 2.25 for Football and Soccer Field
   b. Model: Truhop 46 for Baseball and Softball Field
3. AstroTurf.; 2680 Abutment Rd, Dalton, GA 30721;
   USA; Tel: (800)723-8873
   a. Model: RootZone 3D Blend for Football and Soccer Field
   b. Model: Diamond Series RBI for Baseball and Softball Field
4. SporTurf.; 200 Howell Drive, Dalton, GA 30721;
   USA; Tel: (800)798-1056
   a. Model: GameChanger 52H for Football and Soccer Field
   b. Model: Fielder's Choice for Baseball and Softball Field

5. Hellas.; 12710 Research Boulevard Suite 240, Austin Texas 78759; USA; Tel: (800)798-1056
   a. Model: Matrix Turf for Football and Soccer Field
   b. Model: Major Play for Baseball and Softball Field

2.2 MATERIALS

A. The component materials of the artificial grass field turf System consist of:
   1. A Carpet made of polyethylene fibers tufted into a fibrous, non-perforated, porous backing.
   2. An Infill that is a controlled mixture of graded sand and rubber crumb that partially covers the carpet.
   3. Glue, thread, paint, seaming fabric and other materials used to install and mark the artificial grass field turf.

B. The installed artificial grass field turf shall have the following properties:

Standard	Property	Specification
ASTM D1577	Fiber Denier	
ASTM D418/D5848	Pile Height	
ASTM D418/D5848	Pile Weight	
ASTM D1335	Tuft Bind	7 lbs. (without infill)
ASTM D1335	Tuft Bind	12 lbs. (with infill)
ASTM D1682/D5034		Grab Tear
(width)	207 lbs/force	ASTM D1682/D5034 Grab
Tear (length)	297 lbs/force	ASTM F1015 Relative
Abrasiveness Index		20.2
ASTM D4491	Carpet Permeability	>30 inches/hour
ASTM D2859		Flammability
(Pill Burn)	Pass	
ASTM F355/F1936	Impact Attenuation, Gmax	=<135 at installation =<200 over field life

C. The Carpet shall consist of fibers tufted into a primary backing with a secondary backing.
   1. The Carpet shall be furnished in 15’ wide rolls. Rolls shall be long enough to go from sideline to sideline without splicing. The perimeter white line shall be tufted into the individual sideline rolls. Head seams, other than at sidelines, will not be acceptable
   2. The Carpet’s primary backing shall be a double-layered polypropylene fabric treated with UV inhibitors. The secondary backing shall consist of an application of porous, heat-activated urethane to permanently

lock the fiber tufts in place. Perforated (with punched holes), backed carpet shall not be acceptable

3. The fiber shall be 8,000 denier, low friction, UV-resistant fiber measuring not less than 2 ½ inches high. The same fiber from the above listed projects (Section 1.04, art. C. 5) must be used on this project. Systems with less than a 2 ½ - inch fiber and/or shock pad enhancements will not be accepted as equivalent.
4. The fiber tufts shall be fanned or unfolded prior to installation, rolling or spiraling is not acceptable.

D. The Infill materials shall be approved by the Manufacturer. The Infill shall consist of a resilient layered granular system, comprising selected and graded dust-free silica sand and cryogenically hammer-milled SBR rubber crumb. Artificial Grass products without cryogenically processed rubber or a finish application of straight rubber cryogenically processed will not be acceptable. The sand component of the infill must represent a minimum of 51% or more of the total infill, by weight.

E. Non-tufted or inlaid lines and markings shall be in laid and must be approved by the synthetic turf Manufacturer.

F. Thread for sewing seams of turf shall be as recommended by the synthetic turf Manufacturer.

G. Glue and seaming fabric for inlaying lines and markings shall be as recommended by the synthetic turf Manufacturer.

2.3 FIELD GROOMER

A. Supply a field groomer, which shall include a towing mechanism compatible with a field utility vehicle.

B. The field groomer shall be the provided by turf manufacturer

PART 3 EXECUTION

3.1 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.

D. All designs, markings, layouts, and materials shall conform to all currently applicable National High school federation rules and other standards that may apply to this type of synthetic grass installation.

3.2 EXAMINATION

A. Verify that all sub-base, drainage and leveling is complete prior to installation.

B. The surface to receive the synthetic turf shall be inspected by the Installer, and prior to the beginning of installation, the Installer must accept in writing the sub- base surface planarity and compaction. The surface must be perfectly clean as installation commences and shall be maintained in that condition throughout the process.

C. The compaction of the aggregate base shall be 95%, according to the Modified Proctor procedure (ASTM D1557), and the surface tolerance shall not exceed 0- 1/4 inch over 10 feet and 0-½" from design grade.

3.3 INSTALLATION

A. Install in accordance with Manufacturer's instructions. The Turf Contractor shall strictly adhere to the installation procedures outlined under this section. Any variance from these requirements must be accepted in writing, by the Manufacturer’s onsite representative, and submitted to the Architect/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.

B. The carpet rolls are to be installed directly over the properly prepared aggregate base. Extreme care should be taken to avoid disturbing the aggregate base, both in regard to compaction and planarity. It is suggested that a 2-5 ton static roller is on site and available to repair and properly compact any disturbed areas of the aggregate base.

C. The full width rolls shall be laid out across the field. Turf shall be of sufficient length to permit full cross-field installation from sideline to sideline. No head or cross seams will be allowed in the main playing area between the sidelines. Utilizing standard state of the art sewing procedures each roll shall be attached to the next. When all of the rolls of the playing surface have been installed, the sideline areas shall be installed at right angles to the playing field turf.

D. This is a 99% sewn installation. Gluing of rolls shall not be acceptable. 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. All seams shall be sewn using double bagger stitches and

polyester thread or adhered using seaming tape and high grade adhesive (per the manufacturer's standard procedures). Seams shall be flat, tight, and permanent with no separation or fraying.

E. 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.

F. The 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 by a homogenous mixture of the sand and the cryogenically processed rubber. A final application of specifically sized cryogenically processed rubber completes the system. The Infill shall be installed to the depth of 1 ¾". Infill density shall consist of no more than 7 pounds of sand and at least 3 pounds of rubber per square foot. The Infill shall be placed so that there is a void of ¾" to the top of the fibers.

G. Prior to the application of any line painting the turf shall be fibrillated by means of a nylon rotary brush to provide the look, feel, and safety of optimally maintained natural grass, including subtle undulations normally associated with natural grass athletic fields.

H. Non-tufted or inlaid lines and markings shall be painted according to the recommendations of the turf Manufacturer and of the paint manufacturer. Several applications may be required.

I. Synthetic turf shall be attached to the perimeter edge detail in accordance with the Manufacturer's standard procedures.

3.4 FIELD MARKINGS

A. The field will have the following lines tufted or inlaid according to NCAA standards:

1. Football: as shown on the contract drawings. Color shall be white, except where noted.
    a. Side lines
    b. End lines
    c. 5-yd lines
    d. Goal lines
    e. [Player's box]
    f. [Coach's box]

B. The field will have the following markings [inlaid] / [painted]:

1. Football: as shown on the contract drawings. Color shall be white, except where noted.

a. 10 yard numbers and arrows
b. 1-yd hash markings
c. Inbound hash markings
d. Extra point lines
e. Kick off markings
f. Limit lines

C. The end zone area will be [made from xxx-colored fiber] / [painted xxx], subject to availability of color

D. The center field logo will be [painted] / [inlaid] according to artwork submitted by the Owner or Architect to the turf Manufacturer or Turf Contractor, subject to the availability of colors.

E. The end-zone letters and logos will be [painted] / [inlaid] according to artwork and fonts submitted by the Owner or Architect to the turf Manufacturer or Turf Contractor, subject to the availability of colors.

F. Standards
1. Standards; all lines and markings shall be to NCAA Standards.
2. Team logo as shown on contract drawings.

3.5 CLEANING

A. Protect installed turf from subsequent construction operations.

B. Do not permit traffic over unprotected floor surface.

C. Contractor shall provide the labor, supplies, and equipment as necessary for final cleaning of surfaces and installed items.

D. All usable remnants of new material shall become the property of the Owner.

E. The Contractor shall keep the area clean throughout the project and clear of debris.

F. Surfaces, recesses, enclosures, etc., 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

SECTION 32 3113
CHAIN LINK FENCES AND GATES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

2.01 SUMMARY

A. Section Includes:
   1. Chain-link fences.
   2. Swing, motor-operated gates.
   3. Horizontal-slide, motor-operated gates.
   4. Privacy slats.

B. Related Requirements:
   1. Section 033000 "Cast-in-Place Concrete" for cast-in-place concrete equipment bases/pads for gate operators and controls.
   2. Section 281500 "Access Control Hardware Devices" for gate controls.
   3. Section 321313 "Concrete Paving" for post footings.

3.01 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
   1. Inspect and discuss electrical roughing-in, equipment bases, and other preparatory work specified elsewhere.
   2. Review sequence of operation for each type of gate operator.
   3. Review coordination of interlocked equipment specified in this Section and elsewhere.
   4. Review required testing, inspecting, and certifying procedures.
   5. Review Construction Documents for fall protection requirements and coordinate with wall designer if required.

4.01 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 the following:
      a. Fence and gate posts, rails, and fittings.
      b. Chain-link fabric, reinforcements, and attachments.
      c. Accessories: Privacy slats Barbed wire Barbed tape.
      d. Gates and hardware.
      e. Gate operators, including operating instructions and motor characteristics.

B. Shop Drawings: For each type of fence and gate assembly.
   1. Include plans, elevations, sections, details, and attachments to other work.

2. Include accessories, hardware, gate operation, and operational clearances.
3. Gate Operator: Show locations and details for installing operator components, switches, and controls. Indicate motor size, electrical characteristics, drive arrangement, mounting, and grounding provisions.
4. Wiring Diagrams: For power, signal, and control wiring.

C. Samples for Initial Selection: For each type of factory-applied finish.

D. Samples for Verification: For each type of component with factory-applied finish, prepared on Samples of size indicated below:
1. Polymer-Coated Components: In 6-inch lengths for components and on full-sized units for accessories.

E. Delegated-Design Submittal: For structural performance of chain-link fence and gate frameworks, include analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

5.01 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency factory-authorized service representative.

B. Product Certificates: For each type of chain-link fence, operator, and gate.

C. Product Test Reports: For framework strength according to ASTM F 1043, for tests performed by a qualified testing agency.

D. Field quality-control reports.

E. Sample Warranty: For special warranty.

6.01 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For gate operators to include in emergency, operation, and maintenance manuals.

7.01 QUALITY ASSURANCE

A. Testing Agency Qualifications: For testing fence grounding; member company of NETA or an NRTL.
1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

B. Emergency Access Requirements: According to requirements of authorities having jurisdiction for gates with automatic gate operators serving as a required means of access.

C. Mockups: Build mockups to set quality standards for fabrication and installation.
1. Build mockup for typical chain-link fence and gate, including accessories.
a. Size: Include 6 foot length of fence and one gate.

8.01 FIELD CONDITIONS

A. Field Measurements: Verify layout information for chain-link fences and gates shown on Drawings in relation to property survey and existing structures. Verify dimensions by field measurements.

9.01 WARRANTY

A. Special Warranty: Manufacturer and Installer agree to repair or replace components of chain-link fences and gates that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Failure to comply with performance requirements.
      b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
      c. Faulty operation of gate operators and controls.
   2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

1.01 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design chain-link fence and gate operator frameworks.

A. Structural Performance: Chain-link fence and gate frameworks shall withstand the effects of gravity loads and stresses within limits and under conditions indicated.
   1. Minimum Post Size: As indicated on drawings.
   2. Minimum Post Size and Maximum Spacing: As indicated on drawings.

B. Lightning Protection System: Maximum resistance-to-ground value of 25 ohms at each grounding location along fence under normal dry conditions.

2.01 CHAIN-LINK FENCE FABRIC

A. General: Provide fabric in one-piece heights measured between top and bottom of outer edge of selvage knuckle or twist according to "CLFMI Product Manual" and requirements indicated below:
   1. Fabric Height: As indicated on Drawings.
   2. Steel Wire for Fabric: Wire diameter of 0.113 inch.
      a. Mesh Size: 2 inches.
      b. Aluminum-Coated Fabric: ASTM A 491, Type I, 0.35 oz./sq. ft.
      c. Polymer-Coated Fabric: ASTM F 668, Class 1 over aluminum-coated steel wire.
         1) Color: As indicated on drawings and according to ASTM F 934.

d. Coat selvage ends of metallic-coated fabric before the weaving process with manufacturer's standard clear protective coating.

3. Aluminum Wire Fabric: ASTM F 1183, with mill finish, and wire diameter of 0.148 inch.
   a. Mesh Size: 2 inches.
4. Selvage: Knuckled at both selvages.

3.01 FENCE FRAMEWORK

A. Posts and Rails: ASTM F 1043 for framework, including rails, braces, and line; terminal; and corner posts. Provide members with minimum dimensions and wall thickness according to ASTM F 1043 or ASTM F 1083 based on the following:
   1. Fence Height: As indicated on Drawings.
   2. Light-Industrial-Strength Material: Group IC-L, round steel pipe.
      a. Line Post: As indicated on drawings.
      b. End, Corner, and Pull Posts: As indicated on drawings.
   3. Heavy-Industrial-Strength Material: Group IA, round steel pipe, Schedule 40.
      a. Line Post: As indicated on drawings.
      b. End, Corner, and Pull Posts **As indicated on drawings**.
   4. Horizontal Framework Members: Top and bottom rails according to ASTM F 1043.
      a. Top Rail: As indicated on drawings.
   5. Brace Rails: ASTM F 1043.
   6. Metallic Coating for Steel Framework:
      a. Type A: Not less than minimum 2.0-oz./sq. ft. average zinc coating according to ASTM A 123/A 123M or 4.0-oz./sq. ft. zinc coating according to ASTM A 653/A 653M.
      b. Type B: Zinc with organic overcoat, consisting of a minimum of 0.9 oz./sq. ft. of zinc after welding, a chromate conversion coating, and a clear, verifiable polymer film.
      c. External, Type B: Zinc with organic overcoat, consisting of a minimum of 0.9 oz./sq. ft. of zinc after welding, a chromate conversion coating, and a clear, verifiable polymer film. Internal, Type D, consisting of 81 percent, not less than 0.3-mil- thick, zinc-pigmented coating.
      d. Type C: Zn-5-Al-MM alloy, consisting of not less than 1.8-oz./sq. ft. coating.
      e. Coatings: Any coating above.
   7. Polymer coating over metallic coating.
      a. Color: As indicated on drawings and according to ASTM F 934.

4.01 TENSION WIRE

A. Metallic-Coated Steel Wire: 0.177-inch- diameter, marcelled tension wire according to ASTM A 817 or ASTM A 824, with the following metallic coating:
   1. Type I: Aluminum coated (aluminized).

B. Polymer-Coated Steel Wire: 0.177-inch- diameter, tension wire according to ASTM F 1664, Class 1 over aluminum-coated steel wire.
   1. Color: Match chain-link fabric as indicated on drawings and according to ASTM F 934.

5.01 SWING GATES

A. General: ASTM F 900 for gate posts and swing gates. Provide automated vehicular gates according to ASTM F 2200.
   1. Gate Leaf Width: Minimum 36 inches or as indicated.
   2. Framework Member Sizes and Strength: Based on gate fabric height.

B. Pipe and Tubing:
   1. Aluminum: ASTM B 429/B 429M; mill finish.
   2. Gate Posts: Round tubular aluminum.
   3. Gate Frames and Bracing: Round tubular aluminum.

C. Frame Corner Construction: assembled with corner fittings.

D. Extended Gate Posts and Frame Members: Fabricate gate posts and frame end members to extend 12 inches above top of chain-link fabric at both ends of gate frame to attach barbed wire or tape assemblies, if indicated.

E. Hardware:
   1. Hinges: 360-degree inward and outward swing.
   2. Latch: Permitting operation from both sides of gate with provision for padlocking accessible from both sides of gate.
   3. Lock: Manufacturer's standard internal device.
   4. Padlock and Chain: Owner furnished or Owner specified.
   5. Closer: Manufacturer's standard.

6.01 HORIZONTAL-SLIDE GATES

A. General: ASTM F 1184 for gate posts and sliding gates. Provide automated vehicular gates according to ASTM F 2200.
   1. Classification: Type I Overhead Slide.
      a. Gate Leaf Width: 36 inches or as indicated.
      b. Framework Member Sizes and Strength: Based on gate fabric height.
   2. Classification: Type II Cantilever Slide, Class 1 with external roller assemblies.
      a. Gate Frame Width and Height: As indicated on drawings.

B. Pipe and Tubing:
   1. Aluminum: ASTM B 429/B 429M; mill finish.
   2. Gate Posts: Round tubular aluminum.
   3. Gate Frames and Bracing: Round tubular aluminum.
C. Frame Corner Construction: assembled with corner fittings.
D. Extended Gate Posts and Frame Members: Fabricate gate posts and frame end members to extend 12 inches above top of chain-link fabric at both ends of gate frame to attach barbed wire or tape assemblies, if indicated.
E. Overhead Track Assembly: Manufacturer's standard track, with overhead framework supports, bracing, and accessories, engineered to support size, weight, width, operation, and design of gate and roller assemblies.
F. Hardware:
   1. Hangers, Roller Assemblies, and Stops: Fabricated from mill-finished Grade 319 aluminum-alloy casting with stainless-steel fasteners.
   2. Latch: Permitting operation from both sides of gate with provision for padlocking accessible from both sides of gate.
   3. Lock: Manufacturer's standard internal device.
   4. Padlock and Chain: Owner furnished or Owner specified.

7.01 FITTINGS

A. Provide fittings according to ASTM F 626.
B. Post Caps: Provide for each post.
   1. Provide line post caps with loop to receive tension wire or top rail.
C. Rail and Brace Ends: For each gate, corner, pull, and end post.
D. Rail Fittings: Provide the following:
   1. Top Rail Sleeves: Aluminum Alloy 6063 not less than 6 inches long.
   2. Rail Clamps: Line and corner boulevard clamps for connecting bottom rails to posts.
E. Tension and Brace Bands: Aluminum Alloy 6063.
F. Tension Bars: Aluminum, length not less than 2 inches shorter than full height of chain-link fabric. Provide one bar for each gate and end post, and two for each corner and pull post, unless fabric is integrally woven into post.
G. Truss Rod Assemblies: Mill-finished aluminum rod and turnbuckle or other means of adjustment.
H. Barbed Wire Arms: Aluminum, with clips, slots, or other means for attaching strands of barbed wire, and means for attaching to posts, integral with post cap, for each post unless otherwise indicated, and as follows:
   1. Provide line posts with arms that accommodate top rail or tension wire.

2. Provide corner arms at fence corner posts unless extended posts are indicated.
3. Single-Arm Type: Type I, slanted arm.

I. Tie Wires, Clips, and Fasteners: According to ASTM F 626.
1. Standard Round Wire Ties: For attaching chain-link fabric to posts, rails, and frames, according to the following:
a. Hot-Dip Galvanized Steel: 0.148-inch- diameter wire; galvanized coating thickness matching coating thickness of chain-link fence fabric.
b. Aluminum: ASTM B 211; Alloy 1350-H19; 0.148-inch-diameter, mill-finished wire.

J. Finish:
1. Metallic Coating for Pressed Steel or Cast Iron: Not less than 1.2 oz./sq. ft. of zinc.
a. Polymer coating over metallic coating.
2. Aluminum: Mill finish.

8.01 PRIVACY SLATS

A. Fiber-Glass-Reinforced Plastic Slats: UV-light-stabilized fiber-glass-reinforced plastic, not less than 0.06 inch thick, sized to fit mesh specified for direction indicated with vandal-resistant fasteners and lock strips.

B. Tubular Polyethylene Slats: Minimum 0.023-inch-thick tubular polyethylene, manufactured for chain-link fences from virgin polyethylene with UV inhibitor, sized to fit mesh specified for direction indicated, with vandal-resistant fasteners and lock strips and fins for increased privacy factor.

C. Aluminum Slats: Minimum 0.01-inch-thick aluminum, sized to fit mesh specified for direction indicated.

D. Redwood Slats: 5/16-inch-thick redwood, sized to fit mesh specified for direction indicated.

E. Hedge-Type Slats: UV-light-stabilized, flame-resistant, PVC "needles" woven into braided, galvanized wire core, sized to fit mesh specified for direction indicated.

F. Color: As indicated on Drawings.

9.01 BARBED WIRE

A. Steel Barbed Wire: ASTM A 121, two-strand barbed wire, 0.099-inch- diameter line wire with 0.080-inch- diameter, four-point round barbs spaced not more than 5 inches o.c.
1. Aluminum Coating: Type A.

10.01 GATE OPERATORS

A. Operators: Factory-assembled, automatic, gate-operating system designed for gate size, type, weight, and frequency of use. Control system shall have characteristics

suitable for Project conditions, with control stations, safety devices, and weatherproof enclosures.

1. Operator design shall allow for removal of cover or motor without disturbing limit-switch adjustment and without affecting auxiliary emergency operation.
2. Electronic components shall have built-in troubleshooting diagnostic feature.
3. Unit shall be designed and wired for both right-hand/left-hand opening, permitting universal installation.

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. UL Standard: Manufacture and label gate operators according to UL 325.

D. Motors: Comply with NEMA MG 1.

1. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.
2. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.
3. Service Factor: 1.15.
4. Electrical Characteristics:
    a. Horsepower: Per manufacturer.
    b. Voltage: Single phase or three phase as required per manufacturer’s requirement.

E. Gate Operators: Equipment base/pad mounted and as follows:

1. Hydraulic Gate Operators:
    a. Duty: Commercial/industrial.
    b. Gate Speed: Minimum **60 feet** per minute.
    c. Maximum Gate Weight: 300 lb.
    d. Frequency of Use: Continuous duty.
    e. Operating Type: Crank arm, Wheel and rail drive, or Roller chain, with manual release.
    f. Hydraulic Fluid: Of viscosity required for gate operation at ambient temperature range for Project.
    g. Locking: Hydraulic in both directions.
    h. Heater: Manufacturer's standard track and roller heater with thermostatic control.
2. Mechanical Gate Operators:

a. Duty: Commercial/industrial.
b. Gate Speed: Minimum **60 feet** per minute.
c. Maximum Gate Weight: Per manufacturer.
d. Frequency of Use: Continuous duty.
e. Operating Type: Crank arm, Wheel and rail drive, Roller chain, with manual release.
f. Drive Type: Per manufacturer.

F. Controls: Electric controls separated from gate and motor and drive mechanism, with NEMA 250, Type 3RorNEMA 250, Type 4 enclosure for equipment base/pad mounting and with space for additional optional equipment.

G. Control Devices:
1. Control Station: Keyed, three-position switch, located remotely from gate. Provide two keys per station.
a. Function: Open, stop, and close.
2. Control Station: Momentary contact, three-button operated; located remotely from gate. Key switch to lock out open and close buttons.
a. Function: Open, stop, and close.
3. Card Reader: Functions only when authorized card is presented. Programmable, magnetic multiple -code system; face-lighted unit fully visible at night.
a. Reader Type: Touch plate or Proximity.
b. Features: Capable of monitoring and auditing gate activity.
4. Digital Keypad Entry Unit: Multiple- programmable-code capability of not less than 500 possible individual codes, consisting of one- to seven -digit codes.
a. Features: Capable of monitoring and auditing gate activity.
b. Face-lighted unit with metal-keyed or keyless-membrane keypad fully visible at night.
5. Radio Control: Digital system consisting of code-compatible universal receiver for each gate, located where indicated, with remote antenna with coaxial cable and mounting brackets designed to operate gates. Provide two programmable transmitter(s) with multiple-code capability, permitting validating or voiding of not less than 1000 codes per channel configured for the following functions:
a. Transmitters: Three-button operated, with open and close function.
b. Channel Settings: Three independent channel settings controlling separate receivers for operating more than one gate from each transmitter.
6. Telephone Entry System: Hands-free voice-communication system for connection to building telephone system, with digital-entry code activation of gate operator and auxiliary keypad entry.

a. Residential System: Designed to be wired to same line with telephone.
b. Multiunit System: Designed to be wired to a dedicated telephone line, with capacity to access 20 telephones and with electronic directory.

7. Vehicle Loop Detector: System that includes automatic closing timer with adjustable time delay before closing, timer cut-off switch, and loop detector designed to open and close gate and hold gate open until traffic clears. Provide electronic detector with adjustable detection patterns, adjustable sensitivity and frequency settings, and panel indicator light designed to detect presence or transit of a vehicle over an embedded loop of wire and to emit a signal activating the gate operator. Provide number of loops consisting of multiple strands of wire, number of turns, loop size, and method of placement at location shown on Drawings, and as recommended in writing by detection system manufacturer for function indicated.
   a. Loop: Field-assembled wire, in size indicated, for pave-over or saw-cut and epoxy-grouted installation.
8. Vehicle Presence Detector: System that includes automatic closing timer with adjustable time delay before closing, timer cut-off switch, and presence detector designed to open and close gate and hold gate open until traffic clears.
   a. Provide retroreflective or emitter/receiver detector with adjustable detection zone pattern and sensitivity, designed to detect the presence or transit of a vehicle in gate pathway when infrared beam in zone pattern is interrupted, and to emit a signal activating the gate operator.

H. Obstruction Detection Devices: Provide each motorized gate with automatic safety sensor(s). Activation of sensor(s) causes operator to immediately function as follows:
1. Action: Stop gate in opening cycle and reverse gate in closing cycle and hold until clear of obstruction.
2. Internal Sensor: Built-in torque or current monitor senses gate is obstructed.
3. Sensor Edge: Contact-pressure-sensitive safety edge, profile, and sensitivity designed for type of gate and component indicated, in locations as follows. Connect to control circuit using gate edge transmitter and operator receiver system.
   a. Along entire gate leaf leading edge.
   b. Across entire gate leaf bottom edge.
   c. Along entire length of gate posts.
   d. Along entire length of gate guide posts.
   e. Where indicated on Drawings.

4. Photoelectric/Infrared Sensor: Designed to detect an obstruction in gate's path when infrared beam in the zone pattern is interrupted.

I. Limit Switches: Adjustable switches, interlocked with motor controls and set to automatically stop gate at fully open and fully closed positions.

J. Emergency Release Mechanism: Quick-disconnect release of operator drive system, permitting manual operation if operator fails. Control circuit power is disconnected during manual operation.
   1. Type: Integral fail-safe release, allowing gate to be pushed open without mechanical devices, keys, cranks, or special knowledge.

K. Operating Features:
   1. Digital Microprocessor Control: Electronic programmable means for setting, changing, and adjusting control features with capability for monitoring and auditing gate activity. Provide unit that is isolated from voltage spikes and surges.
   2. System Integration: With controlling circuit board capable of accepting any type of input from external devices.
   3. Master/Slave Capability: Control stations designed and wired for gate pair operation.
   4. Automatic Closing Timer: With adjustable time delay before closing and timer cut-off switch.
   5. Open Override Circuit: Designed to override closing commands.
   6. Reversal Time Delay: Designed to protect gate system from shock load on reversal in both directions.
   7. Maximum Run Timer: Designed to prevent damage to gate system by shutting down system if normal time to open gate is exceeded.
   8. Clock Timer: 24 hour, programmable for regular events.

L. Accessories:
   1. Warning Module: Audio, -light alarm sounding three to five seconds in advance of gate operation and continuing until gate stops moving.
   2. Battery Backup System: Battery-powered drive and access-control system, independent of primary drive system.
      a. Fail Safe: Gate opens and remains open until power is restored.
      b. Fail Secure: Gate cycles on battery power, then fail safe when battery is discharged.
   3. External electric-powered solenoid or magnetic lock with delay timer allowing time for lock to release before gate operates.
   4. Fire box.

5. Fire siren alarm.
6. Intercom System.
7. Instructional, Safety, and Warning Labels and Signs: According to UL 325and per Manufacturer's standard for components and features specified.
8. Equipment Bases/Pads: 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.

11.01 GROUT AND ANCHORING CEMENT

A. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout, recommended in writing by manufacturer, for exterior applications.

B. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound. Provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating, and that is recommended in writing by manufacturer for exterior applications.

12.01 GROUNDING MATERIALS

A. Comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems."

B. Connectors and Grounding Rods: Listed and labeled for complying with UL 467.

PART 3 - EXECUTION

1.01 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for a certified survey of property lines and legal boundaries, site clearing, earthwork, pavement work, and other conditions affecting performance of the Work.

1. Do not begin installation before final grading is completed unless otherwise permitted by Design Professional.

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

2.01 PREPARATION

A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

3.01 CHAIN-LINK FENCE INSTALLATION

A. Install chain-link fencing according to ASTM F 567 or more stringent requirements specified.

1. Install fencing on established boundary lines inside property line.

B. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacings indicated, in firm, undisturbed soil.

C. Post Setting: Set posts in concrete with mechanical anchors by mechanically driving into soil 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 to dimensions indicated and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.
    a. Exposed Concrete: Extend 2 inches above grade; shape and smooth to shed water.
    b. Concealed Concrete: Place top of concrete 2 inches below grade as indicated on Drawings to allow covering with surface material.
    c. Posts Set into Sleeves in Concrete: Use steel pipe 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 or anchoring cement, mixed and placed according to anchoring material manufacturer's written instructions. Finish anchorage joint to slope away from post to drain water.
    d. Posts Set into Holes in Concrete: Form or core drill holes not less than 5 inches deep and 3/4 inch larger than OD of post. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout or anchoring cement, mixed and placed according to anchoring material manufacturer's written instructions. Finish anchorage joint to slope away from post to drain water.
3. Mechanically Driven Posts: Drive into soil to depth as indicated on drawings. Protect post top to prevent distortion.

D. Terminal Posts: Install terminal end, corner, and gate posts according to ASTM F 567 and terminal pull posts at changes in horizontal or vertical alignment as indicated on Drawings. For runs exceeding 500 feet, space pull posts an equal distance between corner or end posts.

E. Line Posts: Space line posts uniformly at 10 feet or as indicated on drawings.

F. Post Bracing and Intermediate Rails: Install according to ASTM F 567, maintaining plumb position and alignment of fence posts. Diagonally brace terminal posts to adjacent line posts with truss rods and turnbuckles. Install braces at end and gate posts and at both sides of corner and pull posts.

1. Locate horizontal braces at midheight of fabric 72 inches or higher, on fences with top rail, and at two-third fabric height on fences without top rail. Install so posts are plumb when diagonal rod is under proper tension.

G. Tension Wire: Install according to ASTM F 567, maintaining plumb position and alignment of fence posts. Pull wire taut, without sags. Fasten fabric to tension wire with 0.120-inch- diameter hog rings of same material and finish as fabric wire, spaced a maximum of 24 inches o.c. Install tension wire in locations indicated before stretching fabric. Provide horizontal tension wire at the following locations:
   1. Extended along top and bottom of fence fabric. Install top tension wire through post cap loops. Install bottom tension wire within 6 inches of bottom of fabric and tie to each post with not less than same diameter and type of wire.
   2. Extended along top of barbed wire arms and top of fence fabric to support barbed tape.
   3. As indicated on Drawings.

H. Top Rail: Install according to ASTM F 567, maintaining plumb position and alignment of fence posts. Run rail continuously through line post caps, bending to radius for curved runs and terminating into rail end attached to posts or post caps fabricated to receive rail at terminal posts. Provide expansion couplings as recommended in writing by fencing manufacturer.

I. Intermediate and Bottom Rails: Secure to posts with fittings.

J. Chain-Link Fabric: Apply fabric to outside of enclosing framework. Leave 2-inch bottom clearance between finish grade or surface and bottom selvage unless otherwise indicated. Pull fabric taut and tie to posts, rails, and tension wires. Anchor to framework so fabric remains under tension after pulling force is released.

K. Tension or Stretcher Bars: Thread through fabric and secure to end, corner, pull, and gate posts, with tension bands spaced not more than 15 inches o.c.

L. Tie Wires: Use wire of proper length to firmly secure fabric to line posts and rails. Attach wire at one end to chain-link fabric, wrap wire around post a minimum of 180 degrees, and attach other end to chain-link fabric according to ASTM F 626. Bend ends of wire to minimize hazard to individuals and clothing.
   1. Maximum Spacing: Tie fabric to line posts at 12 inches o.c. and to braces at 24 inches o.c.

M. Fasteners: Install nuts for tension bands and carriage bolts on the side of fence opposite the fabric side. Peen ends of bolts or score threads to prevent removal of nuts.

N. Privacy Slats: Install slats in direction indicated, securely locked in place.
   1. privacy factor of 70 to 75.

2. Direction and privacy factor as indicated on Drawings.

O. Barbed Wire: Install barbed wire uniformly spaced as indicated on Drawings. Pull wire taut, install securely to extension arms, and secure to end post or terminal arms.

P. Barbed Tape: Install according to ASTM F 1911. Install barbed tape uniformly in configurations indicated and fasten securely to prevent movement or displacement.

4.01 GATE INSTALLATION

A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach fabric as for fencing. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation.

5.01 GATE-OPERATOR INSTALLATION

A. Install gate operators according to manufacturer's written instructions, aligned and true to fence line and grade.

B. Excavation: Hand-excavate holes for posts, pedestals, and equipment bases/pads, in firm, undisturbed soil to dimensions and depths and at locations according to gate-operator component manufacturer's written instructions and as indicated.

C. Vehicle Loop Detector System: Cut grooves in pavement, bury, and seal wire loop according to manufacturer's written instructions. Connect to equipment operated by detector.

D. Ground electric-powered motors, controls, and other devices according to NFPA 70 and manufacturer's written instructions.

6.01 GROUNDING AND BONDING

A. Comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems."

B. Fence and Gate Grounding:

1. Ground for fence and fence posts shall be a separate system from ground for gate and gate posts.

C. Fences Enclosing Electrical Power Distribution Equipment: Ground according to IEEE C2 unless otherwise indicated.

D. Bonding to Lightning Protection System: Ground fence and bond fence grounding conductor to lightning protection down conductor or lightning protection grounding conductor according to NFPA 780.

E. Comply with requirements in Section 264113 "Lightning Protection for Structures."

7.01 FIELD QUALITY CONTROL

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

B. Grounding Tests: Comply with requirements in Section 264113 "Lightning Protection for Structures."

C. Provide test reports.

8.01 ADJUSTING

A. Gates: Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

B. Automatic Gate Operator: Energize circuits to electrical equipment and devices, start units, and verify proper motor rotation and unit operation.

1. Hydraulic Operator: Purge operating system, adjust pressure and fluid levels, and check for leaks.
2. Test and adjust operators, controls, alarms, and safety devices. Replace damaged and malfunctioning controls and equipment.
3. Lubricate operator and related components.

C. Lubricate hardware and other moving parts.

9.01 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain chain-link fences and gates.

END OF SECTION

SECTION 32 3119
DECORATIVE METAL FENCES AND GATES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Decorative metal gates.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit manufacturer's data sheets on each product to be used, including:

1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Installation methods.

C. Shop Drawings:

1. Indicate plan layout, spacing of components, post foundation dimensions, hardware anchorage, gates, and schedule of components.

D. Manufacturer's Warranty.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum five years documented experience.

1.05 DELIVERY, STORAGE AND HANDLING

A. Store materials in a manner to ensure proper ventilation and drainage. Protect against damage, weather, vandalism and theft.

1.06 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Decorative Metal Fences and Gates:

1. Alumi-Guard: www.alumi-guard.com/#sle.
2. Ameristar Perimeter Security, USA: www.ameristarfence.com/#sle.
3. Ideal Aluminum Products: www.ideal-ap.com/#sle.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Set fence posts in accordance with the manufacturer recommended spacing.

3.04 CLEANING

A. Clean jobsite of excess materials; scatter excess material from post hole excavations uniformly away from posts. Remove excess material if required.

B. Clean fence with mild household detergent and clean water rinse well.

3.05 CLOSEOUT ACTIVITIES

A. See Section 01 7800 - Closeout Submittals, for closeout submittals.

3.06 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair, or replace damaged products before Date of Substantial Completion.

END OF SECTION 32 3119

SECTION 32 3223
SEGMENTAL RETAINING WALLS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

2.01 SUMMARY

A. This Section includes single- and multiple-depth segmental retaining walls with and without soil reinforcement.

B. Related Requirements:

1. Section 312000 "Earth Moving" for excavation for segmental retaining walls.

3.01 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

4.01 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:

1. Environmental Product Declaration (EPD): For each product.

C. Samples: For each color and texture of concrete unit specified. Submit full-size units.

D. Design Submittal: For segmental retaining walls, the Civil Engineer of record will be provided a copy of the Action submittals in addition to the Professional Engineer designing the Segmental Retaining Wall to ensure conformance to the construction documents.

1. The SRW contractor shall provide to the Owner a minimum of 14-days prior to the anticipated start date for the SRW a submittal package including the following:
    a) A set of detailed SRW design plans sealed by a registered professional engineer licensed in the State of Georgia. The professional engineer shall have a minimum of five (5) years of experience in designing retaining wall systems of similar type and size to that which is being proposed. The SRW plans shall include all details, dimensions, quantities and cross sections necessary to construct the SRW and shall include:
    b) Plan, elevation and cross section views for each wall,
    c) Details for cap blocks, coping, or barriers constructed as part of the wall contract,
    d) Construction specifications, and
    e) Computer generated outputs demonstrating compliance with this Specification must be provided.

i. The computer program MSEW (v3.0) based on FHWA NHI-00-043 is acceptable. Detailed hand calculations demonstrating compliance with this Specification must be submitted if no computer program is used for design.

ii. The FHWA method based on NHI-00-043 and AASHTO 98/Demo 82 are the same with respect to external stability and internal stability. The difference between NHI-00-043 and AASHTO 98/Demo 82 is related to connection analyses as follows:

- AASHTO 98/Demo 82 (ASD) is based on *short-term connection tests*, which are commonly done at most testing labs.
- NHI-043 (ASD) is based on *long-term creep connection tests*. NHI-043 (ASD) method is applicable only if a creep connection test is performed.
- If a creep connection test has not been performed, then AASHTO 98/Demo 82 (ASD) must be used for the connection analysis.

iii. Overall stability calculations with respect to global external, compound internal and translation stability can be determined using the following computer program: ReSSA (v3.0).

5.01 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Product Certificates: For each type of segmental retaining wall unit and soil reinforcement from manufacturer.
   1. Include test data for shear strength between segmental retaining wall units according to ASTM D 6916.
   2. Include test data for connection strength between segmental retaining wall units and soil reinforcement according to ASTM D 6638.

C. Product Test Reports: For each type of segmental retaining wall unit and soil reinforcement, for tests performed by a qualified testing agency.
   1. Include test data for freeze-thaw durability of segmental retaining wall units.
   2. Include test data for shear strength between segmental retaining wall units according to ASTM D 6916.
   3. Include test data for connection strength between segmental retaining wall units and soil reinforcement according to ASTM D 6638.

D. Preconstruction test reports.

E. Source quality-control reports.

F. Field quality-control reports.

G. Documentation for the SRW units and soil reinforcement demonstrating compliance with the requirements of this specification including but not limited to SRW compressive strength, absorption and durability; SRW/geosynthetic reinforcement connection and block shear capacity; geosynthetic reinforcement coefficients for direct sliding and interaction; and geosynthetic reinforcement reduction factors for creep, durability, installation damage and pullout.

H. Manufacturer's certification that SRW units meet the requirements of this specification.

I. Manufacturer's certification that the geosynthetic reinforcement meets the requirements of this specification.

J. Contractor's certification that:

1. The specific SRW system proposed for use on this project has been successfully used on a minimum of ten (10) similar projects and has been successfully installed on a minimum of 1,000,000 square feet of retaining walls.
2. The contractor has a minimum of 1,000,000 square feet of experience within the previous five (5) years with the proposed SRW system. Contact names and telephone numbers shall be listed for projects used to document the 1,000,000 square feet.

K. Contractor shall be responsible for providing all required permits for the MSE wall.

6.01 QUALITY ASSURANCE

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

B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects.

1. Build mockup of segmental retaining wall approximately 72 inches long by not less than 36 inches high above finished grade at front of wall.
   a. Include typical soil reinforcement.
   b. Include typical base and cap or finished top construction.
   c. Include backfill to typical finished grades at both sides of wall.
   d. Include typical end construction at one end of mockup.
   e. Include 36-inch return at one end of mockup, with typical corner construction.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

7.01 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage a qualified testing agency to perform the following preconstruction testing:

1. Test soil reinforcement and backfill materials for pullout resistance according to ASTM D 6706.
2. Test soil reinforcement and backfill materials for coefficient of friction according to ASTM D 5321.

8.01 DELIVERY, STORAGE, AND HANDLING

A. Store and handle concrete units and accessories to prevent deterioration or damage due to contaminants, breaking, chipping, or other causes.

B. Store geosynthetics in manufacturer's original packaging with labels intact. Store and handle geosynthetics to prevent deterioration or damage due to sunlight, chemicals, flames, temperatures above 160 deg F or below 32 deg F, and other conditions that might damage them. Verify identification of geosynthetics before use, and examine them for defects as material is placed.

PART 2 - PRODUCTS

1.01 PERFORMANCE REQUIREMENTS

A. Basis of Design: Engage a qualified professional engineer to design segmental retaining walls.

B. Compliance Review: Qualified professional engineer responsible for segmental retaining wall design shall review and approve submittals and source and field quality-control reports for compliance of materials and construction with design.

C. Structural Performance: Engineering design shall be based on the project specific loads and be according to NCMA's "Design Manual for Segmental Retaining Walls."

2.01 SEGMENTAL RETAINING WALL UNITS

A. Concrete Units: ASTM C 1372, Normal Weight, except that maximum water absorption shall not exceed 7 percent by weight and units shall not differ in height more than plus or minus 1/16 inch from specified dimension.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Allan Block Corporation.
    b. Anchor Wall Systems, Inc.
    c. CornerStone Wall Solutions Inc.
    d. GeoStone Retaining Wall Systems, Inc.
    e. GeoWestern, Inc.
    f. ICD Corporation.
    g. Keystone Retaining Wall Systems, Inc.
    h. Risi Stone Systems.
    i. Rockwood Retaining Walls, Inc.
    j. Tensar Earth Technologies, Inc.

k. Versa-Lok Retaining Wall Systems.

2. Provide units that comply with requirements in ASTM C 1372 for freeze-thaw durability.
3. Provide units that interlock with courses above and below by means of integral lugs, lips, or tongues and grooves pins clips splines or hollow cores filled with drainage fill.

B. Regional Materials: If required for LEED, manufacture units within 100 miles of Project site from aggregates and cementitious materials that have been extracted, harvested, or recovered, as well as manufactured, within 100 miles of Project site.

C. Color: As selected by Owner from manufacturer's full range.

D. Shape and Texture: Provide units matching basic shape, dimensions, and face texture of basis-of-design product.

E. Batter: Provide units that offset from course below per manufacturer's recommendation. Contractor to verify that the project specific batter selected does not conflict with the geometry constraints of the site design.

F. Cap Units: Provide cap units with smooth, as-cast top surfaces without holes or lugs.

G. Special Units: Provide corner units, end units, and other shapes as needed to produce segmental retaining walls of dimensions and profiles indicated.

3.01 INSTALLATION MATERIALS

A. Pins: Product supplied by segmental retaining wall unit manufacturer for use with units provided, made from nondegrading polymer reinforced with glass fibers.

B. Clips: Product supplied by segmental retaining wall unit manufacturer for use with units provided, made from nondegrading polymer reinforced with glass fibers.

C. Cap Adhesive: Product supplied or recommended by segmental retaining wall unit manufacturer for adhering cap units to units below.

D. Leveling Base: Comply with requirements in Section 312000 "Earth Moving" for base course.

E. Drainage Fill: Comply with requirements in Section 312000 "Earth Moving" for drainage course.

F. Fill material used to construct the soil reinforced and retained zones (where applicable) shall consist of one of the following inorganic soil types according to their USCS designations (GP, GW, SW, SP, SM). The fill material must also meet the gradation below and the strength requirements noted below. Maximum particle size to be ¾-inches.

Sieve Size	Percent Passing
¾-inch	75-100
No. 4	20-100

No. 40	0-60
No. 200	0-35

1. Less than 35% passing the No. 200 sieve per ASTM D422.
2. Materials passing the No. 40 sieve should have a liquid limit less than 35 and a plasticity index less than 10 as per ASTM D4318.
3. An effective internal angle of friction greater than or equal to 30-degrees per ASTM D2166 or D3080 at the compaction standard.
4. The reinforced fill material shall have a maximum dry unit weight greater than or equal to 100-pcf as determined by standard Proctor (ASTM D 698).
5. Fill containing brush, sod, peat, roots, or other organic, perishable, or deleterious matter including, but not limited to snow, ice, or frozen soils, shall be considered unsuitable material and shall be removed. Less than 0.5% organic material.

G. Use of an effective friction angle greater than 30-degrees for design shall be verified by appropriate testing submitted to and approved by the Owners engineer prior to construction.

H. The pH of the backfill soil shall be between 5 and 8 when tested in accordance with ASTM G51.

I. Nonreinforced-Soil Fill: Comply with requirements in Section 312000 "Earth Moving" for satisfactory soils.

J. Drainage Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent.
   1. Apparent Opening Size: No. 70 to 100 sieve, maximum; ASTM D 4751.
   2. Minimum Grab Tensile Strength: 110 lb; ASTM D 4632.
   3. Minimum Weight: 6 oz./sq. yd.

K. Soil Reinforcement: Product specifically manufactured for use as soil reinforcement and as follows:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Bonar Inc.; a Low & Bonar company.
      b. Hanes Geo Components; Leggett & Platt Incorporated.
      c. Huesker Inc.
      d. Mirafi Construction Products.
      e. Propex Fabrics Inc.
      f. Strata Systems, Inc.
      g. Synteen Technical Fabrics, Inc.

h. Tenax Corporation - USA.
i. Tensar Earth Technologies, Inc.
j. Versa-Lok Retaining Wall Systems.
k. Webtec, Inc.

2. Product Type: Knitted or woven geogrid made from polyester yarns with a protective coating, molded geogrid made from high-density polyethylene, or woven geotextile made from polyamides, polyesters, or polyolefins.

4.01 SOURCE QUALITY CONTROL

A. Factory test and inspect each roll of soil reinforcement for minimum average roll values for geosynthetic index property tests, including the following:
1. Weight.
2. Grab or single-rib strength.
3. Aperture opening.
4. Rib or yarn size.

PART 3 - EXECUTION

1.01 PREPARATION AND EXCAVATION

A. Include all means of subsurface improvement as required.
B. Comply with all state and local requirements for execution of the work, including local building codes and current OSHA excavation regulations. The General Contractor is responsible for stability of the area during excavation and wall construction. Any excavation support required to maintain/protect existing structures, utilities, landscape features or property shall be the responsibility of the General Contractor.
C. Prior to undertaking any grading or excavation of the site, confirm the location of the retaining walls and all underground features, including utility locations within the area of construction. Ensure surrounding structures are protected from effects of wall excavation.
D. Coordinate installation of underground utilities with wall installation.
E. Control surface water drainage and prevent inundation of the MSE wall area during construction.
F. Contractor shall excavate to the lines and grades shown on the construction drawings. Owner’s representative shall inspect the excavation and approve prior to placement of leveling material or fill soils. Proofroll foundation area and perform on-site bearing capacity tests as directed to determine if foundation improvement is required.
G. Before construction of the reinforced wall, the contractor shall clear and grub the fill zone area removing topsoil, brush, sod, organics, or other deleterious materials. Any unsuitable soils shall be over-excavated and replaced before placing additional fill soils.

H. Over-excavation and replacement of unsuitable foundation soils and replacement with approved compacted fill will be compensated as agreed upon with the Owner.

I. Foundation bearing capacity shall be inspected by a qualified geotechnical testing company. The engineer shall confirm with a field inspection that the foundation has been properly prepared and the bearing capacity requirements are appropriate before placement of the geosynthetic reinforced zone.

1. Required Bearing Capacity (psf) > 3,000 psf "or" = Level Backfill: $q = \gamma H*1.3$
= 2H:1V Backfill: $q = \gamma H*1.6$

J. A pre-construction meeting shall be conducted by the General Contractor prior to beginning construction on segmental retaining walls. Owner and Architect shall be notified of the date, time, and location of the meeting. Mandatory attendees include the General Contractor, the wall design engineer of record, the project geotechnical engineer, the Contractor's testing agency, Owner's independent testing laboratory, and representatives of all sub-contractors involved with the foundation preparation, erection, and backfilling of the MSE wall. Meeting topics shall include, but are not limited to contractor qualifications as stated above; schedule and phasing of wall construction; coordination with other on-site construction activities; responsibilities of parties; and sources, quality, and acceptance of materials. Location and coordination of backfill soil sources for the retaining wall must be discussed and acknowledged prior to any site grading. If contractor fails to protect and utilize soils designated as suitable backfill for MSE walls contractor will be responsible for providing appropriate suitable backfill at their expense and at no additional cost to owner.

3.2 **BASE LEVELING PAD**

A. Leveling pad material shall be placed to the lines and grades shown on the construction drawings, to a minimum thickness of 6-inches and extend laterally a minimum of 6-inches in front and behind the concrete masonry unit.

B. Leveling pad materials to be compacted to a minimum 95% Standard Proctor density per ASTM D-698.

C. Leveling pad shall be prepared to insure full contact to the base surface of the SRW units.

D. First course of units shall be placed on the leveling pad at the appropriate line and grade. Alignment and level shall be checked in all directions and ensure that all units are in full contact with the base and properly seated.

3.3 **SRW UNIT INSTALLATION**

A. Place the front of unit's side-by-side. Do not leave gaps between adjacent units. Layout of corners and curves shall be in accordance with manufacturer's recommendations.

B. Install mechanical shear/connecting devices per manufacturer's recommendation.
C. Place and compact drainage fill within (frictional systems with vertically oriented cores) and behind wall units (all SRW systems). Place and compact backfill soil behind drainage fill. Follow wall erection and drainage fill closely with structure backfill.
D. Maximum-stacked vertical height of wall units, prior to unit drainage fill and backfill placement and compaction, shall not exceed two courses or 16-inches whichever is less.

3.4 **GEOSYNTHETIC INSTALLATION**

A. Geosynthetic reinforcement shall be oriented with the highest strength axis (machine direction) perpendicular to the wall alignment. Contractor shall verify correct orientation.
B. Reinforced fill zone length is measured from the backside of the masonry block units unless otherwise noted on drawings.
C. Geosynthetic reinforcement shall be continuous throughout embedment lengths and placed side-by-side to provide 100% coverage at each level. Spliced connections between shorter pieces of geosynthetic or gaps between adjacent pieces of geosynthetic are not permitted.
D. Before placing fill, the geosynthetic materials shall be placed to lay flat, or slightly sloping downward away from the wall face on compacted backfill and mechanically attached to the masonry block units. Place the next course of masonry block units over the geosynthetic. The geosynthetic shall be pulled taut to remove any slack in the geosynthetics, and anchored prior to backfill placement on the geosynthetic.
E. Tracked construction equipment shall not be operated directly on the geosynthetic reinforcement. A minimum fill thickness of 6 inches is required for operation of tracked vehicles over the geosynthetic reinforcement. Turning of tracked vehicles should be kept to a minimum to prevent tracks from displacing the fill and the geosynthetic reinforcement.
F. Rubber-tired vehicles may pass over the geosynthetic reinforcement at slow speeds, less than 10-mph. Sudden braking and sharp turning shall be avoided.
G. Geosynthetic reinforcement shall be cut next to the cross machine direction (CMD) apertures. Cross machine direction apertures shall be placed along the front face of the MSE wall.

5.01 REINFORCED BACKFILL PLACEMENT

A. Construct wall in location and to top and bottom elevations shown on grading plans.
B. Reinforced backfill shall be placed, spread, and compacted in such a manner that minimizes the development of slack in the geosynthetic and installation damage. Reinforced backfill materials shall be placed from the wall face back toward the ends of the geosynthetic to ensure further tensioning of the reinforcement.

C. Reinforced backfill shall be placed and compacted in lifts not to exceed 6-inches where hand compaction is used, or 8-inches where heavy compaction equipment is used. Lift thickness shall be decreased to achieve the required density as required.

D. Reinforced backfill shall be compacted to 95% of the maximum density as determined by ASTM D698. The moisture content of the backfill material prior to and during compaction shall be uniformly distributed throughout each layer and shall be within a range of 2% below to 2% above optimum moisture content.

E. Fill shall be placed in horizontal layers not exceeding 6-inches in uncompacted thickness for zones where compaction is accomplished with hand-operated equipment. Only lightweight hand-operated equipment shall be allowed within 4-feet from the face of the SRW unit.

F. The infill soil shall be compacted in maximum 8-inch compacted lifts to the following minimum densities (percentage of the maximum standard Proctor ASTM D698):
   1. fine grained (SM) soils to a minimum of 95 percent Standard Proctor within -2/+2 percent of optimum moisture content, whichever is greater; and
   2. coarse grained (GP, GW, SW, SP) soils to a minimum of 95 percent Standard Proctor.

G. Testing methods and frequency, and verification of material specifications and compaction shall be the responsibility of the project geotechnical engineer.

H. Wall including reinforced mass shall be constructed on foundation soils having a minimum internal friction angle of 30-degrees to a minimum depth of one third (1/3) the wall height or a net allowable bearing pressure as stated in Section 3.1.I.

I. Reinforced fill shall be compacted to the top of each row of masonry block units prior to the placement of the next row of masonry block units.

J. SRW units shall be placed not more than 2-courses or 16-inch above level backfill.

K. Contractor shall have an approved set of plans and specifications on site at all times during construction of the wall.

6.01 RETAINED BACKFILL PLACEMENT

A. Retained backfill shall be compacted to a minimum 95 percent Standard Proctor density (ASTM D698) in landscape areas. Retained backfill located in the upper two feet below crest slopes or pavement structures shall be compacted to a minimum 98 percent Standard Proctor density or to the density recommended by the project geotechnical engineer.

7.01 CAP INSTALLATION

A. If applicable, cap units shall be permanently secured to the masonry block units using an approved construction adhesive conforming to ASTM 2339.

B. The general contractor shall verify the in-place top of wall elevation before installing the top units. Top units may require shifting to comply with the design elevations.

C. Incorporate surface water drainage control (swale) into the finished grade at top of wall, as shown on the civil engineers grading and drainage plan, where applicable.

8.01 AS-BUILT CONSTRUCTION TOLERANCES

A. Vertical alignment: ±1.25-inch over any 10.0-foot distance.

B. Wall Batter: Must be within 2.0-degrees of design batter.

C. Horizontal alignment: ±1.5-inch over any 10.0-foot distance and in corners, bends and curves ± 1.0-foot of the theoretical location.

D. Maximum horizontal gap between erected units shall be 1/8-inch.

9.01 FIELD QUALITY CONTROL

A. The Owner shall engage inspection and testing services, including independent laboratories, to province quality assurance and testing services during construction. As a minimum, quality assurance testing should include foundations soil inspection, soil and backfill testing, verification of design parameters, and observation of construction for general compliance with design drawings and specifications. This does not relieve the Contractor form securing the necessary construction quality control testing during construction.

B. Quality control testing and inspections services shall only be performed by qualified soil technicians and geotechnical engineers.

C. Quality control testing, as a minimum shall include:

1. Special inspector shall verify / document each of the following:
    a. Correct reinforcement type, elevation, length, orientation, reinforcement tensioning procedures, placement of drainage materials and outlets to be observed by the project geotechnical engineer.
    b. Verification of entire foundation (entire reinforcement length, L) must be observed by the project geotechnical engineer.
    c. Field location in plan and elevation, wall batter to be observed by the project surveyor.
2. Reinforced Soil Testing
    a. Every new soil type and/or every 2,000 cy run pH, Atterberg Limits, Sieve Analysis, Proctor new soil type per geotechnical field personnel.
    b. Triaxial Test on every appreciable different soil type based on index testing.
    c. Run Consolidated-Undrained Triaxial Shear Tests and report the stress strain test results as well as present the Mohr-Coulomb failure diagram for peak and residual stress levels, as required by ASTM. The geotechnical

consultant will provide a recommended effective internal friction angle based on their results.

d. Run compaction tests as follows:
    1) Every two-foot change in height and interval of 100-feet of Wall length.
    2) Run 4 compaction tests one within 4-feet of face, and three others randomly throughout the reinforced soil zone.

3. Retained Soils Testing:
    a. Every new soil type and/or every 2,500-cy run Atterberg Limits, Sieve Analysis, Proctor per Geotech Field Personnel and if different from Reinforced Soil.
    b. Cohesion in the retained soil should not be used in design even if the failure envelope determined from shear tests indicates that such value temporarily exists.
    c. Run compaction tests as follows:
        1) Every two-foot change in height and interval of 200-feet of Wall length.
        2) Run 3 compaction tests one within 3-feet of reinforced zone and two others randomly throughout the retained soil zone.
4. Foundation Soils Testing
    a. Strength testing at time of design. Generally, one in the worst area would suffice.
    b. IF foundation fill is required, treat as if it were reinforced soil fill, those criteria apply.
    c. Verify foundation bearing capacity by probe rod and static cone penetrometer testing every 10-feet of wall length for entire Reinforced soil zone. Also use hand auger borings to a depth of 12-feet or the reinforcement length whichever is shorter, every 30-feet along the wall length at third points of the reinforcement length.
    d. For walls in excess of 20-feet tall, power auger holes with cone or SPT testing to depth equal to twice the wall height is required, every 50-feet of wall length or as required by the geotech to establish appropriate allowable bearing capacity, unless already performed in pre-Wall design geotechnical investigation. If there is soft soil, it should be done to the bottom of the soft soil layer.
5. Please note that the special inspector must notify the contractor of out-of-tolerance work. The inspector cannot observe or test and let out-of-spec work

be covered. With all of the parameters established in the MSE wall specifications and the guidelines for testing frequency outlined above the geotechnical engineer can perform their role within those parameters.

6. The MSE wall shall be staked in the field and located as per the civil grading plan by a registered Georgia Surveyor. Stakes shall be placed on 25-foot intervals so as to identify location along the wall alignment with respect to geogrid placement and soil compaction tests.

10.01 CHANGES TO GEOSYNTHETIC REINFORCEMENT LAYOUT AND PLACEMENT

A. No changes to the masonry block or geosynthetic reinforcement layout, including but not limited to, length, geosynthetic type, or elevation shall be made without the expressed prior written consent of the wall design engineer.

11.01 SITE DRAINAGE

A. Backfill shall be graded a minimum of 2-percent away from the wall face and rolled at the end of each work day to prevent ponding of water on the surface of the reinforced soil mass. A berm at the crest of the wall shall be constructed at the end of each workday to prevent rainwater from overtopping the wall. The Contractor shall not allow surface runoff from adjacent areas to enter the wall construction site.

B. Care shall be taken not to contaminate the filter fabric, unit fill, blanket drains, chimney drains and/or the drainage composite with poor drainage material such as fine grained silt and clay.

C. Drainage aggregate shall extend one foot behind the back of the masonry block units to alleviate the build up of possible hydrostatic pressure behind the masonry block units.

D. The engineering, design, analysis, detailing and mitigation of surface water control related to the MSE wall shall be the responsibility of the project civil engineer.

E. The engineering, design, analysis, detailing and mitigation of groundwater seepage shall be the collective responsibility of the project geotechnical engineer and MSE wall engineer.

12.01 GENERAL CONSTRUCTION NOTES

A. Construction shall conform to all state and local and manufacturers' requirements.

B. General or grading contractor is responsible for location and protection of underground utilities in the vicinity of the wall and for maintaining safe excavations and working conditions.

C. All utilities located within the reinforced zone are to be installed concurrently with the reinforced backfill placement.

D. All liquid carrying utilities located within the reinforced backfill are to be encased in a drainage aggregate and geotextile filter. All liquid carrying utilities located outside of,

but within 100-feet of the reinforced backfill shall be water tight to prevent migration of water into the surrounding soils.

E. Wall elevation views and locations and geometry of existing structures must be verified by the owner or owner's representative prior to construction.

F. Backfill and compact in front of wall prior to exceeding 5.0-feet of wall height.

G. A copy of the design report and the wall drawings should be provided to future owners of the developed property to provide them with a record of the location of the reinforced zone and recommendations regarding permissible construction activities.

13.01 WALL CERTIFICATION

A. A wall certification letter should be submitted at the completion of construction from the wall design engineer of record stating that the wall was designed, constructed, and tested in accordance with the project specifications. A pre-construction meeting should be held by all parties involved in the design, construction, and testing of the MSE wall(s) to review the design documents and establish roles of responsibility for wall certification.

END OF SECTION

SECTION 33 0500
COMMON WORK RESULTS FOR UTILITIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

2.01 SUMMARY

A. This Section includes the following:
   1. Piping joining materials.
   2. Transition fittings.
   3. Dielectric fittings.
   4. Sleeves.
   5. Identification devices.
   6. Grout.
   7. Flowable fill.
   8. Piped utility demolition.
   9. Piping system common requirements.
   10. Equipment installation common requirements.
   11. Painting.
   12. Concrete bases.
   13. Metal supports and anchorages.

3.01 DEFINITIONS

A. Exposed Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions.

B. Concealed 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.

C. ABS: Acrylonitrile-butadiene-styrene plastic.

D. CPVC: Chlorinated polyvinyl chloride plastic.

E. PE: Polyethylene plastic.

F. PVC: Polyvinyl chloride plastic.

4.01 ACTION SUBMITTALS

A. Product Data: For the following:
   1. Dielectric fittings.
   2. Identification devices.

5.01 INFORMATIONAL SUBMITTALS

A. Welding certificates.

6.01 QUALITY ASSURANCE

A. Steel Support Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Steel Piping Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. Comply with ASME A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.

7.01 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.

8.01 COORDINATION

A. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

B. Coordinate installation of identifying devices after completing covering and painting if devices are applied to surfaces.

C. Coordinate size and location of concrete bases. Formwork, reinforcement, and concrete requirements are specified in Section 033000 "Cast-in-Place Concrete."

PART 2 - PRODUCTS

1.01 PIPING JOINING MATERIALS

A. 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 otherwise 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.

B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

C. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

D. Solder Filler Metals: ASTM B32, lead-free alloys. Include water-flushable flux according to ASTM B813.

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/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

G. Solvent Cements for Joining Plastic Piping:
   1. ABS Piping: ASTM D2235.
   2. CPVC Piping: ASTM F493.
   3. PVC Piping: ASTM D2564. Include primer according to ASTM F656.
   4. PVC to ABS Piping Transition: ASTM D3138.

H. Fiberglass Pipe Adhesive: As furnished or recommended by pipe manufacturer.

2.01 TRANSITION FITTINGS

A. Transition Fittings, General: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.

B. Transition Couplings NPS 1-1/2 and Smaller:
   1. Underground Piping: Manufactured piping coupling or specified piping system fitting.
   2. Aboveground Piping: Specified piping system fitting.

C. AWWA Transition Couplings NPS 2 and Larger:
   1. Description: AWWA C219, metal sleeve-type coupling for underground pressure piping.

D. Plastic-to-Metal Transition Fittings:
   1. Description: CPVC and PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint or threaded end.

E. Plastic-to-Metal Transition Unions:
   1. Description: MSS SP-107, CPVC and PVC four-part union. Include brass or stainless-steel threaded end, solvent-cement-joint or threaded plastic end, rubber O-ring, and union nut.

F. Flexible Transition Couplings for Underground Nonpressure Drainage Piping:
   1. Description: ASTM C1173 with elastomeric sleeve, ends same size as piping to be joined, and corrosion-resistant metal band on each end.

3.01 DIELECTRIC FITTINGS

A. Dielectric Fittings, General: Assembly of copper alloy and ferrous materials or ferrous material body with separating nonconductive insulating material suitable for system fluid, pressure, and temperature.

B. Dielectric Unions:
   1. Description: Factory fabricated, union, NPS 2 and smaller.
      a. Pressure Rating: 250 psig at 180 deg F.
      b. End Connections: Solder-joint copper alloy and threaded ferrous; threaded ferrous.

C. Dielectric Flanges:
   1. Description: Factory-fabricated, bolted, companion-flange assembly, NPS 2-1/2 to NPS 4 and larger.
      a. Pressure Rating: 300 psig.
      b. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Kits:
   1. Description: Nonconducting materials for field assembly of companion flanges, NPS 2-1/2 and larger.
      a. Pressure Rating: 150 psig minimum.
      b. Gasket: Neoprene or phenolic.
      c. Bolt Sleeves: Phenolic or polyethylene.
      d. Washers: Phenolic with steel backing washers.

E. Dielectric Couplings:
   1. Description: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining, NPS 3 and smaller.
      a. Pressure Rating: 300 psig at 225 deg F.
      b. End Connections: Threaded.

F. Dielectric Nipples:
   1. Description: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining.
      a. Pressure Rating: 300 psig at 225 deg F.
      b. End Connections: Threaded or grooved.

4.01 SLEEVES

A. Mechanical sleeve seals for pipe penetrations are specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

B. Galvanized-Steel Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

C. Steel Pipe Sleeves: ASTM A53/A53M, Type E, Grade B, Schedule 40, galvanized, plain ends.
D. Cast-Iron Sleeves: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
E. Molded PVC Sleeves: Permanent, with nailing flange for attaching to wooden forms.
F. PVC Pipe Sleeves: ASTM D1785, Schedule 40.
G. Molded PE Sleeves: Reusable, PE, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

5.01 IDENTIFICATION DEVICES

A. General: Products specified are for applications referenced in other utilities Sections. If more than single type is specified for listed applications, selection is Installer's option.
B. Equipment Nameplates: Metal permanently fastened to equipment with data engraved or stamped.
    1. Data: Manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and essential data.
    2. Location: Accessible and visible.
C. Stencils: Standard stencils prepared with letter sizes complying with recommendations in ASME A13.1. Minimum letter height is 1-1/4 inches for ducts, and 3/4 inch for access door signs and similar operational instructions.
    1. Material: Fiberboard or Brass.
    2. Stencil Paint: Exterior, oil-based, alkyd-gloss black enamel, unless otherwise indicated. Paint may be in pressurized spray-can form.
    3. Identification Paint: Exterior, oil-based, alkyd enamel in colors according to ASME A13.1, unless otherwise indicated.
D. Snap-on Plastic Pipe Markers: Manufacturer's standard preprinted, semirigid, snap-on type. Include color-coding according to ASME A13.1, unless otherwise indicated.
E. Pressure-Sensitive Pipe Markers: Manufacturer's standard preprinted, color-coded, pressure-sensitive-vinyl type with permanent adhesive.
F. Pipes with OD, Including Insulation, Less Than 6 Inches: Full-band pipe markers, extending 360 degrees around pipe at each location.
G. Pipes with OD, Including Insulation, 6 Inches and Larger: Either full-band or strip-type pipe markers, at least three times letter height and of length required for label.
H. Lettering: Manufacturer's standard preprinted captions as selected by Architect.
I. Lettering: Use piping system terms indicated and abbreviate only as necessary for each application length.

1. Arrows: Either integrally with piping system service lettering to accommodate both directions of flow, or as separate unit on each pipe marker to indicate direction of flow.

J. Plastic Tape: Manufacturer's standard color-coded, pressure-sensitive, self-adhesive vinyl tape, at least 3 mils thick.
   1. Width: 1-1/2 inches on pipes with OD, including insulation, less than 6 inches; 2-1/2 inches for larger pipes.
   2. Color: Comply with ASME A13.1, unless otherwise indicated.

K. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch sequenced numbers. Include 5/32-inch hole for fastener.
   1. Material: 0.032-inch- thick, polished brass or aluminum.
   2. Material: 0.0375-inch- thick stainless steel.
   3. Material: 3/32-inch- thick plastic laminate with 2 black surfaces and a white inner layer.
   4. Material: Valve manufacturer's standard solid plastic.
   5. Size: 1-1/2 inches in diameter, unless otherwise indicated.
   6. Shape: As indicated for each piping system.

L. Valve Tag Fasteners: Brass, wire-link or beaded chain; or brass S-hooks.

M. Engraved Plastic-Laminate Signs: ASTM D709, Type I, cellulose, paper-base, phenolic-resin-laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white melamine subcore, unless otherwise indicated. Fabricate in sizes required for message. Provide holes for mechanical fastening.
   1. Engraving: Engraver's standard letter style, of sizes and with terms to match equipment identification.
   2. Thickness: 1/16 inch, for units up to 20 sq. in. or 8 inches in length, and 1/8 inch for larger units.
   3. Fasteners: Self-tapping, stainless-steel screws or contact-type permanent adhesive.

N. Plastic Equipment Markers: Manufacturer's standard laminated plastic, in the following color codes:
   1. Green: Cooling equipment and components.
   2. Yellow: Heating equipment and components.
   3. Brown: Energy reclamation equipment and components.
   4. Blue: Equipment and components that do not meet criteria above.
   5. Hazardous Equipment: Use colors and designs recommended by ASME A13.1.
   6. Terminology: Match schedules as closely as possible. Include the following:
      a. Name and plan number.

b. Equipment service.
c. Design capacity.
d. Other design parameters such as pressure drop, entering and leaving conditions, and speed.

7. Size: 2-1/2 by 4 inches for control devices, dampers, and valves; 4-1/2 by 6 inches for equipment.

O. Plasticized Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with mat finish suitable for writing.
1. Size: 3-1/4 by 5-5/8 inches.
2. Fasteners: Brass grommets and wire.
3. Nomenclature: Large-size primary caption such as DANGER, CAUTION, or DO NOT OPERATE.

P. Lettering and Graphics: Coordinate names, abbreviations, and other designations used in piped utility identification with corresponding designations indicated. Use numbers, letters, and terms indicated for proper identification, operation, and maintenance of piped utility systems and equipment.
1. Multiple Systems: Identify individual system number and service if multiple systems of same name are indicated.

6.01 GROUT

A. Description: ASTM C1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
1. Characteristics: Post hardening, volume adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psi, 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

7.01 FLOWABLE FILL

A. Description: Low-strength-concrete, flowable-slurry mix.
1. Cement: ASTM C150, Type I, portland.
2. Density: 115- to 145-lb/cu. ft.
3. Aggregates: ASTM C33, natural sand, fine and crushed gravel or stone, coarse.
4. Aggregates: ASTM C33, natural sand, fine.
5. Admixture: ASTM C618, fly-ash mineral.
6. Water: Comply with ASTM C94/C94M.
7. Strength: 100 to 200 psig at 28 days.

PART 3 - EXECUTION

1.01 PIPED UTILITY DEMOLITION

A. Refer to Section 024119 "Selective Demolition" for general demolition requirements and procedures.

B. Disconnect, demolish, and remove piped utility systems, equipment, and components indicated to be removed.

1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
2. Piping to Be Abandoned in Place: Drain piping. Fill abandoned piping with flowable fill, and cap or plug piping with same or compatible piping material.
3. Equipment to Be Removed: Disconnect and cap services and remove equipment.
4. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make operational.
5. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

2.01 DIELECTRIC FITTING APPLICATIONS

A. Dry Piping Systems: Connect piping of dissimilar metals with the following:

1. NPS 2 and Smaller: Dielectric unions.
2. NPS 2-1/2 to NPS 12: Dielectric flanges or dielectric flange kits.

B. Wet Piping Systems: Connect piping of dissimilar metals with the following:

1. NPS 2 and Smaller: Dielectric couplings no staining or dielectric nipples no staining.
2. NPS 2-1/2 to NPS 4: Dielectric nipples.
3. NPS 2-1/2 to NPS 8: Dielectric nipples or dielectric flange kits.
4. NPS 10 and NPS 12: Dielectric flange kits.

3.01 PIPING INSTALLATION

A. Install piping according to the following requirements and utilities Sections specifying piping systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on the Coordination Drawings.

C. 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.
D. Install piping to permit valve servicing.
E. Install piping at indicated slopes.
F. Install piping free of sags and bends.
G. Install fittings for changes in direction and branch connections.
H. Select system components with pressure rating equal to or greater than system operating pressure.
I. Sleeves are not required for core-drilled holes.
J. Permanent sleeves are not required for holes formed by removable PE sleeves.
K. Install sleeves for pipes passing through concrete and masonry walls 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 equipment areas or other wet areas 2 inches above finished floor level.
    2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
        a. PVC Pipe Sleeves: For pipes smaller than NPS 6.
        b. Steel Sheet Sleeves: For pipes NPS 6 and larger, penetrating gypsum-board partitions.
L. Verify final equipment locations for roughing-in.
M. Refer to equipment specifications in other Sections for roughing-in requirements.

4.01 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and utilities 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. 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.
E. Welded Joints: Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

F. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

G. Grooved Joints: Assemble joints with grooved-end pipe coupling with coupling housing, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.

H. Soldered Joints: Apply ASTM B813 water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B828 or CDA's "Copper Tube Handbook," using lead-free solder alloy (0.20 percent maximum lead content) complying with ASTM B32.

I. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

J. Pressure-Sealed Joints: Assemble joints for plain-end copper tube and mechanical pressure seal fitting with proprietary crimping tool to according to fitting manufacturer's written instructions.

K. Plastic Piping Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
   1. Comply with ASTM F402 for safe-handling practice of cleaners, primers, and solvent cements.
   2. ABS Piping: Join according to ASTM D2235 and ASTM D2661 appendixes.
   3. CPVC Piping: Join according to ASTM D2846/D2846M Appendix.
   4. PVC Pressure Piping: Join schedule number ASTM D1785, PVC pipe and PVC socket fittings according to ASTM D2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D2855.
   5. PVC Nonpressure Piping: Join according to ASTM D2855.
   6. PVC to ABS Nonpressure Transition Fittings: Join according to ASTM D3138 Appendix.

L. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D3139.

M. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D3212.

N. Plastic Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D2657.
   1. Plain-End PE Pipe and Fittings: Use butt fusion.
   2. Plain-End PE Pipe and Socket Fittings: Use socket fusion.

O. Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

5.01 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. Install dielectric fittings at connections of dissimilar metal pipes.

6.01 EQUIPMENT INSTALLATION

A. Install equipment level and plumb, unless otherwise indicated.

B. Install equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference with other installations. Extend grease fittings to an accessible location.

C. Install equipment to allow right of way to piping systems installed at required slope.

7.01 PAINTING

A. Painting of piped utility systems, equipment, and components is specified in Section 099113 "Exterior Painting," Section 099123 "Interior Painting," and Section 099600 "High-Performance Coatings."

B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

8.01 IDENTIFICATION

A. Piping Systems: Install pipe markers on each system. Include arrows showing normal direction of flow.
   1. Stenciled Markers: According to ASME A13.1.
   2. Plastic markers, with application systems. Install on insulation segment if required for hot noninsulated piping.
   3. Locate pipe markers on exposed piping according to the following:
      a. Near each valve and control device.
      b. Near each branch, excluding short takeoffs for equipment and terminal units. Mark each pipe at branch if flow pattern is not obvious.
      c. Near locations where pipes pass through walls or floors or enter inaccessible enclosures.
      d. At manholes and similar access points that permit view of concealed piping.
      e. Near major equipment items and other points of origination and termination.

B. Equipment: Install engraved plastic-laminate sign or equipment marker on or near each major item of equipment.

1. Lettering Size: Minimum 1/4 inch high for name of unit if viewing distance is less than 24 inches, 1/2 inch high for distances up to 72 inches, and proportionately larger lettering for greater distances. Provide secondary lettering two-thirds to three-fourths of size of principal lettering.
2. Text of Signs: Provide name of identified unit. Include text to distinguish among multiple units, inform user of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.

C. Adjusting: Relocate identifying devices that become visually blocked by work of this or other Divisions.

9.01 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 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 Section 033000 "Cast-in-Place Concrete."

10.01 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Section 055000 "Metal Fabrications" for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor piped utility materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

11.01 GROUTING

A. Mix and install grout for 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

SECTION 33 1000
SITE WATER DISTRIBUTION PIPING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes water-distribution piping and related components outside the building for domestic water service and fire-service mains.
B. Utility-furnished products include water meters that will be furnished to the site, ready for installation, or installed by the utility.
C. Provide labor, material, and equipment for the construction of the water distribution system as shown on the drawings from taps to the public system to building plumbing connection.
D. Testing and disinfection of the installed system is incidental to the work.
E. Provide construction staking in accordance with generally accepted practice for layout of underground utilities.
F. The work includes coordination with building plumbing Contractors and building plumbing plans and fire protection design.
G. Coordinate responsibilities for installation of meters, vaults, check valves, backflow preventers, taps, valves and appurtenances with the local jurisdiction.
H. Identify fees related to water main installation and clarify prior to bid submittal whether tap, meter, and other fees will be paid by the Owner or by the Contractor. Identify fees for installation of water services and provide a written report to the Owner.

1.03 DEFINITIONS

A. ASME: American Society of Mechanical Engineers.
B. ASSE: American Society of Safety Engineers.
C. ASTM: American Society for Testing and Materials.
D. AWWA: American Water Works Association.
E. DIP: Ductile Iron Pipe.
F. EPDM: Ethylene propylene diene monomer rubber.
G. FDA: Food and Drug Administration.
H. FM: Factory Mutual.
I. FMG: Factory Mutual Global.
J. MSS: Manufacturer’s Standardization Society.
K. NFPA: National Fire Protection Association.
L. NPS: Nominal Pipe Size.
M. NSF: National Science Foundation.
O. OS&Y: Open Stem and Yoke.
P. PVC: Polyvinyl chloride plastic.
Q. UL: Underwriter’s Laboratory.

1.04 ACTION SUBMITTALS

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

B. Shop Drawings: Detail precast concrete vault assemblies and indicate dimensions, method of field assembly, and components.

1. Wiring Diagrams: Power, signal, and control wiring for alarms.

1.05 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: For piping and specialties including relation to other services in same area, drawn to scale. Show piping and specialty sizes and valves, meter and specialty locations, and elevations.

B. Field quality-control test reports.

C. Operation and Maintenance Data: For water valves and specialties to include in emergency, operation, and maintenance manuals.

1.06 QUALITY ASSURANCE

A. Regulatory Requirements:

1. Comply with requirements of utility company supplying water. Include coordination of tapping of water mains and backflow prevention.
2. Comply with standards of authorities having jurisdiction for potable-water-service piping, including materials, installation, testing, and disinfection.
3. Comply with standards of authorities having jurisdiction for fire-suppression water-service piping, including materials, hose threads, installation, and testing.

B. Piping materials shall bear label, stamp, or other markings of specified testing agency.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. Comply with ASTM F 645 for selection, design, and installation of thermoplastic water piping.

E. Comply with FMG's "Approval Guide" or UL's "Fire Protection Equipment Directory" for fire-service-main products.

F. NFPA Compliance: Comply with NFPA 24 for materials, installations, tests, flushing, and valve and hydrant supervision for fire-service-main piping for fire suppression.

G. NSF Compliance:

1. Comply with NSF 14 for plastic potable-water-service piping.
2. Comply with NSF 61 for materials for water-service piping and specialties for domestic water.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Preparation for Transport: Prepare valves, including fire hydrants, according to the following:

1. Ensure that valves are dry and internally protected against rust and corrosion.
2. Protect valves against damage to threaded ends and flange faces.
3. Set valves in best position for handling. Set valves closed to prevent rattling.

B. During Storage: Use precautions for valves, including fire hydrants, according to the following:

1. Do not remove end protectors unless necessary for inspection; then reinstall for storage.
2. Protect from weather. Store indoors and maintain temperature higher than ambient dew-point temperature. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.

C. Handling: Use sling to handle valves and fire hydrants if size requires handling by crane or lift. Rig valves to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.
D. Deliver piping 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.
E. Protect stored piping from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.
F. Protect flanges, fittings, and specialties from moisture and dirt.
G. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.

1.08 FIELD CONDITIONS

A. Interruption of Existing Water-Distribution Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water-distribution service according to requirements indicated:
1. Notify Owner in writing no fewer than 72 hours in advance of proposed interruption of service.

1.09 COORDINATION

A. Coordinate connection to water main with utility company.
B. Coordinate installation of the water distribution system with grading and paving operations.
C. Provide water mains when grade is within 6 inches of final grade and prior to paving base installation.
D. After completion and testing of the water distribution system, provide the Owner with the Contractor's Material and Test Certificates required by the National Fire Protection Association.

PART 2 PRODUCTS

2.01 COPPER TUBE AND FITTINGS

A. Soft Copper Tube: ASTM B 88, Type K and ASTM B 88, Type L, water tube, annealed temper.
1. Copper, Solder-Joint Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint pressure type. Furnish only wrought-copper fittings if indicated.
2. Copper, Pressure-Seal Fittings:
a. NPS 2 and Smaller: Wrought-copper fitting with EPDM O-ring seal in each end.

b. NPS 2-1/2 to NPS 4: Bronze fitting with stainless-steel grip ring and EPDM O-ring seal in each end.

B. Hard Copper Tube: ASTM B 88, Type K and ASTM B 88, Type L, water tube, drawn temper.
1. Copper, Solder-Joint Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint pressure type. Furnish only wrought-copper fittings if indicated.
2. Copper, Pressure-Seal Fittings:
a. NPS 2 and Smaller: Wrought-copper fitting with EPDM O-ring seal in each end.
b. NPS 2-1/2 to NPS 4: Bronze fitting with stainless-steel grip ring and EPDM O-ring seal in each end.

C. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end. Furnish Class 300 flanges if required to match piping.

D. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

2.02 DUCTILE-IRON PIPE AND FITTINGS

A. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated.
1. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
2. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

B. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint bell and plain spigot end unless grooved or flanged ends are indicated.
1. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
2. Gaskets: AWWA C111, rubber.

C. Grooved-Joint, Ductile-Iron Pipe: AWWA C151, with cut, rounded-grooved ends.
1. Grooved-End, Ductile-Iron Pipe Appurtenances:
a. Grooved-End, Ductile-Iron Fittings: ASTM A 47, malleable-iron castings or ASTM A 536, ductile-iron castings with dimensions matching pipe.
b. Grooved-End, Ductile-Iron-Piping Couplings: AWWA C606, for ductile-iron-pipe dimensions. Include ferrous housing sections, gasket suitable for water, and bolts and nuts.

D. Flanges: ASME 16.1, Class 125, cast iron.

2.03 PVC PIPE AND FITTINGS

A. PVC, Schedule 40 Pipe: ASTM D 1785, per applicable pressure rating.
1. PVC, Schedule 40 Socket Fittings: ASTM D 2466.

B. PVC, Schedule 80 Pipe: ASTM D 1785, per applicable pressure rating.
1. PVC, Schedule 80 Socket Fittings: ASTM D 2467.
2. PVC, Schedule 80 Threaded Fittings: ASTM D 2464.

C. PVC, AWWA Pipe: AWWA C900, Class 200, with bell end with gasket, and with spigot end.
   1. Comply with UL 1285 for fire-service mains if indicated.
   2. PVC Fabricated Fittings: AWWA C900, Class 200, with bell-and-spigot or double-bell ends. Include elastomeric gasket in each bell.
   3. PVC Molded Fittings: AWWA C907, Class 150, with bell-and-spigot or double-bell ends. Include elastomeric gasket in each bell.
   4. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
      a. Gaskets: AWWA C111, rubber.
   5. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
      a. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

2.04 SPECIAL PIPE FITTINGS

A. Ductile-Iron Rigid Expansion Joints:
   1. Description: Three-piece, ductile-iron assembly consisting of telescoping sleeve with gaskets and restrained-type, ductile-iron, bell-and-spigot end sections complying with AWWA C110 or AWWA C153. Select and assemble components for expansion indicated. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.
      a. Pressure Rating: 250 psig minimum.

B. Ductile-Iron Flexible Expansion Joints:
   1. Description: Compound, ductile-iron fitting with combination of flanged and mechanical-joint ends complying with AWWA C110 or AWWA C153. Include two gasketed ball-joint sections and one or more gasketed sleeve sections. Assemble components for offset and expansion indicated. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.
      a. Pressure Rating: 250 psig minimum.

C. Ductile-Iron Deflection Fittings:
   1. Description: Compound, ductile-iron coupling fitting with sleeve and 1 or 2 flexing sections for up to 15-degree deflection, gaskets, and restrained-joint ends complying with AWWA C110 or AWWA C153. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.
      a. Pressure Rating: 250 psig minimum.

2.05 JOINING MATERIALS

A. Refer to Division 22 for commonly used joining materials.

B. Brazing Filler Metals: AWS A5.8, BCuP Series.

C. Plastic Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

2.06 PIPING SPECIALTIES

A. Transition Fittings: Manufactured fitting or coupling same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

B. Tubular-Sleeve Pipe Couplings:
   1. Description: Metal, bolted, sleeve-type, reducing or transition coupling, with center sleeve, gaskets, end rings, and bolt fasteners and with ends of same sizes as piping to be joined.
      a. Standard: AWWA C219.
      b. Center-Sleeve Material: Manufacturer's standard.
      c. Gasket Material: Natural or synthetic rubber.
      d. Pressure Rating: 200 psig minimum.
      e. Metal Component Finish: Corrosion-resistant coating or material.

C. Split-Sleeve Pipe Couplings:
   1. Description: Metal, bolted, split-sleeve-type, reducing or transition coupling with sealing pad and closure plates, O-ring gaskets, and bolt fasteners.
      a. Standard: AWWA C219.
      b. Sleeve Material: Manufacturer's standard.
      c. Sleeve Dimensions: Of thickness and width required to provide pressure rating.
      d. Gasket Material: O-rings made of EPDM rubber, unless otherwise indicated.
      e. Pressure Rating: 200 psig minimum.
      f. Metal Component Finish: Corrosion-resistant coating or material.

D. Flexible Connectors:
   1. Nonferrous-Metal Piping: Bronze hose covered with bronze wire braid; with copper-tube, pressure-type, solder-joint ends or bronze flanged ends brazed to hose.
   2. Ferrous-Metal Piping: Stainless-steel hose covered with stainless-steel wire braid; with ASME B1.20.1, threaded steel pipe nipples or ASME B16.5, steel pipe flanges welded to hose.

E. Dielectric Fittings: Combination of copper alloy and ferrous; threaded, solder, or plain end types; and matching piping system materials.
   1. Dielectric Unions: Factory-fabricated union assembly, designed for 250-psig minimum working pressure at 180 deg F. Include insulating material that isolates dissimilar metals and ends with inside threads according to ASME B1.20.1.
   2. Dielectric Flanges: Factory-fabricated companion-flange assembly, for 150- or 300-psig minimum working pressure to suit system pressures.
   3. Dielectric-Flange Insulation Kits: Field-assembled companion-flange assembly, full-face or ring type. Components include neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
      a. Provide separate companion flanges and steel bolts and nuts for 150- or 300-psig minimum working pressure to suit system pressures.
   4. Dielectric Couplings: Galvanized-steel couplings with inert and noncorrosive thermoplastic lining, with threaded ends and 300-psig minimum working pressure at 225 deg F.

5. Dielectric Nipples: Electroplated steel nipples with inert and noncorrosive thermoplastic lining, with combination of plain, threaded, or grooved end types, and 300-psig minimum working pressure at 225 deg F.

2.07 GATE VALVES

A. AWWA, Cast-Iron Gate Valves:
   1. Nonrising-Stem, Metal-Seated Gate Valves:
      a. Description: Gray- or ductile-iron body and bonnet; with cast-iron or bronze double-disc gate, bronze gate rings, bronze stem, and stem nut.
         1) Standard: AWWA C500.
         2) Minimum Pressure Rating: 200 psig.
         3) End Connections: Mechanical joint.
         4) Interior Coating: Complying with AWWA C550.
   2. Nonrising-Stem, Resilient-Seated Gate Valves:
      a. Description: Gray- or ductile-iron body and bonnet; with bronze or gray- or ductile-iron gate, resilient seats, bronze stem, and stem nut.
         1) Standard: AWWA C509.
         2) Minimum Pressure Rating: 200 psig.
         3) End Connections: Mechanical joint.
         4) Interior Coating: Complying with AWWA C550.
   4. Nonrising-Stem, High-Pressure, Resilient-Seated Gate Valves:
      a. Description: Ductile-iron body and bonnet; with bronze or ductile-iron gate, resilient seats, bronze stem, and stem nut.
         1) Standard: AWWA C509.
         2) Minimum Pressure Rating: 250 psig.
         3) End Connections: Push on or mechanical joint.
         4) Interior Coating: Complying with AWWA C550.
   5. OS&Y, Rising-Stem, Metal-Seated Gate Valves:
      a. Description: Cast- or ductile-iron body and bonnet, with cast-iron double disc, bronze disc and seat rings, and bronze stem.
         1) Standard: AWWA C500.
         2) Minimum Pressure Rating: 200 psig.
         3) End Connections: Flanged.
   6. OS&Y, Rising-Stem, Resilient-Seated Gate Valves:
      a. Description: Cast- or ductile-iron body and bonnet, with bronze or gray- or ductile-iron gate, resilient seats, and bronze stem.
         1) Standard: AWWA C509.
         2) Minimum Pressure Rating: 200 psig.
         3) End Connections: Flanged.

B. UL/FMG, Cast-Iron Gate Valves:
   1. UL/FMG, Nonrising-Stem Gate Valves:
      a. Description: Iron body and bonnet with flange for indicator post, bronze seating material and inside screw.
         1) Standards: UL 262 and FMG approved.

2) Minimum Pressure Rating: 175 psig.
3) End Connections: Flanged.

2. OS&Y, Rising-Stem Gate Valves:
   a. Description: Iron body and bonnet and bronze seating material.
      1) Standards: UL 262 and FMG approved.
      2) Minimum Pressure Rating: 175 psig.
      3) End Connections: Flanged.

C. Bronze Gate Valves:
1. OS&Y, Rising-Stem Gate Valves:
   a. Description: Bronze body and bonnet and bronze stem.
      1) Standards: UL 262 and FMG approved.
      2) Minimum Pressure Rating: 175 psig.
      3) End Connections: Threaded.
2. Nonrising-Stem Gate Valves:
   a. Description: Class 125, Type 1, bronze with solid wedge, threaded ends, and malleable-iron handwheel.
      1) Standard: MSS SP-80.

2.08 GATE VALVE ACCESSORIES AND SPECIALTIES

A. Tapping-Sleeve Assemblies:
1. Description: Sleeve and valve compatible with drilling machine.
   a. Standard: MSS SP-60.
   b. Tapping Sleeve: Cast- or ductile-iron or stainless-steel, two-piece bolted sleeve with flanged outlet for new branch connection. Include sleeve matching size and type of pipe material being tapped and with recessed flange for branch valve.
   c. Valve: AWWA, cast-iron, nonrising-stem, metal or resilient-seated gate valve with one raised face flange mating tapping-sleeve flange.

B. Valve Boxes: Comply with AWWA M44 for cast-iron valve boxes. Include top section, adjustable extension of length required for depth of burial of valve, plug with lettering "WATER," and bottom section with base that fits over valve and with a barrel approximately 5 inches in diameter.
1. Operating Wrenches: Steel, tee-handle with one pointed end, stem of length to operate deepest buried valve, and socket matching valve operating nut.

C. Indicator Posts: UL 789, FMG-approved, vertical-type, cast-iron body with operating wrench, extension rod, and adjustable cast-iron barrel of length required for depth of burial of valve.

2.09 CHECK VALVES

A. AWWA Check Valves:
1. Description: Swing-check type with resilient seat. Include interior coating according to AWWA C550 and ends to match piping.
   a. Standard: AWWA C508.
   b. Pressure Rating: 175 psig.

B. UL/FMG, Check Valves:

1. Description: Swing-check type with pressure rating; rubber-face checks, unless otherwise indicated; and ends matching piping.
    a. Standards: UL 312 and FMG approved.
    b. Pressure Rating: 250 psig.

2.10 DETECTOR CHECK VALVES

A. Detector Check Valves:
1. Description: Galvanized cast-iron body, bolted cover with air-bleed device for access to internal parts, and flanged ends. Include one-piece bronze disc with bronze bushings, pivot, and replaceable seat. Include threaded bypass taps in inlet and outlet for bypass meter connection. Set valve to allow minimal water flow through bypass meter when major water flow is required.
    a. Standards: UL 312 and FMG approved.
    b. Pressure Rating: 175 psig.
    c. Water Meter: AWWA C700, disc type, at least one-fourth size of detector check valve. Include meter, bypass piping, gate valves, check valve, and connections to detector check valve.
3. Description: Iron body, corrosion-resistant clapper ring and seat ring material, flanged ends, with connections for bypass and installation of water meter.
    a. Standards: UL 312 and FMG approved.
    b. Pressure Rating: 175 psig.

2.11 BUTTERFLY VALVES

A. AWWA Butterfly Valves:
1. Description: Rubber seated.
    a. Standard: AWWA C504.
    b. Body: Cast or ductile iron.
    c. Body Type: Wafer or flanged.
    d. Pressure Rating: 150 psig.

B. UL Butterfly Valves:
1. Description: Metal on resilient material seating.
    a. Standards: UL 1091 and FMG approved.
    b. Body: Cast or ductile iron.
    c. Body Type: Wafer or flanged.
    d. Pressure Rating: 175 psig.

2.12 PLUG VALVES

A. Plug Valves:
1. Description: Resilient-seated eccentric.
    a. Standard: MSS SP-108.
    b. Body: Cast iron.
    c. Pressure Rating: 175-psig minimum CWP.
    d. Seat Material: Suitable for potable-water service.

2.13 CORPORATION VALVES AND CURB VALVES

A. Service-Saddle Assemblies: Comply with AWWA C800. Include saddle and valve compatible with tapping machine.

1. Service Saddle: Copper alloy with seal and AWWA C800, threaded outlet for corporation valve.
2. Corporation Valve: Bronze body and ground-key plug, with AWWA C800, threaded inlet and outlet matching service piping material.
3. Manifold: Copper fitting with two to four inlets as required, with ends matching corporation valves and outlet matching service piping material.

B. Curb Valves: Comply with AWWA C800. Include bronze body, ground-key plug or ball, and wide tee head, with inlet and outlet matching service piping material.

C. Service Boxes for Curb Valves: Similar to AWWA M44 requirements for cast-iron valve boxes. Include cast-iron telescoping top section of length required for depth of burial of valve, plug with lettering "WATER," and bottom section with base that fits over curb valve and with a barrel approximately 3 inches in diameter.
1. Shutoff Rods: Steel, tee-handle with one pointed end, stem of length to operate deepest buried valve, and slotted end matching curb valve.

2.14 WATER METERS

A. Water meters shall be furnished in accordance with the rules of the utility company.

B. Displacement-Type Water Meters:
1. Description: With bronze main case.
a. Standard: AWWA C700.
b. Registration: Flow in gallons or cubic feet.

C. Turbine-Type Water Meters:
1. Description:
a. Standard: AWWA C701.
b. Registration: Flow in gallons or cubic feet.

D. Compound-Type Water Meters:
1. Description:
a. Standard: AWWA C702.
b. Registration: Flow in gallons or cubic feet.

E. Remote Registration System:
1. Description: Utility company standard; direct-reading type. Include meter modified with signal-transmitting assembly, low-voltage connecting wiring, and remote register assembly.
a. Standard: AWWA C706.
b. Registration: Flow in gallons or cubic feet.

F. Remote Registration System:
1. Description: Utility company standard; encoder type. Include meter modified with signal-transmitting assembly, low-voltage connecting wiring, and remote register assembly.
a. Standard: AWWA C707.
b. Registration: Flow in gallons or cubic feet.
c. Data-Acquisition Units: Comply with utility company requirements for type and quantity.

d. Visible Display Units: Comply with utility company requirements for type and quantity.

2.15 DETECTOR-TYPE WATER METERS

A. Description: Main line, proportional meter with second meter on bypass. Register flow in gallons or cubic feet.
   1. Standards: AWWA C703, UL listed, and FMG approved.
   2. Pressure Rating: 150 psig.
   3. Bypass Meter: AWWA C701, turbine or AWWA C702, compound-type, bronze case.
      a. Size: At least one-half nominal size of main-line meter.

B. Description: Main-line turbine meter with strainer and second meter on bypass. Register flow in gallons or cubic feet.
   1. Standards: AWWA C703, UL listed, and FMG approved.
   2. Pressure Rating: 175 psig.
   3. Bypass Meter: AWWA C701, turbine-type, bronze case.
      a. Size: At least NPS 2.

C. Remote Registration System – direct read:
   1. Description: Utility company standard; direct-reading type. Include meter modified with signal-transmitting assembly, low-voltage connecting wiring, and remote register assembly.
      a. Standard: AWWA C706.
      b. Registration: Flow in gallons or cubic feet.

D. Remote Registration System - encoder:
   1. Description: Utility company standard; encoder type. Include meter modified with signal-transmitting assembly, low-voltage connecting wiring, and remote register assembly.
      a. Standard: AWWA C707.
      b. Registration: Flow in gallons or cubic feet.
      c. Data-Acquisition Units: Comply with utility company requirements for type and quantity.
      d. Visible Display Units: Comply with utility company requirements for type and quantity.

2.16 PRESSURE-REDUCING VALVES

A. Water Regulators:
   1. Standard: ASSE 1003.
   2. Pressure Rating: Initial pressure of 150 psig.
   3. Size: As required by local jurisdiction.
   4. Body: Bronze for NPS 2 and smaller; cast iron for NPS 2-1/2 and NPS 3.
   5. Valves for Booster Heater Water Supply: Include integral bypass.
   6. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and NPS 3.

B. Water Control Valves:

1. Description: Pilot-operation, diaphragm-type, single-seated main water control valve with AWWA C550 or FDA-approved, interior epoxy coating. Include small pilot control valve, restrictor device, specialty fittings, and sensor piping.
    a. Pressure Rating: Initial pressure of 150 psig minimum.
    b. Main Valve Body: Cast- or ductile-iron body with AWWA C550 or FDA-approved, interior epoxy coating; or stainless-steel body.
        1) Size: As required by local jurisdiction.
        2) Pattern: Angle or Globe-valve design.
        3) Trim: Stainless steel.
    c. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.

2.17 RELIEF VALVES

A. Air-Release Valves:
    1. Description: Hydromechanical device to automatically release accumulated air.
        a. Standard: AWWA C512.
        b. Pressure Rating: 300 psig.
        c. Body Material: Cast iron.
        d. Trim Material: Stainless steel, brass, or bronze.

B. Air/Vacuum Valves:
    1. Description: Direct-acting, float-operated, hydromechanical device with large orifice to automatically release accumulated air or to admit air during filling of piping.
        a. Standard: AWWA C512.
        b. Pressure Rating: 300 psig.
        c. Body Material: Cast iron.
        d. Trim Material: Stainless steel, brass, or bronze.

C. Combination Air Valves:
    1. Description: Float-operated, hydromechanical device to automatically release accumulated air or to admit air.
        a. Standard: AWWA C512.
        b. Pressure Rating: 300 psig.
        c. Body Material: Cast iron.
        d. Trim Material: Stainless steel, brass, or bronze.

2.18 VACUUM BREAKERS

A. Pressure Vacuum Breaker Assembly:
    1. Standard: ASSE 1020.
    2. Operation: Continuous-pressure applications.
    3. Pressure Loss: 5 psig maximum, through middle 1/3 of flow range.
    4. Size: Per local jurisdiction requirements.
    5. Accessories: Ball valves on inlet and outlet.

2.19 BACKFLOW PREVENTERS

A. Reduced-Pressure-Principle Backflow Preventers:
    1. Standard: AWWA C511.

2. Operation: Continuous-pressure applications.
3. Pressure Loss: 12 psig maximum, through middle 1/3 of flow range.
4. Size: Per local jurisdiction requirements.
5. Body: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 and larger.
6. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
7. Configuration: Designed for application required.
8. Accessories:
    a. Valves: Ball type with threaded ends on inlet and outlet of NPS 2 and smaller; OS&Y gate type with flanged ends on inlet and outlet of NPS 2-1/2 and larger.
    b. Air-Gap Fitting: ASME A112.1.2, matching backflow preventer connection.

B. Double-Check, Backflow-Prevention Assemblies:
1. Standard: AWWA C510.
2. Operation: Continuous-pressure applications, unless otherwise indicated.
3. Pressure Loss: 5 psig maximum, through middle 1/3 of flow range.
4. Size: As required by local jurisdiction.
5. Body: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 and larger.
6. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
7. Configuration: Designed for application required.
8. Accessories: Ball valves with threaded ends on inlet and outlet of NPS 2 and smaller; OS&Y gate valves with flanged ends on inlet and outlet of NPS 2-1/2 and larger.

C. Reduced-Pressure-Detector, Fire-Protection Backflow Preventer Assemblies:
1. Standards: ASSE 1047 and UL listed or FMG approved.
2. Operation: Continuous-pressure applications.
3. Pressure Loss: 12 psig maximum, through middle 1/3 of flow range.
4. Body: Cast iron with interior lining complying with AWWA C550 or that is FDA approved.
5. End Connections: Flanged.
6. Configuration: Designed application required.
7. Accessories:
    a. Valves: UL 262, FMG-approved, OS&Y gate type with flanged ends on inlet and outlet.
    b. Air-Gap Fitting: ASME A112.1.2, matching backflow preventer connection.
    c. Bypass: With displacement-type water meter, shutoff valves, and reduced-pressure backflow preventer.

D. Double-Check, Detector-Assembly Backflow Preventers:
1. Standards: ASSE 1048 and UL listed or FMG approved.
2. Operation: Continuous-pressure applications.

3. Pressure Loss: 5 psig maximum, through middle 1/3 of flow range.
4. Body: Cast iron with interior lining complying with AWWA C550 or that is FDA approved.
5. End Connections: Flanged.
6. Configuration: Designed for application required.
7. Accessories:
   a. Valves: UL 262, FMG-approved, OS&Y gate type with flanged ends on inlet and outlet.
   b. Bypass: With displacement-type water meter, shutoff valves, and reduced-pressure backflow preventer.

E. Backflow Preventer Test Kits:
1. Description: Factory calibrated, with gages, fittings, hoses, and carrying case with test-procedure instructions.

2.20 WATER METER BOXES

A. Cast-iron body and cover for disc-type water meter, with lettering "WATER METER" in cover; and with slotted, open-bottom base section of length to fit over service piping. Boxes to meet local jurisdiction requirements.
1. Option: Base section may be cast-iron, PVC, or other pipe.

B. Cast-iron body and double cover for disc-type water meter, with lettering "WATER METER" in top cover; and with separate inner cover; air space between covers; and slotted, open-bottom base section of length to fit over service piping. Boxes to meet local jurisdiction requirements.

C. Polymer-concrete body and cover for disc-type water meter, with lettering "WATER" in cover; and with slotted, open-bottom base section of length to fit over service piping. Include vertical and lateral design loadings of 15,000 lb minimum over 10 by 10 inches square. Boxes to meet local jurisdiction requirements.

2.21 CONCRETE VAULTS

A. Description: Precast, reinforced-concrete vault, designed for A-16 load designation according to ASTM C 857 and made according to ASTM C 858.
1. Ladder: ASTM A 36, steel or polyethylene-encased steel steps.
2. Manhole: ASTM A 48 Class No. 35A minimum tensile strength, gray-iron traffic frame and cover.
   a. Dimension: 24-inch minimum diameter, unless otherwise indicated.
3. Manhole: ASTM A 536, Grade 60-40-18, ductile-iron traffic frame and cover.
   a. Dimension: 24-inch minimum diameter, unless otherwise indicated.
4. Drain: ASME A112.6.3, cast-iron floor drain with outlet of size indicated. Include body anchor flange, light-duty cast-iron grate, bottom outlet, and integral or field-installed bronze ball or clapper-type backwater valve.

2.22 PROTECTIVE ENCLOSURES

A. Freeze-Protection Enclosures:
1. Insulated enclosure designed to protect aboveground water piping, equipment, or specialties from freezing and damage, with heat source to maintain minimum

internal temperature of 40 deg F when external temperatures reach as low as minus 34 deg F.

a. Standard: ASSE 1060.
b. Class I: For equipment or devices other than pressure or atmospheric vacuum breakers.
c. Class I-V: For pressure or atmospheric vacuum breaker equipment or devices. Include drain opening in housing.
    1) Housing: Reinforced aluminum or fiberglass construction.
        a) Size: Not less than those required for access and service of protected unit.
        b) Drain opening for units with drain connection.
        c) Access doors with locking devices.
        d) Insulation inside housing.
        e) Anchoring devices for attaching housing to concrete base.
    2) Electric heating cable or heater with self-limiting temperature control.

B. Weather-Resistant Enclosures:
1. Uninsulated enclosure designed to protect aboveground water piping, equipment, or specialties from weather and damage.
    . Standard: ASSE 1060.
    b. Class III: For equipment or devices other than pressure or atmospheric vacuum breakers.
    c. Class III-V: For pressure or atmospheric vacuum breaker equipment or devices. Include drain opening in housing.
        1) Housing: Reinforced aluminum or fiberglass construction.
            a) Size: Not less than those required for access and service of protected unit.
            b) Drain opening for units with drain connection.
            c) Access doors with locking devices.
            d) Anchoring devices for attaching housing to concrete base.

C. Expanded-Metal Enclosures:
1. Enclosure designed to protect aboveground water piping, equipment, or specialties from damage.
    a. Material: ASTM F 1267, expanded metal side and top panels, of weight and with reinforcement of same metal at edges as required for rigidity.
    b. Type: Type I, expanded or II, expanded and flattened.
    c. Class: Class 2, hot-dip, zinc-coated carbon steel.
    d. Finish: Manufacturer's enamel paint.
    e. Size: Not less than those required for access and service of protected unit.
    f. Locking device.
    g. Lugs or devices for securing enclosure to base.

D. Enclosure Bases:

1. Description: 6-inch minimum thickness precast concrete, of dimensions required to extend at least 6 inches beyond edges of enclosure housings. Include openings for piping.

2.23 FIRE HYDRANTS

A. Meet local jurisdiction requirements.

B. Dry-Barrel Fire Hydrants:

1. Freestanding, with one NPS 4-1/2 and two NPS 2-1/2 outlets, 5-1/4-inch main valve, drain valve, and NPS 6 mechanical-joint inlet. Include interior coating according to AWWA C550. Hydrant shall have cast-iron body, compression-type valve opening against pressure and closing with pressure.
   a. Standard: AWWA C502.
   b. Pressure Rating: 250 psig.
2. Freestanding, with one NPS 4-1/2 and two NPS 2-1/2 outlets, 5-1/4-inch main valve, drain valve, and NPS 6 mechanical-joint inlet. Hydrant shall have cast-iron body, compression-type valve opening against pressure and closing with pressure.
   a. Standards: UL 246, FMG approved.
   b. Pressure Rating: 250 psig.
   c. Outlet Threads: NFPA 1963, with external hose thread used by local fire department. Include cast-iron caps with steel chains.
   d. Operating and Cap Nuts: Pentagon, 1-1/2 inches point to flat.
   e. Direction of Opening: Open hydrant valve by turning operating nut to left or counterclockwise.
   f. Exterior Finish: Red alkyd-gloss enamel paint, unless otherwise indicated.

C. Wet-Barrel Fire Hydrants:

1. Freestanding, with one NPS 4-1/2 and two NPS 2-1/2 outlets, NPS 6 threaded or flanged inlet, and base section with NPS 6 mechanical-joint inlet. Include interior coating according to AWWA C550.
   a. Standard: AWWA C503.
   b. Pressure Rating: 150 psig minimum.
2. Freestanding, with one NPS 4-1/2 and two NPS 2-1/2 outlets, NPS 6 threaded or flanged inlet, and base section with NPS 6 mechanical-joint inlet.
   a. Standards: UL 246 and FMG approved.
   b. Pressure Rating: 150 psig minimum.
   c. Outlet Threads: NFPA 1963, with external hose thread used by local fire department. Include cast-iron caps with steel chains.
   d. Operating and Cap Nuts: Pentagon, 1-1/2 inches point to flat.
   e. Direction of Opening: Open hydrant valves by turning operating nut to left or counterclockwise.
   f. Exterior Finish: Red alkyd-gloss enamel paint, unless otherwise indicated.

2.24 FLUSHING HYDRANTS

A. Meet local jurisdiction requirements.

B. Post-Type Flushing Hydrants:

1. Nonfreeze and drainable, of length required for shutoff valve installation below frost line.
    a. Pressure Rating: 150 psig minimum.
    b. Outlet: One, with horizontal discharge.
    c. Hose Thread: NPS 2-1/2, with NFPA 1963 external hose thread for use by local fire department, and with cast-iron cap with brass chain.
    d. Barrel: Cast-iron or steel pipe with breakaway feature.
    e. Valve: Bronze body with bronze-ball or plunger closure, and automatic draining.
    f. Security: Locking device for padlock.
    g. Exterior Finish: Red alkyd-gloss enamel paint, unless otherwise indicated.
    h. Inlet: NPS 2 minimum.
    i. Operating Wrench: One for each unit.

C. Ground-Type Flushing Hydrants:
1. Nonfreeze and drainable, of length required for shutoff valve installation below frost line.
    a. Pressure Rating: 150 psig minimum.
    b. Outlet: One, with vertical or angle discharge.
    c. Hose Thread: NPS 2-1/2, with NFPA 1963 external hose thread for use by local fire department, and with cast-iron cap with brass chain.
    d. Barrel: Cast-iron or steel pipe.
    e. Valve: Bronze body with bronze-ball or plunger closure, and automatic draining.
    f. Inlet: NPS 2 minimum.
    g. Hydrant Box: Cast iron with cover, for ground mounting.
    h. Operating Wrench: One for each unit.

C. Post-Type Sampling Station:
1. Nonfreeze and drainable, of length required for shutoff valve installation below frost line.
    a. Pressure Rating: 100 psig minimum.
    b. Sampling Outlet: One unthreaded nozzle with handle.
    c. Valve: Bronze body with bronze-ball or plunger closure. Include operating handle.
    d. Drain: Tubing with separate manual vacuum pump.
    e. Inlet: NPS 3/4 minimum.
    f. Housing: Weatherproof material with locking device. Include anchor device.
    g. Operating Wrench: One for each unit.

2.25 FIRE DEPARTMENT CONNECTIONS

A. Fire Department Connections:
1. Freestanding, with cast-bronze body, thread inlets according to NFPA 1963 and matching local fire department hose threads, and threaded bottom outlet. Include lugged caps, gaskets, and chains; lugged swivel connection and drop

clapper for each hose-connection inlet; 18-inch high brass sleeve; and round escutcheon plate.

a. Standard: UL 405.
b. Connections: As required by local jurisdiction.
c. Inlet Alignment: Inline, horizontal.
e. Finish Including Sleeve: Polished bronze.
f. Escutcheon Plate Marking: Per local jurisdiction requirements.

2.26 ALARM DEVICES

A. Alarm Devices, General: UL 753 and FMG approved, of types and sizes to mate and match piping and equipment.

B. Water-Flow Indicators: Vane-type water-flow detector, rated for 250-psig working pressure; designed for horizontal or vertical installation; with 2 single-pole, double-throw circuit switches to provide isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal when cover is removed.

C. Supervisory Switches: Single pole, double throw; designed to signal valve in other than fully open position.

D. Pressure Switches: Single pole, double throw; designed to signal increase in pressure.

PART 3 - EXECUTION

3.01 EARTHWORK

A. Refer to Division 31 for excavating, trenching, and backfilling.

3.02 COORDINATION

A. Public main extensions shall be coordinated with utility service provider and shall meet the local jurisdiction requirements.

B. Contractor to confirm all valves, fittings and appurtenances comply with Plumbing and Fire Protection design.

C. Contractor to coordinate any proposed pump or booster pressures with all specified pipe and fitting materials.

3.03 PIPING APPLICATIONS

A. General: Use pipe, fittings, and joining methods for piping systems according to the following applications.

B. Transition couplings and special fittings with pressure ratings at least equal to piping pressure rating may be used, unless otherwise indicated.

C. Do not use flanges or unions for underground piping.

D. Flanges, unions, grooved-end-pipe couplings, and special fittings may be used, instead of joints indicated, on aboveground piping and piping in vaults.

E. Underground water-service piping NPS 3/4 to NPS 3 shall be the following:

1. Soft copper tube, ASTM B 88, Type K or ASTM B 88, Type L; wrought-copper, solder-joint fittings; and brazed joints.
2. PVC, Schedule 80 pipe; PVC, Schedule 80 socket fittings; and solvent-cemented joints.

F. Underground water-service piping NPS 4 to NPS 8 shall be the following:

1. Soft copper tube, ASTM B 88, Type K or ASTM B 88, Type L; wrought-copper, solder-joint fittings; and brazed joints.
2. Ductile-iron, push-on-joint pipe; ductile-iron, push-on-joint fittings; and gasketed or mechanical-joint pipe; ductile-iron, mechanical-joint fittings; and mechanical joints.
3. PVC, Schedule 80 pipe; PVC, Schedule 80 socket fittings; and solvent-cemented joints.
4. NPS 4 and NPS 6: NPS 6 PVC, AWWA Class 200 pipe; PVC, AWWA Class 200 fittings; and gasketed joints.
5. NPS 8: PVC, AWWA Class 200 pipe; PVC, AWWA Class 200 fabricated fittings; and gasketed joints.

G. Water Meter Box Water-Service Piping NPS 3/4 to NPS 2 shall be same as underground water-service piping.

H. Aboveground and Vault Water-Service Piping NPS 3/4 to NPS 3 shall be the following:
1. Hard copper tube, ASTM B 88, Type K or Type L joints.
2. PVC, Schedule 80 pipe; PVC, Schedule 80 socket fittings; and solvent-cemented joints.

I. Aboveground and vault water-service piping NPS 4 to NPS 8 shall be the following:
1. Hard copper tube, ASTM B 88, Type K or Type L; wrought-copper, solder-joint fittings; and brazed joints.
2. Ductile-iron, grooved-end pipe; ductile-iron, grooved-end appurtenances; and grooved joints.
3. PVC, Schedule 80 pipe; PVC, Schedule 80 socket fittings; and solvent-cemented joints.

J. Underground Fire-Service-Main Piping NPS 4 to NPS 12 shall be the following:
1. Ductile-iron, push-on-joint pipe; ductile-iron, push-on-joint fittings; and gasketed or mechanical-joint pipe; ductile-iron, mechanical-joint fittings; and mechanical joints.
2. PVC, AWWA Class 200 pipe listed for fire-protection service; PVC Class 200 fabricated fittings; and gasketed joints.

K. Aboveground and Vault Fire-Service-Main Piping NPS 4 to NPS 12 shall be ductile-iron, grooved-end pipe; ductile-iron-pipe appurtenances; and grooved joints.

L. Underground Combined Water-Service and Fire-Service-Main Piping NPS 6 to NPS 12 shall be the following:
1. Ductile-iron, push-on-joint pipe; ductile-iron, push-on-joint fittings; and gasketed or mechanical-joint pipe; ductile-iron, mechanical-joint fittings; and mechanical joints.
2. PVC, AWWA Class 200 pipe listed for fire-protection service; PVC fabricated or molded fittings of same class as pipe; and gasketed joints.

M. Aboveground and Vault Combined Water Service and Fire-Service-Main Piping NPS 6 to NPS 12 shall be ductile-iron, grooved-end pipe; ductile-iron-pipe appurtenances; and grooved joints.

3.04 VALVE APPLICATIONS

A. General Application: Use mechanical-joint-end valves for NPS 3 and larger underground installation. Use threaded- or flanged-end valves for installation in vaults. Use UL/FMG, nonrising-stem gate valves for installation with indicator posts. Use corporation valves and curb valves with ends compatible with piping, for NPS 2
B. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
    1. Underground Valves, NPS 3 and Larger: AWWA, cast-iron, nonrising-stem, resilient -seated gate valves with valve box.
    2. Underground Valves, NPS 4 and Larger, for Indicator Posts: UL/FMG, cast-iron, nonrising-stem gate valves with indicator post.
    3. Use the following for valves in vaults and aboveground:
        a. Gate Valves, NPS 2 and Smaller: Bronze, nonrising or rising stem per local jurisdiction requirements.
        b. Gate Valves, NPS 3 and Larger: AWWA, cast iron, OS&Y rising stem, metal seated or AWWA, cast iron, OS&Y rising stem, resilient seated.
        c. Check Valves: AWWA C508, swing type.
    4. Pressure-Reducing Valves: Use for water-service piping in vaults and aboveground to control water pressure.
    5. Relief Valves: Use for water-service piping in vaults and aboveground.
        a. Air-Release Valves: To release accumulated air.
        b. Air/Vacuum Valves: To release or admit large volume of air during filling of piping.
        c. Combination Air Valves: To release or admit air.
    6. Detector Check Valves: Use for water-service piping in vaults and aboveground to detect unauthorized use of water.

3.05 PIPING INSTALLATION

A. Water-Main Connection: Tap water main according to requirements of water utility company and of size and in location indicated.
B. Make connections larger than NPS 2 with tapping machine according to the following:
    1. Install tapping sleeve and tapping valve according to MSS SP-60.
    2. Install tapping sleeve on pipe to be tapped. Position flanged outlet for gate valve.
    3. Use tapping machine compatible with valve and tapping sleeve; cut hole in main. Remove tapping machine and connect water-service piping.
    4. Install gate valve onto tapping sleeve. Comply with MSS SP-60. Install valve with stem pointing up and with valve box.
C. Make connections NPS 2 and smaller with drilling machine according to the following:
    1. Install service-saddle assemblies and corporation valves in size, quantity, and arrangement required by utility company standards.
    2. Install service-saddle assemblies on water-service pipe to be tapped. Position outlets for corporation valves.

3. Use drilling machine compatible with service-saddle assemblies and corporation valves. Drill hole in main. Remove drilling machine and connect water-service piping.
4. Install corporation valves into service-saddle assemblies.
5. Install manifold for multiple taps in water main.
6. Install curb valve in water-service piping with head pointing up and with service box.

D. Comply with NFPA 24 for fire-service-main piping materials and installation.
   1. Install PE corrosion-protection encasement according to ASTM A 674 or AWWA C105.
   2. Install copper tube and fittings according to CDA's "Copper Tube Handbook."
E. Install ductile-iron, water-service piping according to AWWA C600 and AWWA M41.
   1. Install PE corrosion-protection encasement according to ASTM A 674 or AWWA C105.
F. Install PVC, AWWA pipe according to ASTM F 645 and AWWA M23.
G. Bury piping with depth of cover over top per local jurisdiction requirements, 4’ minimum.
H. Install piping by tunneling or jacking, or combination of both, under streets and other obstructions that cannot be disturbed.
I. Extend water-service piping and connect to water-supply source and building-water-piping systems at outside face of building wall in locations and pipe sizes indicated.
   1. Terminate water-service piping at building wall until building-water-piping systems are installed. Terminate piping with caps, plugs, or flanges as required for piping material. Make connections to building-water-piping systems when those systems are installed.
J. Sleeves are specified in Division 22.
K. Mechanical sleeve seals are specified in Division 22.
L. Install underground piping with restrained joints at horizontal and vertical changes in direction. Use restrained-joint piping, thrust blocks, anchors, tie-rods and clamps, and other supports.
M. See Division 21 for fire-suppression-water piping inside the building.
N. See Division 22 for potable-water piping inside the building.

3.06 JOINT CONSTRUCTION

A. Make pipe joints according to the following:
   1. Copper-Tubing, Pressure-Sealed Joints: Use proprietary crimping tool and procedure recommended by copper, pressure-seal-fitting manufacturer.
   2. Ductile-Iron Piping, Gasketed Joints for Water-Service Piping: AWWA C600 and AWWA M41.
   3. Ductile-Iron Piping, Gasketed Joints for Fire-Service-Main Piping: UL 194.
   4. Ductile-Iron Piping, Grooved Joints: Cut-groove pipe. Assemble joints with grooved-end, ductile-iron-piping couplings, gaskets, lubricant, and bolts according to coupling manufacturer's written instructions.

5. PVC Piping Gasketed Joints: Use joining materials according to AWWA C900. Construct joints with elastomeric seals and lubricant according to ASTM D 2774 or ASTM D 3139 and pipe manufacturer's written instructions.
6. Dissimilar Materials Piping Joints: Use adapters compatible with both piping materials, with OD, and with system working pressure. Refer to Division 22 for joining piping of dissimilar metals.

3.07 ANCHORAGE INSTALLATION

A. Anchorage, General: Install water-distribution piping with restrained joints. Anchorages and restrained-joint types that may be used include the following:
   1. Concrete thrust blocks.
   2. Locking mechanical joints.
   3. Set-screw mechanical retainer glands.
   4. Bolted flanged joints.
   5. Heat-fused joints.
   6. Pipe clamps and tie rods.

B. Install anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches. Include anchorages for the following piping systems:
   1. Gasketed-Joint, Ductile-Iron, Water-Service Piping: According to AWWA C600.
   2. Gasketed-Joint, PVC Water-Service Piping: According to AWWA M23.
   3. Bonded-Joint Fiberglass, Water-Service Piping: According to AWWA M45.
   4. Fire-Service-Main Piping: According to NFPA 24.

C. Apply full coat of asphalt or other acceptable corrosion-resistant material to surfaces of installed ferrous anchorage devices.

3.08 VALVE INSTALLATION

A. AWWA Gate Valves: Comply with AWWA C600 and AWWA M44. Install each underground valve with stem pointing up and with valve box.

B. AWWA Valves Other Than Gate Valves: Comply with AWWA C600 and AWWA M44.

C. UL/FMG, Gate Valves: Comply with NFPA 24. Install each underground valve and valves in vaults with stem pointing up and with vertical cast-iron indicator post.

D. UL/FMG, Valves Other Than Gate Valves: Comply with NFPA 24.

E. MSS Valves: Install as component of connected piping system.

F. Corporation Valves and Curb Valves: Install each underground curb valve with head pointed up and with service box.

G. Pressure-Reducing Valves: Install in vault or aboveground between shutoff valves.

H. Relief Valves: Comply with AWWA C512. Install aboveground with shutoff valve on inlet.

3.09 DETECTOR-CHECK VALVE INSTALLATION

A. Install in vault or aboveground.

B. Install for proper direction of flow. Install bypass with water meter, gate valves on each side of meter, and check valve downstream from meter.

C. Support detector check valves, meters, shutoff valves, and piping on brick or concrete piers.

3.10 WATER METER INSTALLATION

A. Install water meters, piping, and specialties according to utility company's written instructions.
B. Install displacement or turbine-type water meters, NPS 2 and smaller, in meter boxes with shutoff valves on water meter inlets. Include valves on water meter outlets and valved bypass around meters unless prohibited by authorities having jurisdiction.
C. Install compound or turbine-type water meters, NPS 3 and larger, in meter vaults. Include shutoff valves on water meter inlets and outlets and valved bypass around meters. Support meters, valves, and piping on brick or concrete piers.
D. Install detector-type water meters in meter vault according to AWWA M6. Include shutoff valves on water meter inlets and outlets and full-size valved bypass around meters. Support meters, valves, and piping on brick or concrete piers.

3.11 ROUGHING-IN FOR WATER METERS

A. Rough-in piping and specialties for water meter installation according to utility provider's written instructions.

3.12 VACUUM BREAKER ASSEMBLY INSTALLATION

A. Install pressure vacuum breaker assemblies of type, size, and capacity indicated. Include valves and test cocks. Install according to requirements of plumbing and health department and authorities having jurisdiction.
B. Do not install pressure vacuum breaker assemblies in vault or other space subject to flooding.

3.13 BACKFLOW PREVENTER INSTALLATION

A. Install backflow preventers of type, size, and capacity indicated. Include valves and test cocks. Install according to requirements of plumbing and health department and authorities having jurisdiction.
B. Do not install backflow preventers that have relief drain in vault or in other spaces subject to flooding.
C. Do not install bypass piping around backflow preventers.
D. Support NPS 2-1/2 and larger backflow preventers, valves, and piping near floor and on brick or concrete piers.

3.14 WATER METER BOX INSTALLATION

A. When in paved areas, install water meter boxes flush with surface.

3.15 CONCRETE VAULT INSTALLATION

A. Install precast concrete vaults according to ASTM C 891.

3.16 PROTECTIVE ENCLOSURE INSTALLATION

A. Install concrete base.
B. Install protective enclosure over valves and equipment.
C. Anchor protective enclosure to concrete base.

3.17 FIRE HYDRANT INSTALLATION

A. General: Install each fire hydrant with separate gate valve in supply pipe, anchor with restrained joints or thrust blocks, and support in upright position.
B. Wet-Barrel Fire Hydrants: Install with valve below frost line. Provide for drainage.
C. AWWA Fire Hydrants: Comply with AWWA M17.
D. UL/FMG Fire Hydrants: Comply with NFPA 24.

3.18 FLUSHING HYDRANT INSTALLATION

A. Install post-type flushing hydrants with valve below frost line and provide for drainage. Support in upright position. Include separate gate valve or curb valve and restrained joints in supply piping.

B. Install ground-type flushing hydrants with valve below frost line and provide for drainage. Install hydrant box flush with grade. Include separate gate valve or curb valve and restrained joints in supply piping.

C. Install sampling stations with valve below frost line and provide for drainage. Attach weather-resistant housing and support in upright position. Include separate curb valve in supply piping.

3.19 FIRE DEPARTMENT CONNECTION INSTALLATION

A. Install ball drip valves at each check valve for fire department connection to mains.

3.20 ALARM DEVICE INSTALLATION

A. General: Comply with NFPA 24 for devices and methods of valve supervision. Underground valves with valve box do not require supervision.

B. Supervisory Switches: Supervise valves in open position.
   1. Valves: Grind away portion of exposed valve stem. Bolt switch, with plunger in stem depression, to OS&Y gate-valve yoke.
   2. Indicator Posts: Drill and thread hole in upper-barrel section at target plate. Install switch, with toggle against target plate, on barrel of indicator post.

C. Locking and Sealing: Secure unsupervised valves as follows:
   1. Valves: Install chain and padlock on open OS&Y gate valve.
   2. Post Indicators: Install padlock on wrench on indicator post.

D. Pressure Switches: Drill and thread hole in exposed barrel of fire hydrant. Install switch.

E. Water-Flow Indicators: Install in water-service piping in vault. Select indicator with saddle and vane matching pipe size. Drill hole in pipe, insert vane, and bolt saddle to pipe.

F. Connect alarm devices to building fire alarm system. Wiring and fire-alarm devices are specified in Division 28.

3.21 CONNECTIONS

A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Coordinate and/or direct water-distribution piping to utility water main. Use tapping sleeve and tapping valve or service clamp and corporation valve as required by local jurisdiction.

C. Connect water-distribution piping to interior domestic water and fire-suppression piping.

D. Connect waste piping from concrete vault drains to sanitary sewerage system or storm drainage system as required by local jurisdiction.

E. Ground equipment according to Division 26.

F. Connect wiring according to Division 26.

3.22 THRUST BLOCKING:

A. Restrain pipe by thrust blocking as shown on the plans, in the event of the following piping conditions:
   1. A change of direction with the use of a tee or bend.
   2. Reduction in the size of the line by use of a reducer.
   3. Termination of line (dead end).

3.23 FIELD QUALITY CONTROL

A. Piping Tests: Conduct piping tests before joints are covered and after concrete thrust blocks have hardened sufficiently. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water.

B. Hydrostatic Tests: Test at not less than one-and-one-half times working pressure for two hours.
   1. Increase pressure in 50-psig increments and inspect each joint between increments. Hold at test pressure for 1 hour; decrease to 0 psig. Slowly increase again to test pressure and hold for 1 more hour. Maximum allowable leakage is 2 quarts per hour per 100 joints. Remake leaking joints with new materials and repeat test until leakage is within allowed limits.

C. Prepare reports of testing activities.

3.24 IDENTIFICATION

A. Install continuous underground detectable warning tape during backfilling of trench for underground water-distribution piping. Locate below finished grade, directly over piping. Underground warning tapes are specified in Division 31.

B. Permanently attach equipment nameplate or marker indicating plastic water-service piping, on main electrical meter panel.

3.25 CLEANING

A. Clean and disinfect water-distribution piping as follows:
   1. Purge new water-distribution piping systems and parts of existing systems that have been altered, extended, or repaired before use.
   2. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in NFPA 24 for flushing of piping. Flush piping system with clean, potable water until dirty water does not appear at points of outlet.
   3. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in AWWA C651 or do as follows:
      a. Fill system or part of system with water/chlorine solution containing at least 50 ppm of chlorine; isolate and allow to stand for 24 hours.
      b. Drain system or part of system of previous solution and refill with water/chlorine solution containing at least 200 ppm of chlorine; isolate and allow to stand for 3 hours.
      c. After standing time, flush system with clean, potable water until no chlorine remains in water coming from system.

d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination shows evidence of contamination.

B. Prepare reports of purging and disinfecting activities.

C. Repeat the procedure until approved by the local jurisdiction.

END OF SECTION

SECTION 33 4100
STORMWATER CONVEYANCE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

2.01 SUMMARY

A. Section Includes:

1. Ductile-iron culvert pipe and fittings.
2. Ductile-iron, pressure pipe and fittings.
3. Corrugated-steel pipe and fittings.
4. Corrugated-aluminum pipe and fittings.
5. Smooth-bore spiral rib (SBSR) pipe -Aluminized Steel Type II
6. ABS pipe and fittings.
7. PE pipe and fittings.
8. PVC pipe and fittings.
9. Concrete pipe and fittings.
10. Non-pressure transition couplings.
11. Pressure pipe couplings.
12. Expansion joints and deflection fittings.
13. Backwater valves.
14. Cleanouts.
15. Drains.
16. Encasement for piping.
17. Manholes.
18. Polymer-concrete, channel drainage systems.
19. Plastic, channel drainage systems.
20. Catch basins.
21. Stormwater inlets.
22. Stormwater detention structures.
23. Pipe outlets.
24. Dry wells.
25. Stormwater disposal systems.

3.01 DEFINITIONS

A. FRP: Fiberglass-reinforced plastic.

B. SBSR: Smooth-bore Spiral Rib

4.01 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals, if applicable:
   1. Product Data: For adhesives, indicating VOC content.
   2. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.

C. Shop Drawings:
   1. Manholes: Include plans, elevations, sections, details, frames, and covers.
   2. Catch basins, stormwater inlets, and dry wells. Include plans, elevations, sections, details, frames, covers, and grates.
   3. Stormwater Detention Structures: Include plans, elevations, sections, details, frames, covers, structural design calculations, and concrete design-mix reports.

5.01 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Show pipe sizes, locations, and elevations. Show other piping in same trench and clearances from storm drainage system piping. Indicate interface and spatial relationship between manholes, piping, and proximate structures.

B. Product Certificates: For each type of cast-iron soil pipe and fitting, from manufacturer.

C. Field quality-control reports.

6.01 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

7.01 DELIVERY, STORAGE, AND HANDLING

A. Do not store plastic manholes, pipe, and fittings in direct sunlight.

B. Protect pipe, pipe fittings, and seals from dirt and damage.

C. Handle manholes in accordance with manufacturer's written rigging instructions.

D. Handle catch basins and stormwater inlets in accordance with manufacturer's written rigging instructions.

E. If utilizing SBSR Pipe, refer to recommendations of the National Corrugated Steel Pipe Association (NCSPA) for proper handling and storage.

8.01 FIELD 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 in accordance with requirements indicated:
   1. Notify Owner no fewer than 48 hours in advance of proposed interruption of service.
   2. Do not proceed with interruption of service without Owner's written permission.

PART 2 - PRODUCTS

1.01 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

A. Source Limitations: Obtain hub-and-spigot, cast-iron soil pipe and fittings from single manufacturer.

B. Pipe and Fittings:
   1. Marked with CISPI collective trademark and NSF certification mark.
   2. Class: ASTM A 74, Service and Extra Heavy class(es).

C. Gaskets: ASTM C 564, rubber.

D. Caulking Materials: ASTM B 29, pure lead and oakum or hemp fiber.

2.01 HUBLESS CAST-IRON SOIL PIPE AND FITTINGS

A. Source Limitations: Obtain hubless cast-iron soil pipe and fittings from single manufacturer.

B. Pipe and Fittings:
   1. Marked with CISPI collective trademark and NSF certification mark.
   2. Standard: ASTM A 888 or CISPI 301.

C. CISPI, Hubless-Piping Couplings:
   1. Source Limitations: Obtain CISPI, hubless-piping couplings from single manufacturer.
   2. Description: Stainless-steel corrugated shield; stainless-steel bands and tightening devices; and rubber sleeve with integral, center pipe stops.
   3. Standards:
      a. ASTM C 1277 and CIPSI 310 for couplings.
      b. ASTM C 564 for gaskets.

D. Heavy-Duty, Hubless-Piping Couplings:
   1. Source Limitations: Obtain heavy-duty, hubless-piping couplings from single manufacturer.
   2. Description: Stainless-steel shield; stainless-steel bands and tightening devices; and rubber sleeve with integral, center pipe stop.
   3. Standards:
      a. ASTM C 1277 and ASTM C 1540 for couplings.
      b. ASTM C564 for rubber gaskets.

E. Cast-Iron, Hubless-Piping Couplings:
   1. Source Limitations: Obtain cast-iron, hubless-piping couplings from single manufacturer.
   2. Description: Two-piece, cast-iron housing; stainless-steel bolts and nuts; and rubber sleeve with integral, center pipe stop.
   3. Standards:

a. ASTM C 1277 for couplings.
b. ASTM A 48/A 48M for cast-iron castings.
c. ASTM C 564 for gaskets.

3.01 SBSR ALUMINIZED STEEL TYPE II, CULVERT PIPE AND FITTINGS

A. Pipe: AASHTO M 36 or ASTM A760
   1. Coupling bands shall be made of the same base metal and coatings as the pipe, to a minimum of 18 gauge.
B. Coils: AASHTO M 274 or ASTM A929.

4.01 DUCTILE-IRON, CULVERT PIPE AND FITTINGS

A. Pipe: ASTM A 716, for push-on joints.
B. Standard Fittings: AWWA C110/A21.10, ductile or gray iron, for push-on joints.
C. Compact Fittings: AWWA C153/A21.53, for push-on joints.
D. Gaskets: AWWA C111/A21.11, rubber.

5.01 DUCTILE-IRON, PRESSURE PIPE AND FITTINGS

A. Source Limitations: Obtain ductile-iron, pressure pipe and fittings from single manufacturer.
B. Ductile-Iron, Push-on-Joint Piping:
   1. Ductile-Iron Pipe: AWWA C151/A21.51, with push-on-joint bell and plain spigot end unless grooved or flanged ends are indicated.
   2. Ductile-Iron Fittings: AWWA C110/A21.10, push-on-joint ductile- or gray-iron standard pattern or AWWA C153/A21.53, ductile-iron compact pattern.
   3. Gaskets: AWWA C111/A21.11, rubber.
C. Ductile-Iron, Mechanical-Joint Piping:
   1. Ductile-Iron Pipe: AWWA C151/A21.51, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated.
   2. Ductile-Iron Fittings: AWWA C110/A21.10, mechanical-joint ductile- or gray-iron standard pattern or AWWA C153/A21.53, ductile-iron compact pattern.
   3. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

6.01 CORRUGATED-STEEL PIPE AND FITTINGS

A. Source Limitations: Obtain corrugated-steel pipe and fittings from single manufacturer.
B. Corrugated-Steel Pipe and Fittings: ASTM A 760/A 760M, Type I with fittings of similar form and construction as pipe.
   1. Special-Joint Bands: Corrugated steel with O-ring seals.
   2. Standard-Joint Bands: Corrugated steel.
   3. Coating: Aluminum or Zinc.

7.01 CORRUGATED-ALUMINUM PIPE AND FITTINGS

A. Source Limitations: Obtain corrugated-aluminum pipe and fittings from single manufacturer.

B. Corrugated-Aluminum Pipe and Fittings: ASTM B 745/B 745M, Type I with fittings of similar form and construction as pipe.

1. Special-Joint Bands: Corrugated aluminum with O-ring seals.
2. Standard-Joint Bands: Corrugated aluminum.

8.01 CORRUGATED-PE PIPE AND FITTINGS

A. Source Limitations: Obtain corrugated-PE pipe and fittings from single manufacturer.

B. Corrugated-PE Drainage Pipe and Fittings NPS 3 to NPS 10: AASHTO M 252, Type S, with smooth waterway for coupling joints.

C. Corrugated-PE Pipe and Fittings NPS 12 to NPS 60: AASHTO M 294, Type S, with smooth waterway for coupling joints.

D. Corrugated-PE Silt-tight Couplings: PE sleeve with ASTM D 1056, Type 2, Class A, Grade 2 gasket material that mates with pipe and fittings.

E. Corrugated-PE Soil-tight Couplings: AASHTO M 294, corrugated, matching pipe and fittings.

9.01 PVC PIPE AND FITTINGS

A. Source Limitations: Obtain PVC pipe and fittings from single manufacturer.

B. NSF Marking: Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-drain" for plastic storm drain and "NSF-sewer" for plastic storm sewer piping.

C. PVC Cellular-Core Piping:

1. PVC Cellular-Core Pipe and Fittings: ASTM F 891, Sewer and Drain Series, PS 50 minimum stiffness, PVC cellular-core pipe with plain ends for solvent-cemented joints.
2. Fittings: ASTM D 3034, SDR 35, PVC socket-type fittings.

D. PVC Corrugated Sewer Piping:

1. Pipe: ASTM F 949, PVC, corrugated pipe with bell-and-spigot ends for gasketed joints.
2. Fittings: ASTM F 949, PVC molded or fabricated, socket type.
3. Gaskets: ASTM F 477, elastomeric seals.

E. PVC Profile Sewer Piping:

1. Pipe: ASTM F 794, PVC profile, gravity sewer pipe with bell-and-spigot ends for gasketed joints.
2. Fittings: ASTM D 3034, PVC with bell ends.
3. Gaskets: ASTM F 477, elastomeric seals.

F. PVC Type PSM Sewer Piping:
   1. Pipe: ASTM D 3034, SDR 35, PVC Type PSM sewer pipe with bell-and-spigot ends for gasketed joints.
   2. Fittings: ASTM D 3034, PVC with bell ends.
   3. Gaskets: ASTM F 477, elastomeric seals.

G. PVC Gravity Sewer Piping:
   1. Pipe and Fittings: ASTM F 679, wall thickness, PVC gravity sewer pipe with bell-and-spigot ends and with integral ASTM F 477, elastomeric seals for gasketed joints.

H. PVC Pressure Piping:
   1. Pipe: AWWA C900, Class 200 or as indicated on drawings, PVC pipe with bell-and-spigot ends for gasketed joints.
   2. Fittings: AWWA C900, Class 200 or as indicated on drawings, PVC pipe with bell ends
   3. Gaskets: ASTM F 477, elastomeric seals.

I. PVC Water-Service Piping:
   1. Pipe: ASTM D 1785, Schedule 80 PVC, with plain ends for solvent-cemented joints.
   2. Fittings: ASTM D 2467, Schedule 80 PVC, socket type.

10.01 POLYPROPYLENE PIPE AND FITTINGS

A. 12- through 30-inch pipe: smooth interior and annular exterior corrugations, meeting or exceeding ASTM F2736 and AASHTO MP-21-11.

B. 36- through 60 –inch pipe: smooth interior and annular exterior corrugations meeting or exceeding ASTM F2881 and AASHTO MP- 21-11.

C. Gasketed integral bell and spigot joint: ASTM F2736 and F2881.

D. Pipe: watertight per ASTM D3212.

E. Gaskets: ASTM F477, installed by the pipe manufacturer and covered with a removable, protective wrap to ensure the gasket is free from debris.

F. Reinforced bell with a polymer composite band installed by the manufacturer.

G. Fittings: ASTM F2736, ASTM F2881 and AASHTO MP-21-11. Bell and Spigot with gasket meeting ASTM F477. Bell & Spigot fittings joint: ASTM D3212. Corrugated couplings: split collar, engaging at least 2 full corrugations.

11.01 HIGH DENSITY POLYETHYLENE

A. FAD4- through 60-inch: smooth interior and annular exterior corrugations meeting or exceeding ASTM F 2648.
   1. Join pipe using a soil tight bell & spigot joint meeting ASTM 2648.

2. Gaskets: ASTM F477, installed by the pipe manufacturer and covered with a removable wrap to ensure the gasket is free from debris. Use a joint lubricant supplied by the manufacturer on the gasket and bell during assembly.
3. Fittings: ASTM F 2306. Utilize a spun-on or welded bell and valley or saddle gasket meeting ASTM F 2306.

12.01 CONCRETE PIPE AND FITTINGS

A. Source Limitations: Obtain concrete pipe and fittings from single manufacturer.
B. Nonreinforced-Concrete Sewer Pipe and Fittings: ASTM C 14, with bell-and-spigot or tongue-and-groove ends and gasketed joints with ASTM C 443, rubber gaskets.
C. Reinforced-Concrete Sewer Pipe and Fittings: ASTM C 76.
   1. Bell-and-spigot or tongue-and-groove ends and gasketed joints with ASTM C 443, rubber gaskets

13.01 NONPRESSURE TRANSITION COUPLINGS

A. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.
B. Sleeve Materials:
   1. For Concrete Pipes: ASTM C 443, rubber.
   2. For Cast-Iron Soil Pipes: ASTM C 564, rubber.
   3. For Fiberglass Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
   4. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
   5. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.
C. Unshielded, Flexible Couplings:
   1. Source Limitations: Obtain unshielded, flexible couplings from single manufacturer.
   2. Description: Elastomeric sleeve with corrosion-resistant-metal tension band and tightening mechanism on each end.
D. Shielded, Flexible Couplings:
   1. Source Limitations: Obtain shielded, flexible couplings from single manufacturer.
   2. Description: ASTM C 1460, elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
E. Ring-Type, Flexible Couplings:

1. Source Limitations: Obtain ring-type, flexible couplings from single manufacturer.
2. Description: Elastomeric compression seal with dimensions to fit inside bell of larger pipe and for spigot of smaller pipe to fit inside ring.

14.01 PRESSURE PIPE COUPLINGS

A. Source Limitations: Obtain pressure pipe couplings from single manufacturer.
B. Description: AWWA C219, tubular-sleeve coupling, with center sleeve, gaskets, end rings, and bolt fasteners.
C. Metal, bolted, sleeve-type, reducing or transition coupling, for joining underground pressure piping. Include 200- psig minimum pressure rating and ends sized to fit adjoining pipes.
D. Center-Sleeve Material: Manufacturer's standard.
E. Gasket Material: Natural or synthetic rubber.
F. Metal Component Finish: Corrosion-resistant coating or material.

15.01 EXPANSION JOINTS AND DEFLECTION FITTINGS

A. Ductile-Iron, Flexible Expansion Joints:
   1. Source Limitations: Obtain ductile-iron, flexible expansion joints from single manufacturer.
   2. Description: Compound fitting with combination of flanged and mechanical-joint ends complying with AWWA C110/A21.10 or AWWA C153/A21.53. Include two gasketed ball-joint sections and one or more gasketed sleeve sections, rated for 250-psig minimum working pressure and for offset and expansion indicated.
B. Ductile-Iron Expansion Joints:
   1. Source Limitations: Obtain ductile-iron expansion joints from single manufacturer.
   2. Description: Three-piece assembly of telescoping sleeve with gaskets and restrained-type, ductile iron; bell-and-spigot end sections complying with AWWA C110/A21.10 or AWWA C153/A21.53.
   3. Pressure Rating: 250-psig minimum working pressure and for expansion indicated.
C. Ductile-Iron Deflection Fittings:
   1. Source Limitations: Obtain ductile-iron deflection fittings from single manufacturer.
   2. Description: Compound, ductile-iron coupling fitting with sleeve and one or two flexing sections for up to 15-degree deflection, gaskets, and restrained-joint ends complying with AWWA C110/A21.10 or AWWA C153/A21.53. Include

AWWA C111/A21.11, ductile-iron glands, rubber gaskets, and steel bolts. Include AWWA C111/A21.11 ductile-iron glands, rubber gaskets, and steel bolts.

3. Pressure Rating: 250 psig minimum.

16.01 BACKWATER VALVES

A. Cast-Iron Backwater Valves:
   1. Source Limitations: Obtain cast-iron backwater valves from single manufacturer.
   2. Description: ASME A112.14.1, gray-iron body and bolted cover, with bronze seat.
   3. Horizontal type; with swing check valve and hub-and-spigot ends.
   4. Combination horizontal and manual gate-valve type; with swing check valve, integral gate valve, and hub-and-spigot ends.
   5. Terminal type; with bronze seat, swing check valve, and hub inlet.

B. PVC Backwater Valves:
   1. Source Limitations: Obtain PVC backwater valves from single manufacturer.
   2. Description: Horizontal type; with PVC body, PVC removable cover, and PVC swing check valve.

17.01 CLEANOUTS

A. Cast-Iron Cleanouts:
   1. Source Limitations: Obtain cast-iron cleanouts from single manufacturer.
   2. Description: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside caulk or spigot connection and countersunk, tapered-thread, brass closure plug.
   3. Top-Loading Classification(s): Light Duty, Medium Duty, Heavy Duty and Extra-Heavy Duty.
   4. Storm Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.

B. PVC Cleanouts:
   1. Source Limitations: Obtain PVC cleanouts from single manufacturer.
   2. Description: PVC body with PVC threaded plug. Include PVC storm pipe fitting and riser to cleanout of same material as storm piping.

18.01 DRAINS

A. Cast-Iron Area Drains:
   1. Source Limitations: Obtain cast-iron area drains from single manufacturer.
   2. Description: ASME A112.6.3 gray-iron round body with anchor flange and round, secured grate. Include bottom outlet with inside caulk or spigot connection, of sizes indicated.
   3. Top-Loading Classification(s): Medium Duty and Heavy Duty.

B. Cast-Iron Trench Drains:
   1. Source Limitations: Obtain cast-iron trench drains from single manufacturer.
   2. Description: ASME A112.6.3, width as indicated on drawings, rectangular body with anchor flange or other anchoring device, and rectangular secured grate. Include units of total length indicated and quantity of bottom outlets with inside caulk or spigot connections, of sizes indicated.
   3. Top-Loading Classification(s): Medium Duty, Heavy Duty and Extra-Heavy Duty.

C. Grate Openings: As indicated on drawings.

19.01 ENCASEMENT FOR PIPING

A. Standard: ASTM A 674 or AWWA C105/A21.5.

B. Material: Linear low-density polyethylene film of 0.008-inch or cross-laminated HDPE film of 0.004-inch minimum thickness.

C. Form: Sheet or tube.

D. Color: Black or natural.

20.01 MANHOLES

A. Standard Precast Concrete Manholes:
   1. Description: Meet requirements of Local Jurisdiction and ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.
   2. Diameter: 48 inches minimum unless otherwise indicated.
   3. Ballast: Increase thickness of precast concrete sections or add concrete to base section as required to prevent flotation.
   4. Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section, and separate base slab or base section with integral floor.
   5. Riser Sections: 4-inch minimum thickness, and lengths to provide depth indicated.
   6. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated, and top of cone of size that matches grade rings.
   7. Joint Sealant: ASTM C 990, bitumen or butyl rubber.
   8. Resilient Pipe Connectors: ASTM C 923, cast or fitted into manhole walls, for each pipe connection.
   9. Steps: Wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls to meet requirements of local jurisdiction, minimum 12- to 16-inch intervals. Omit steps if total depth from floor of manhole to finished grade is less than 36 inches.
   10. Adjusting Rings: Interlocking HDPE rings with level or sloped edge in thickness and diameter matching manhole frame and cover, and of height required to

adjust manhole frame and cover to indicated elevation and slope. Include sealant recommended by ring manufacturer.

11. Grade Rings: Reinforced-concrete rings, 6- to 9-inch total thickness, to match diameter of manhole frame and cover, and height as required to adjust manhole frame and cover to indicated elevation and slope.

B. Designed Precast Concrete Manholes:
   1. Description: ASTM C 913; designed in accordance with ASTM C 890 for A-16 (AASHTO HS20-44), heavy-traffic, structural loading; of depth, shape, and dimensions indicated, with provision for sealant joints.
   2. Ballast: Increase thickness of one or more precast concrete sections or add concrete to manhole as required to prevent flotation.
   3. Joint Sealant: ASTM C 990, bitumen or butyl rubber.
   4. Resilient Pipe Connectors: ASTM C 923, cast or fitted into manhole walls, for each pipe connection.
   5. Steps: Wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls to meet requirements of local jurisdiction, minimum 12- to 16-inch intervals. Omit steps if total depth from floor of manhole to finished grade is less than 36 inches.
   6. Adjusting Rings: Interlocking HDPE rings with level or sloped edge in thickness and diameter matching manhole frame and cover, and of height required to adjust manhole frame and cover to indicated elevation and slope. Include sealant recommended by ring manufacturer.
   7. Grade Rings: Reinforced-concrete rings, 6- to 9-inch total thickness, to match diameter of manhole frame and cover, and of height required to adjust manhole frame and cover to indicated elevation and slope.

C. Manhole Frames and Covers:
   1. Description: Ferrous; 24-inch ID by 7- to 9-inch riser with 4-inch- minimum width flange and 26-inch- diameter cover. Include indented top design with lettering cast into cover, using wording equivalent to "STORM SEWER.", per local jurisdiction.
   2. Material: ASTM A 536, Grade 60-40-18 ductile or ASTM A 48/A 48M, Class 35 gray iron unless otherwise indicated. Meet local jurisdiction requirements.

21.01 CONCRETE

A. General: Cast-in-place concrete in accordance with ACI 318, ACI 350, and the following:
   1. Cement: ASTM C 150/C 150M, Type II.
   2. Fine Aggregate: ASTM C 33/C 33M, sand.

3. Coarse Aggregate: ASTM C 33/C 33M, crushed gravel.
4. Water: Potable.

B. Portland Cement Design Mix: 4000 psi minimum, with 0.50 maximum water/cementitious materials ratio.
1. Reinforcing Fabric: ASTM A 1064/A 1064M, steel, welded wire fabric, plain.
2. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (420 MPa) deformed steel.

C. Manhole Channels and Benches: Factory or field formed from concrete. Portland cement design mix, 4000 psi minimum, with 0.50 maximum water/cementitious materials ratio. Include channels and benches in manholes.
1. Channels: Concrete invert, formed to same width as connected piping, with height of vertical sides to three-fourths of pipe diameter. Form curved channels with smooth, uniform radius and slope.
a. Invert Slope: Meet local jurisdiction requirements.
2. Benches: Concrete, sloped to drain into channel.
a. Slope: Meet local jurisdiction requirements.

D. Ballast and Pipe Supports: Meet local jurisdiction requirements, Portland cement design mix, 3000 psi minimum, with 0.58 maximum water/cementitious materials ratio.
1. Reinforcing Fabric: ASTM A 1064/A 1064M, steel, welded wire fabric, plain.
2. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (420 MPa) deformed steel.

22.01 POLYMER-CONCRETE, CHANNEL DRAINAGE SYSTEMS

A. Narrow, Sloped-Invert, Polymer-Concrete Channel Drainage Systems:
1. Source Limitations: Obtain narrow, sloped-invert channel drainage systems from single manufacturer.
2. Description: Modular system of channel sections, grates, and appurtenances; designed so grates fit into channel recesses without rocking or rattling.
3. Channel Sections: Narrow, interlocking-joint, sloped-invert, polymer-concrete modular units with end caps.
a. Include rounded bottom, with built-in invert slope of 0.6 percent and with outlets in number, sizes, and locations indicated.
b. Include extension sections necessary for required depth.
c. Dimensions: Width as indicated on drawings. Include number of units required to form total lengths indicated.
d. Frame: Gray-iron or galvanized steel for grates.
4. Grates: Manufacturer's designation " heavy or medium duty," with slots or perforations, and of width and thickness that fit recesses in channel sections.
a. Material: Ductile iron or Gray iron

1) Locking Mechanism: Manufacturer's standard device for securing grates to channel sections.

5. Covers: Solid ductile or gray iron, of width and thickness that fit recesses in channel sections, and of lengths indicated.
6. Supports, Anchors, and Setting Devices: Manufacturer's standard unless otherwise indicated.
7. Channel-Section Joining and Fastening Materials: As recommended by system manufacturer.

23.01 PLASTIC, CHANNEL DRAINAGE SYSTEMS

A. General Requirements for Plastic, Channel Drainage Systems:
1. Modular system of plastic channel sections, grates, and appurtenances.
2. Designed so grates fit into frames without rocking or rattling.
3. Number of units required to form total lengths indicated.

B. HDPE or PE Channel Drainage Systems:
1. Source Limitations: Obtain HDPE or PE channel drainage systems from single manufacturer.
2. Description: Modular system of channel sections, grates, and appurtenances; designed so grates fit into channel recesses without rocking or rattling.
3. Channel Sections: Interlocking-joint, HDPE or PE modular units, with end caps. Include flat, rounded, or inclined bottom, with level invert and with outlets in number, sizes, and locations indicated.
a. Dimensions: Width as indicated on drawings. Include number of units required to form total lengths indicated.
4. Grates: With slots or perforations and widths and thickness that fit recesses in channel sections.
a. Material: Galvanized steel or Gray iron.
b. Color: As selected by Owner from manufacturer's full range.
5. Supports, Anchors, and Setting Devices: Manufacturer's standard unless otherwise indicated.
6. Channel-Section Joining and Fastening Materials: As recommended by system manufacturer.

24.01 CATCH BASINS

A. Standard Precast Concrete Catch Basins:
1. Description: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.

2. Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section, and separate base slab or base section with integral floor.
3. Riser Sections: 4-inch minimum thickness, 48-inch diameter, and lengths to provide depth indicated.
4. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated. Top of cone of size that matches grade rings.
5. Joint Sealant: ASTM C 990, bitumen or butyl rubber.
6. Adjusting Rings: Interlocking rings with level or sloped edge in thickness and shape matching catch basin frame and grate. Include sealant recommended by ring manufacturer.
7. Grade Rings: Include two or three reinforced-concrete rings, of 6- to 9-inch total thickness, that match 24-inch- diameter frame and grate.
8. Steps: Wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls to meet requirements of local jurisdiction, minimum 12- to 16-inch intervals. Omit steps if total depth from floor of catch basin to finished grade is less than 36 inches.
9. Pipe Connectors: ASTM C 923, resilient, of size required, for each pipe connecting to base section.

B. Designed Precast Concrete Catch Basins: ASTM C 913, precast, reinforced concrete; designed in accordance with ASTM C 890 for A-16 (ASSHTO HS20-44), heavy-traffic, structural loading; of depth, shape, and dimensions indicated, with provision for joint sealants.
1. Joint Sealants: ASTM C 990, bitumen or butyl rubber.
2. Adjusting Rings: Interlocking rings with level or sloped edge in thickness and shape matching catch basin frame and grate. Include sealant recommended by ring manufacturer.
3. Grade Rings: Include two or three reinforced-concrete rings, of 6- to 9-inch total thickness, that match 24-inch- diameter frame and grate.
4. Steps: Wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 16-inch intervals. Omit steps if total depth from floor of catch basin to finished grade is less than 36 inches.
5. Pipe Connectors: ASTM C 923, resilient, of size required, for each pipe connecting to base section.

C. Frames and Grates: ASTM A 536, Grade 60-40-18, ductile iron designed for A-16 (AASHTO HS20-44), structural loading. Include flat grate with small square or short-slotted drainage openings.
   1. Size: 24 by 24 inches minimum unless otherwise indicated.
   2. Grate Free Area: Approximately 50 percent unless otherwise indicated.

D. Frames and Grates: ASTM A 536, Grade 60-40-18, ductile iron designed for A-16 (AASHTO HS20-44), structural loading. Include 24-inch ID by 7- to 9-inch riser with 4-inch- minimum width flange, and 26-inch- diameter flat grate with small square or short-slotted drainage openings.
   1. Grate Free Area: Approximately 50 percent unless otherwise indicated.

25.01 STORMWATER INLETS

A. Curb Inlets: Made with vertical curb opening, of materials and dimensions in accordance with utility standards.

B. Gutter Inlets: Made with horizontal gutter opening, of materials and dimensions in accordance with utility standards. Include heavy-duty frames and grates.

C. Combination Inlets: Made with vertical curb and horizontal gutter openings, of materials and dimensions in accordance with utility standards. Include heavy-duty frames and grates.

D. Frames and Grates: Heavy duty, in accordance with utility standards.

26.01 STORMWATER DETENTION STRUCTURES

A. Cast-in-Place Concrete, Stormwater Detention Structures: Constructed of reinforced-concrete bottom, walls, and top; designed in accordance with ASTM C 890 for A-16 (AASHTO HS20-44), heavy-traffic, structural loading; of depth, shape, dimensions, and appurtenances indicated.
   1. Ballast: Increase thickness of concrete as required to prevent flotation.
   2. Grade Rings: Include two or three reinforced-concrete rings, of 6- to 9-inch total thickness, that match 24-inch- diameter frame and cover.
   3. Steps: Wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 16-inch intervals. Omit steps if total depth from floor of structure to finished grade is less than 36 inches.

B. Manhole Frames and Covers: ASTM A 536, Grade 60-40-18, ductile-iron castings designed for heavy-duty service. Include 24-inch ID by 7- to 9-inch riser with 4-inch- minimum width flange, and 26-inch- diameter cover. Include indented top design with lettering cast into cover, using wording equivalent to "STORM SEWER."

27.01 PIPE OUTLETS

A. Head Walls: Cast-in-place reinforced or precast concrete, with apron and tapered sides.

B. Riprap Basins: Broken, irregularly sized and shaped, graded stone in accordance with State Erosion Control Specifications.

C. Filter Stone: In accordance with State Erosion Control Specifications.

D. Energy Dissipaters: In accordance with State Erosion Control Specifications

28.01 DRY WELLS

A. ASTM C 913, precast, reinforced, perforated concrete rings. Include the following:
   1. Floor: Cast-in-place concrete.
   2. Cover: Liftoff-type concrete cover with cast-in lift rings.
   3. Wall Thickness: 4 inches minimum with 1-inch diameter or 1-by-3-inch-maximum slotted perforations arranged in rows parallel to axis of ring.
      a. Total Free Area of Perforations: Approximately 15 percent of ring interior surface.
      b. Ring Construction: Designed to be self-aligning.
   4. Filtering Material: ASTM D 448, Size No. 24, 3/4- to 2-1/2-inch washed, crushed stone or gravel.

B. Manufactured PE Dry Wells:
   1. Manufactured PE side panels and top cover that assemble into 50-gal. storage capacity units.
   2. Source Limitations: Obtain manufactured PE dry wells from single manufacturer.
   3. Side Panels: With knockout ports for piping and seepage holes.
   4. Top Cover: With knockout port for drain.
   5. Filter Fabric: As recommended by unit manufacturer.
   6. Filtering Material: ASTM D 448, Size No. 24, 3/4- to 2-1/2-inch washed, crushed stone or gravel.

C. Constructed-in-place aggregate type. Include the following:
   1. Lining: Clay or concrete bricks.
   2. Lining: Concrete blocks or precast concrete rings with notches or weep holes.
   3. Filtering Material: ASTM D 448, Size No. 24, 3/4- to 2-1/2-inch washed, crushed stone or gravel.
   4. Cover: Precast, reinforced-concrete slab, designed for structural loading in accordance with ASTM C 890 and made in accordance with ASTM C 913. Include slab dimensions that will extend 12 inches minimum beyond edge of excavation, with bituminous coating over entire surface. Cast cover with opening for manhole in center.

5. Manhole: 24-inch- diameter, reinforced-concrete access lid with steel lift rings. Include bituminous coating over entire surface.

29.01 STORMWATER DISPOSAL SYSTEMS

A. Chamber Systems:
   1. Source Limitations: Obtain chamber systems from single manufacturer.
   2. Storage and Leaching Chambers: Molded PE with perforated sides and open bottom. Include number of chambers, distribution piping, end plates, and other standard components as required for system total capacity.
   3. Filtering Material: ASTM D 448, Size No. 24, 3/4- to 2-1/2-inch washed, crushed stone or gravel.
   4. Filter Mat: Geotextile woven or spun filter fabric, in one or more layers, for minimum total unit weight of 4 oz./sq. yd..

B. Pipe Systems: Perforated manifold, header, and lateral piping complying with AASHTO M 252 for NPS 10 and smaller, AASHTO M 294 for NPS 12 to NPS 60. Include proprietary fittings, couplings, seals, and filter fabric.
   1. Source Limitations: Obtain pipe systems from single manufacturer.

PART 3 - EXECUTION

1.01 EARTHWORK

A. Excavation, trenching, and backfilling are specified in Section 312000 "Earth Moving."

2.01 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 in accordance with manufacturer's written instructions for use of lubricants, cements, and other installation requirements.

C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing storm sewer is indicated.

D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

E. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process of microtunneling.

F. Install gravity-flow, nonpressure drainage piping in accordance with 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 piping with minimum cover, per local jurisdiction or manufacturer’s specifications, whichever is more stringent.
4. Install hub-and-spigot, cast-iron soil piping in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook."
5. Install hubless cast-iron soil piping in accordance with CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook."
6. Install ductile-iron piping and special fittings in accordance with AWWA C600 or AWWA M41.
7. Install corrugated-steel piping in accordance with ASTM A 798/A 798M.
8. Install corrugated-aluminum piping in accordance with ASTM B 788/B 788M.
9. Install ABS sewer piping in accordance with ASTM D 2321 and ASTM F 1668.
10. Install PE corrugated sewer piping in accordance with ASTM D 2321.
11. Install PVC cellular-core piping in accordance with ASTM D 2321 and ASTM F 1668.
12. Install PVC sewer piping in accordance with ASTM D 2321 and ASTM F 1668.
13. Install PVC profile gravity sewer piping in accordance with ASTM D 2321 and ASTM F 1668.
14. Install PVC water-service piping in accordance with ASTM D 2321 and ASTM F 1668.
15. Install nonreinforced-concrete sewer piping in accordance with ASTM C 1479 and ACPA's "Concrete Pipe Installation Manual."
16. Install reinforced-concrete sewer piping in accordance with ASTM C 1479 and ACPA's "Concrete Pipe Installation Manual."
17. Install polypropylene sewer piping in accordance with ASTM D 2321 and ASTM F 1668.
18. Install polyethylene sewer piping in accordance with ASTM D 2321 and ASTM F 1668.

G. If utilizing SBSR Pipe, installation will follow the manufacturer's recommendations, shall be in accordance with ASTM A798, as well as the following:
   1. SBSR Pipe will not be installed within pond dams or public/private rights-of-way.

2. If substituting SBSR Pipe for RCP pipe on approved construction drawings, the engineer of record must be notified and authorization to do so must be provided prior to installation.

3. Contractor should coordinate directly with supplier/manufacturer to ensure appropriate bedding is provided to meet both manufacturer's specifications and local jurisdictional requirements.

4. Construction loads may be greater than design loads, and the contractor shall follow the recommendations for additional compacted material per manufacturer's specifications in this instance.

H. Install force-main pressure piping in accordance with the following:
1. Install piping with restrained joints at tee fittings and at horizontal and vertical changes in direction. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place concrete supports or anchors.
2. Install piping with minimum cover, per local jurisdiction.
3. Install ductile-iron pressure piping in accordance with AWWA C600 or AWWA M41.
4. Install ductile-iron special fittings in accordance with AWWA C600.
5. Install PVC pressure piping in accordance with AWWA M23, or ASTM D 2774 and ASTM F 1668.
6. Install PVC water-service piping in accordance with ASTM D 2774 and ASTM F 1668.

I. Install corrosion-protection piping encasement over the following underground metal piping in accordance with ASTM A 674 or AWWA C105/A21.5:
1. Hub-and-spigot, cast-iron soil pipe and fittings.
2. Hubless cast-iron soil pipe and fittings.
3. Ductile-iron pipe and fittings.
4. Expansion joints and deflection fittings.

3.01 PIPE JOINT CONSTRUCTION

A. Join gravity-flow, nonpressure drainage piping in accordance with the following:
1. Join hub-and-spigot, cast-iron soil piping with gasketed joints in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
2. Join hub-and-spigot, cast-iron soil piping with caulked joints in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead and oakum caulked joints.
3. Join hubless cast-iron soil piping in accordance with CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.

4. Join ductile-iron culvert piping in accordance with AWWA C600 for push-on joints.
5. Join ductile-iron piping and special fittings in accordance with AWWA C600 or AWWA M41.
6. Join corrugated-steel sewer piping in accordance with ASTM A 798/A 798M.
7. Join corrugated-aluminum sewer piping in accordance with ASTM B 788/B 788M.
8. Join ABS sewer piping in accordance with ASTM D 2321 for elastomeric-seal joints.
9. Join corrugated-PE piping in accordance with ASTM D 3212 for push-on joints.
10. Join PVC cellular-core piping in accordance with ASTM D 2321 and ASTM F 891 for solvent-cemented joints.
11. Join PVC corrugated sewer piping in accordance with ASTM D 2321 for elastomeric-seal joints.
12. Join PVC sewer piping in accordance with ASTM D 2321 and ASTM D 3034 for elastomeric-seal joints or ASTM D 3034 for elastomeric-gasketed joints.
13. Join PVC profile gravity sewer piping in accordance with ASTM D 2321 for elastomeric-seal joints or ASTM F 794 for gasketed joints.
14. Join nonreinforced-concrete sewer piping in accordance with ASTM C 14 and ACPA's "Concrete Pipe Installation Manual" for rubber-gasketed joints.
15. Join reinforced-concrete sewer piping in accordance with ACPA's "Concrete Pipe Installation Manual" for rubber-gasketed joints.
16. Join dissimilar pipe materials with nonpressure-type flexible couplings.

B. Join force-main pressure piping in accordance with the following:
1. Join ductile-iron pressure piping in accordance with AWWA C600 or AWWA M41 for push-on joints.
2. Join ductile-iron special fittings in accordance with AWWA C600 or AWWA M41 for push-on joints.
3. Join PVC pressure piping in accordance with AWWA M23 for gasketed joints.
4. Join PVC water-service piping in accordance with ASTM D 2855 for solvent-cemented joints.
5. Join dissimilar pipe materials with pressure-type couplings.

4.01 BACKWATER VALVE INSTALLATION

A. Install horizontal-type backwater valves in piping where indicated.

B. Install combination horizontal and manual gate-valve type in piping and in manholes where indicated.

C. Install terminal-type backwater valves on end of piping and in manholes where indicated.

5.01 CLEANOUT INSTALLATION

A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts and cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.
   1. Use Light-Duty, top-loading classification cleanouts in earth or unpaved foot-traffic areas.
   2. Use Medium-Duty, top-loading classification cleanouts in paved foot-traffic areas.
   3. Use Heavy-Duty, top-loading classification cleanouts in vehicle-traffic service areas.
   4. Use Extra-Heavy-Duty, top-loading classification cleanouts in roads.

B. Set cleanout frames and covers in earth in cast-in-place concrete block, 18 by 18 by 6 inches deep. Set with tops 1 inch above surrounding earth grade.

C. Set cleanout frames and covers in concrete pavement and roads with tops flush with pavement surface.

6.01 DRAIN INSTALLATION

A. Install type of drains in locations indicated.
   1. Use Light-Duty, top-loading classification drains in earth or unpaved foot-traffic areas.
   2. Use Medium-Duty, top-loading classification drains in paved foot-traffic areas.
   3. Use Heavy-Duty, top-loading classification drains in vehicle-traffic service areas.
   4. Use Extra-Heavy-Duty, top-loading classification drains in roads.

B. Embed drains in 4-inch- minimum concrete around bottom and sides.

C. Fasten grates to drains if indicated.

D. Set drain frames and covers with tops flush with pavement surface.

E. Assemble trench sections with flanged joints.

F. Embed trench sections in manufacturer’s minimum concrete around bottom and sides.

7.01 MANHOLE INSTALLATION

A. General: Install manholes, complete with appurtenances and accessories indicated.

B. Install precast concrete manhole sections with sealants in accordance with ASTM C 891.

C. Where specific manhole construction is not indicated, follow manhole manufacturer's written instructions.

D. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops flush at finished surface elsewhere unless otherwise indicated.

8.01 CATCH BASIN INSTALLATION

A. Construct catch basins to sizes and shapes indicated.

B. Set frames and grates to elevations indicated.

9.01 STORMWATER INLET AND OUTLET INSTALLATION

A. Construct inlet head walls, aprons, and sides of reinforced concrete, as indicated.

B. Construct riprap of broken stone, as indicated.

C. Install outlets that spill onto grade, anchored with concrete, where indicated.

D. Install outlets that spill onto grade, with flared end sections that match pipe, where indicated.

E. Construct energy dissipaters at outlets, as indicated.

10.01 DRY WELL INSTALLATION

A. Excavate hole to diameter of at least 6 inches greater than outside of dry well. Do not extend excavation into ground-water table.

B. Install precast, concrete-ring dry wells in accordance with the following:

1. Assemble rings to depth indicated.
2. Extend rings to height where top of cover will be approximately 8 inches below finished grade.
3. Backfill bottom of inside of rings with filtering material to level at least 12 inches above bottom.
4. Extend effluent inlet pipe 12 inches into rings and terminate into side of tee fitting.
5. Backfill around outside of rings with filtering material to top level of rings.
6. Install cover over top of rings.

C. Install manufactured, PE dry wells in accordance with manufacturer's written instructions and the following:

1. Assemble and install panels and cover.
2. Backfill bottom of inside of unit with filtering material to level at least 12 inches above bottom.
3. Extend effluent inlet pipe 12 inches into unit and terminate into side of tee fitting.
4. Install filter fabric around outside of unit.
5. Install filtering material around outside of unit.

D. Install constructed-in-place dry wells in accordance with the following:

1. Install brick lining material dry and laid flat, with staggered joints for seepage. Build to diameter and depth indicated.

2. Install block lining material dry, with staggered joints and 20 percent minimum of blocks on side for seepage. Install precast concrete rings with notches or weep holes for seepage. Build to diameter and depth indicated.
3. Extend lining material to height where top of manhole will be approximately 8 inches below finished grade.
4. Backfill bottom of inside of lining with filtering material to level at least 12 inches above bottom.
5. Extend effluent inlet pipe 12 inches into lining and terminate into side of tee fitting.
6. Backfill around outside of lining with filtering material to top level of lining.
7. Install manhole over top of dry well. Support cover on undisturbed soil. Do not support cover on lining.

11.01 CONCRETE PLACEMENT

A. Place cast-in-place concrete in accordance with ACI 318.

12.01 CHANNEL DRAINAGE SYSTEM INSTALLATION

A. Install with top surfaces of components, except piping, flush with finished surface.
B. Assemble channel sections to form slope down toward drain outlets. Use sealants, adhesives, fasteners, and other materials recommended by system manufacturer.
C. Embed channel sections and drainage specialties in manufacturer’s minimum concrete around bottom and sides.
D. Fasten grates to channel sections if indicated.
E. Assemble channel sections with flanged or interlocking joints.

13.01 STORMWATER DISPOSAL SYSTEM INSTALLATION

A. Chamber Systems: Excavate trenches of width and depth, and install system and backfill in accordance with chamber manufacturer's written instructions. Include storage and leaching chambers, filtering material, and filter mat.
B. Piping Systems: Excavate trenches of width and depth, and install piping system, filter fabric, and backfill, in accordance with piping manufacturer's written instructions.

14.01 CONNECTIONS

A. Connect nonpressure, gravity-flow drainage piping in building's storm building drains specified in Section 221413 "Facility Storm Drainage Piping."
B. Connect force-main piping to building's storm drainage force mains. Terminate piping where indicated.
C. 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. Make branch connections from side into existing piping, NPS 21 or larger, or to underground manholes and structures by cutting into existing unit and creating an opening large enough to allow 3 inches of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of and be flush with inside wall unless otherwise indicated. On outside of pipe, manhole, or structure wall, encase entering connection in 6 inches of concrete for minimum length of 12 inches to provide additional support of collar from connection to undisturbed ground.
    a. Use concrete that will attain a minimum 28-day compressive strength of 3000 psi unless otherwise indicated.
    b. Use epoxy-bonding compound as interface between new and existing concrete and piping materials.
4. 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.

D. Connect to sediment interceptors.

E. Pipe couplings, expansion joints, and deflection fittings 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. Flexible couplings for same or minor difference OD pipes.
    b. Unshielded, increaser/reducer-pattern, flexible couplings for pipes with different OD.
    c. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.
2. Use pressure-type pipe couplings for force-main joints.

15.01 CLOSING ABANDONED STORM DRAINAGE SYSTEMS

A. Abandoned Piping: Close open ends of abandoned underground piping indicated to remain in place. Include closures strong enough to withstand hydrostatic and earth

pressures that may result after ends of abandoned piping have been closed. Use either procedure below:

1. Close open ends of piping with at least 8- inch- thick, brick masonry bulkheads.
2. Close open ends of piping with threaded metal caps, plastic plugs, or other acceptable methods suitable for size and type of material being closed. Do not use wood plugs.

B. Abandoned Manholes and Structures: Excavate around manholes and structures as required and use one procedure below:

1. Remove manhole or structure and close open ends of remaining piping.
2. Remove top of manhole or structure down to at least 36 inches below final grade. Fill to within 12 inches of top with stone, rubble, gravel, or compacted dirt. Fill to top with concrete.

C. Backfill to grade in accordance with Section 312000 "Earth Moving."

16.01 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.

17.01 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 in accordance with 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 in accordance with requirements of authorities having jurisdiction, UNI-B-6, and the following:
      a. Exception: Piping with soil-tight joints unless required by authorities having jurisdiction.
      b. Option: Test plastic piping in accordance with ASTM F 1417.
   6. Force-Main Storm Drainage Piping: Perform hydrostatic test after thrust blocks, supports, and anchors have hardened. Test at pressure not less than 1-1/2 times the maximum system operating pressure, but not less than 150 psig (kPa).
      a. Ductile-Iron Piping: Test in accordance with AWWA C600, "Hydraulic Testing" Section.
      b. PVC Piping: Test in accordance with AWWA M23, "Testing and Maintenance" Chapter.

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.

18.01 CLEANING

A. Clean interior of piping of dirt and superfluous materials. Flush with water.

END OF SECTION

SECTION 33 4600
SUBDRAINAGE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

2.01 SUMMARY

A. Section Includes:
   1. Drainage pipe and fittings.
   2. Drainage panels.
   3. Geotextile filter fabrics.

3.01 ACTION SUBMITTALS

A. Product Data:
   1. Drainage pipe and fittings, including rated capacities.
   2. Drainage panels, including rated capacities.
   3. Geotextile filter fabrics.

4.01 DEFINITIONS

A. ABS: Acrylonitrile-butadiene-styrene plastic.
B. HDPE: High-density polyethylene plastic.
C. PE: Polyethylene plastic.
D. PP: Polypropylene plastic.
E. PS: Polystyrene plastic.
F. PVC: Polyvinyl chloride plastic.
G. Subdrainage: Drainage system that collects and removes subsurface or seepage water.

PART 2 - PRODUCTS

1.01 PERFORATED-WALL PIPES AND FITTINGS

A. Perforated PE Pipe and Fittings:
   1. NPS 6 and Smaller: ASTM F405 or AASHTO M 252, Type CP; corrugated, for coupled joints.
   2. NPS 8 and Larger: ASTM F667; AASHTO M 252, Type CP; or AASHTO M 294, Type CP; corrugated; for coupled joints.
   3. Couplings: Manufacturer's standard, band type.
B. Perforated PVC Sewer Pipe and Fittings: ASTM D2729, bell-and-spigot ends, for loose joints.

2.01 DRAINAGE PANELS

A. Molded-Sheet Drainage Panels: Prefabricated geocomposite, 36 to 60 inches wide with drainage core faced with geotextile filter fabric.
   1. Drainage Core: Three-dimensional, nonbiodegradable, molded PP.
      a. Minimum Compressive Strength: **15,000 lbf/sq. ft.** when tested according to ASTM D1621.
      b. Minimum In-Plane Flow Rate: 7 gpm/ft. of unit width at hydraulic gradient of 1.0 and compressive stress of 25 psig when tested according to ASTM D4716.

2. Filter Fabric: Nonwoven needle-punched geotextile, manufactured for subsurface drainage, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with the following properties determined according to AASHTO M 288:
   a. Survivability: Class 2.
   b. Apparent Opening Size: No. 70 sieve, maximum.
   c. Permittivity: 0.5 per second, minimum.
3. Filter Fabric: Woven geotextile fabric, manufactured for subsurface drainage, made from polyolefins or polyesters; with elongation less than 50 percent; complying with the following properties determined according to AASHTO M 288:
   a. Survivability: Class 2.
   b. Apparent Opening Size: No. 70 sieve, maximum.
   c. Permittivity: 0.5 per second, minimum.
4. Film Backing: Polymeric film bonded to drainage core surface.

B. Mesh Fabric Drainage Panels: Prefabricated geocomposite with drainage core faced with geotextile filter fabric.
1. Drainage Core: Open-construction, resilient, plastic-filament mesh, approximately 0.4 inches thick.
   a. Minimum In-Plane Flow Rate: 2.4 gpm/ft. of unit width at hydraulic gradient of 1.0 and normal pressure of 25 psig when tested according to ASTM D4716.
2. Filter Fabric: Nonwoven geotextile of PP or polyester fibers or combination of both. Flow rates range from 120 to 200 gpm/sq. ft. when tested according to ASTM D4491.

C. Net Fabric Drainage Panels: Prefabricated geocomposite with drainage core faced with geotextile filter fabric.
1. Drainage Core: Three-dimensional, PE nonwoven-strand geonet, approximately 0.25 inches thick.
   a. Minimum In-Plane Flow Rate: 5 gpm/ft. of unit width at hydraulic gradient of 1.0 and normal pressure of 25 psig when tested according to ASTM D4716.
2. Filter Fabric: Nonwoven geotextile of PP or polyester fibers or combination of both. Flow rates range from 120 to 200 gpm/sq. ft. when tested according to ASTM D4491.

D. Ring Fabric Drainage Panels: Drainage-core panel for field application of geotextile filter fabric.
1. Drainage Core: Three-dimensional, HDPE rings-in-grid pattern, approximately 1 inch thick.
   a. Minimum In-Plane Flow Rate: 40 gpm/ft. of unit width at hydraulic gradient of 1.0 and normal pressure of 25 psig when tested according to ASTM D4716.

3.01 SOIL MATERIALS

A. Soil materials are specified in Section 312000 "Earth Moving."

4.01 WATERPROOFING FELTS

A. Material: Comply with ASTM D226, Type I, asphalt or ASTM D227, coal-tar-saturated organic felt.

5.01 GEOTEXTILE FILTER FABRICS

A. Description: Fabric of PP or polyester fibers or combination of both, with flow rate range from 110 to 330 gpm/sq. ft. when tested according to ASTM D4491.

B. Structure Type: Nonwoven, needle-punched continuous filament.

1. Survivability: AASHTO M 288 Class 2.
2. Styles: Flat and sock.

PART 3 - EXECUTION

1.01 EXAMINATION

A. Examine surfaces and areas for suitable conditions where subdrainage systems are to be installed.

B. If subdrainage is required for landscaping, locate and mark existing utilities, underground structures, and aboveground obstructions before beginning installation and avoid disruption and damage of services.

C. Verify that drainage panels installed as part of foundation wall waterproofing are properly positioned to drain into subdrainage system.

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

2.01 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Section 312000 "Earth Moving."

3.01 FOUNDATION DRAINAGE INSTALLATION

A. Place impervious fill material on subgrade adjacent to bottom of footing after concrete footing forms have been removed. Place and compact impervious fill to dimensions indicated, but not less than 6 inches deep and 12 inches wide.

B. Lay flat-style geotextile filter fabric in trench and overlap trench sides.

C. Place supporting layer of drainage course over compacted subgrade and geotextile filter fabric, to compacted depth of not less than 4 inches.

D. Encase pipe with sock-style geotextile filter fabric before installing pipe. Connect sock sections with adhesive or tape.

E. Install drainage piping as indicated in Part 3 "Piping Installation" Article for foundation subdrainage.

F. Add drainage course to width of at least 6 inches on side away from wall and to top of pipe to perform tests.

G. After satisfactory testing, cover drainage piping to width of at least 6 inches on side away from footing and above top of pipe to within 12 inches of finish grade.

H. Install drainage course and wrap top of drainage course with flat-style geotextile filter fabric.

I. Place layer of flat-style geotextile filter fabric waterproofing felt over top of drainage course, overlapping edges at least 4 inches.

J. Install drainage panels on foundation walls as follows:

1. Coordinate placement with other drainage materials.
2. Lay perforated drainage pipe at base of footing. Install as indicated in Part 3 "Piping Installation" Article.
3. Separate 4 inches of fabric at beginning of roll and cut away 4 inches of core. Wrap fabric around end of remaining core.
4. Wrap bottom of panel around subdrainage pipe.

5. Attach panels to wall beginning at subdrainage pipe. Place and secure molded-sheet drainage panels, with geotextile facing away from wall.

K. Place backfill material over compacted drainage course. Place material in loose-depth layers not exceeding 6 inches. Thoroughly compact each layer. Final backfill to finish elevations and slope away from building.

L. Do not use drainage panels as protection for waterproof membrane unless approved by factory-authorized service representative of waterproofing membrane manufacturer. Submit approval if so used.

4.01 UNDERSLAB DRAINAGE INSTALLATION

A. Excavate for underslab drainage system after subgrade material has been compacted but before drainage course has been placed. Include horizontal distance of at least 6 inches between drainage pipe and trench walls. Grade bottom of trench excavations to required slope, and compact to firm, solid bed for drainage system.

B. Lay flat-style geotextile filter fabric in trench and overlap trench sides.

C. Place supporting layer of drainage course over compacted subgrade and geotextile filter fabric, to compacted depth of not less than 4 inches.

D. Encase pipe with sock-style geotextile filter fabric before installing pipe. Connect sock sections with adhesive or tape.

E. Install drainage piping as indicated in Part 3 "Piping Installation" Article for underslab subdrainage.

F. Add drainage course to width of at least 6 inches on side away from wall and to top of pipe to perform tests.

G. After satisfactory testing, cover drainage piping with drainage course to elevation of bottom of slab, and compact and wrap top of drainage course with flat-style geotextile filter fabric.

H. Install horizontal drainage panels as follows:

1. Coordinate placement with other drainage materials.
2. Lay perforated drainage pipe at inside edge of footing.
3. Place drainage panel over drainage pipe with core side up. Peel back fabric and wrap fabric around pipe. Locate top of core at bottom elevation of floor slab.
4. Butt additional panels against other installed panels. If panels have plastic flanges, overlap installed panel with flange.
5. If additional panels are required on same row, cut away 4 inches of installed panel core, in-stall new panel against installed panel, and overlap new panel with installed panel fabric.
6. If additional rows of panels are required, overlap lower panel with 4 inches of fabric.
7. Cut panel as necessary to keep top 12 inches below finish grade.
8. For inside corners, bend panel. For outside corners, cut core to provide 3 inches for overlap.

5.01 RETAINING-WALL DRAINAGE INSTALLATION

A. Lay flat-style geotextile filter fabric in trench and overlap trench sides.

B. Place supporting layer of drainage course over compacted subgrade to compacted depth of not less than 4 inches.

C. Encase pipe with sock-style geotextile filter fabric before installing pipe. Connect sock sections with adhesive or tape.
D. Install drainage piping as indicated in Part 3 "Piping Installation" Article for retaining-wall subdrainage.
E. Add drainage course to width of at least 6 inches on side away from wall and to top of pipe to perform tests.
F. After satisfactory testing, cover drainage piping to width of at least 6 inches on side away from footing and above top of pipe to within 12 inches of finish grade.
G. Place drainage course in layers not exceeding 3 inches in loose depth; compact each layer placed and wrap top of drainage course with flat-style geotextile filter fabric.
H. Place layer of flat-style geotextile filter fabric waterproofing felt over top of drainage course, overlapping edges at least 4 inches.
I. Install drainage panels on wall as follows:
    1. Coordinate placement with other drainage materials.
    2. Lay perforated drainage pipe at base of footing as described elsewhere in this Specification. Do not install aggregate.
    3. If weep holes are used instead of drainage pipe, cut 1/2-inch- diameter holes on core side at weep-hole locations. Do not cut fabric.
    4. Mark horizontal chalk line on wall at a point 6 inches less than panel width above footing bottom. Before marking wall, subtract footing width.
    5. Separate 4 inches of fabric at beginning of roll and cut away 4 inches of core. Wrap fabric around end of remaining core.
    6. Wrap bottom of panel around subdrainage pipe.
    7. Attach panel to wall at horizontal mark and at beginning of wall corner. Place core side of panel against wall. Use concrete nails with washers through product. Place nails from 2 to 6 inches below top of panel, approximately 48 inches apart. Construction adhesives, metal stick pins, or double-sided tape may be used instead of nails. Do not penetrate waterproofing. Before using adhesives, acquire approval from waterproofing manufacturer.
    8. If another panel is required on same row, cut away 4 inches of installed panel core and wrap fabric over new panel.
    9. If additional rows of panel are required, overlap lower panel with 4 inches of fabric.
    10. Cut panel as necessary to keep top 12 inches below finish grade.
    11. For inside corners, bend panel. For outside corners, cut core to provide 3 inches for overlap.
J. Fill to Grade: Place satisfactory soil fill material over compacted drainage course. Place material in loose-depth layers not exceeding 6 inches. Thoroughly compact each layer. Fill to finish grade.

6.01 LANDSCAPING DRAINAGE INSTALLATION

A. Provide trench width to allow installation of drainage pipe. Grade bottom of trench excavations to required slope, and compact to firm, solid bed for drainage system.
B. Lay flat-style geotextile filter fabric in trench and overlap trench sides.

C. Place supporting layer of drainage course over compacted subgrade and geotextile filter fabric, to compacted depth of not less than 4 inches.
D. Install drainage conduits as indicated in Part 3 "Piping Installation" Article for landscaping subdrainage with horizontal distance of at least 6 inches between pipe and trench walls. Wrap drainage pipe without integral geotextile filter fabric with flat-style geotextile filter fabric before installation. Connect fabric sections with adhesive or tape.
E. Add drainage course to top of drainage pipe.
F. After satisfactory testing, cover drainage pipe to within 12 inches of finish grade.
G. Install drainage course and wrap top of drainage course with flat-style geotextile filter fabric.
H. Place layer of flat-style geotextile filter fabric waterproofing felt over top of drainage course, overlapping edges at least 4 inches.
I. Fill to Grade: Place satisfactory soil fill material over drainage course. Place material in loose-depth layers not exceeding 6 inches. Thoroughly compact each layer. Fill to finish grade.

7.01 PIPING INSTALLATION

A. Install piping beginning at low points of system, true to grades and alignment indicated, with unbroken continuity of invert. Bed piping with full bearing in filtering material. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions and other requirements indicated.
    1. Foundation Subdrainage: Install piping level and with a minimum cover of 36 inches unless otherwise indicated.
    2. Underslab Subdrainage: Install piping level, unless otherwise indicated.
    3. Plaza Deck Subdrainage: Install piping level, unless otherwise indicated.
    4. Retaining-Wall Subdrainage: When water discharges at end of wall into stormwater piping system, install piping level and with a minimum cover of 36 inches unless otherwise indicated.
    5. Landscaping Subdrainage: Install piping pitched down in direction of flow, at a minimum slope of 0.5 percent and with a minimum cover of 36 inches unless otherwise indicated.
    6. Lay perforated pipe with perforations down.
    7. Excavate recesses in trench bottom for bell ends of pipe. Lay pipe with bells facing upslope and with spigot end entered fully into adjacent bell.
B. Use increasers, reducers, and couplings made for different sizes or materials of pipes and fittings being connected. Reduction of pipe size in direction of flow is prohibited.
C. Install thermoplastic piping according to ASTM D2321.

8.01 PIPE JOINT CONSTRUCTION

A. Join perforated PE pipe and fittings with couplings according to ASTM D3212 with loose banded, coupled, or push-on joints.
B. Join perforated PVC sewer pipe and fittings according to ASTM D3212 with loose bell-and-spigot, push-on joints.
C. Special Pipe Couplings: Join piping made of different materials and dimensions with special couplings made for this application. Use couplings that are compatible with and fit materials and dimensions of both pipes.

9.01 BACKWATER VALVE INSTALLATION

A. Comply with requirements for backwater valves specified in Section 334100 "Stormwater Conveyance."

B. When required, install horizontal backwater valves in header piping downstream from perforated subdrainage piping.

C. Install horizontal backwater valves in piping in manholes or pits where indicated.

10.01 CLEANOUT INSTALLATION

A. Comply with requirements for cleanouts specified in Section 334100 "Stormwater Conveyance."

B. Cleanouts for Foundation Retaining-Wall and Landscaping Subdrainage:

1. Install cleanouts from piping to grade. Locate cleanouts at beginning of piping run and at changes in direction. Install fittings so cleanouts open in direction of flow in piping.
2. In vehicular-traffic areas, use NPS 4 cast-iron soil pipe and fittings for piping branch fittings and riser extensions to cleanout. Set cleanout frames and covers in a cast-in-place concrete anchor, 18 by 18 by 12 inches deep. Set top of cleanout flush with grade.
3. In nonvehicular-traffic areas, use NPS 4 cast-iron pipe and fittings for piping branch fittings and riser extensions to cleanout. Set cleanout frames and covers in a cast-in-place concrete anchor, 12 by 12 by 4 inches deep. Set top of cleanout 1 inch above grade.
4. Comply with requirements for concrete specified in Section 033000 "Cast-in-Place Concrete."

C. Cleanouts for Underslab Subdrainage:

1. Install cleanouts and riser extensions from piping to top of slab. Locate cleanouts at beginning of piping run and at changes in direction. Install fittings so cleanouts open in direction of flow in piping.
2. Use NPS 4 cast-iron soil pipe and fittings for piping branch fittings and riser extensions to cleanout flush with top of slab.

11.01 CONNECTIONS

A. Comply with requirements for piping specified in Section 334100 "Stormwater Conveyance." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect low elevations of subdrainage system to building's solid-wall-piping storm drainage system.

C. Where required, connect low elevations of foundation underslab subdrainage to stormwater sump pumps. Comply with requirements for sump pumps specified in Section 221429 "Sump Pumps."

12.01 IDENTIFICATION

A. Arrange for installation of green warning tapes directly over piping. Comply with requirements for underground warning tapes specified in Section 312000 "Earth Moving."

1. Install PE warning tape or detectable warning tape over ferrous piping.
2. Install detectable warning tape over nonferrous piping and over edges of underground structures.

13.01 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. After installing drainage course to top of piping, test drain piping with water to ensure free flow before backfilling.
2. Remove obstructions, replace damaged components, and repeat test until results are satisfactory.

B. Drain piping will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

14.01 CLEANING

A. Clear interior of installed piping and structures of dirt and other superfluous material as work progresses. Maintain swab or drag in piping and pull past each joint as it is completed. Place plugs in ends of uncompleted pipe at end of each day or when work stops.

END OF SECTION

SECTION 33 7000
SANITARY SEWERS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01.

1.02 SUMMARY

A. Section Includes:

1. Pipe and fittings.
2. Nonpressure and pressure couplings.
3. Cleanouts.
4. Manholes.

1.03 ACTION SUBMITTALS

A. Product Data: For the following:

1. Pipe.
2. Cleanouts.

B. Shop Drawings: For manholes. Include plans, elevations, sections, details, and frames and covers. Demonstrate compliance with local jurisdiction requirements.

1.04 INFORMATIONAL SUBMITTALS

C. Coordination Drawings: Show pipe sizes, locations, and elevations. Show other piping in same trench and clearances from sewer system piping. Indicate interface and spatial relationship between manholes, piping, and proximate structures.

D. Product Certificates: For each type of cast-iron soil pipe and fitting, from manufacturer.

E. Field quality-control reports.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Do not store plastic pipe and fittings in direct sunlight.

B. Protect pipe, pipe fittings, and seals from dirt and damage.

C. Handle manholes according to manufacturer's written rigging instructions.

1.06 FIELD CONDITIONS

A. Interruption of Existing Sanitary Sewerage 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 48 hours in advance of proposed interruption of service.
2. Do not proceed with interruption of service without Owner's written permission.
3. Coordinate and obtain approval from local jurisdiction and/or utility provider.

PART 2 - PRODUCTS

2.01 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 74, Service and Extra-Heavy classes.

B. Gaskets: ASTM C 564, rubber.

C. Caulking Materials: ASTM B 29, pure lead and oakum or hemp fiber.

2.02 DUCTILE-IRON, GRAVITY SEWER PIPE AND FITTINGS

A. Pipe: ASTM A 746, for push-on joints.

B. Standard Fittings: AWWA C110, ductile or gray iron, for push-on joints.

C. Compact Fittings: AWWA C153, ductile iron, for push-on joints.

D. Gaskets: AWWA C111, rubber.

2.03 DUCTILE-IRON, PRESSURE PIPE AND FITTINGS

A. Push-on-Joint Piping:

1. Pipe: AWWA C151.
2. Standard Fittings: AWWA C110, ductile or gray iron.
3. Compact Fittings: AWWA C153.
4. Gaskets: AWWA C111, rubber, of shape matching pipe and fittings.

B. Mechanical-Joint Piping:

1. Pipe: AWWA C151, with bolt holes in bell.
2. Standard Fittings: AWWA C110, ductile or gray iron, with bolt holes in bell.

3. Compact Fittings: AWWA C153, with bolt holes in bells.
4. Glands: Cast or ductile iron; with bolt holes and high-strength, cast-iron or high-strength, low-alloy steel bolts and nuts.
5. Gaskets: AWWA C111, rubber, of shape matching pipe, fittings, and glands.

2.04 PVC PIPE AND FITTINGS

A. PVC Type PSM Sewer Piping:

1. Pipe: ASTM D 3034, SDR 35, PVC Type PSM sewer pipe with bell-and-spigot ends for gasketed joints.
2. Fittings: ASTM D 3034, PVC with bell ends.
3. Gaskets: ASTM F 477, elastomeric seals.

B. PVC Gravity Sewer Piping:

1. Pipe and Fittings: ASTM F 679, PVC gravity sewer pipe with bell-and-spigot ends and with integral ASTM F 477, elastomeric seals for gasketed joints.

C. PVC Pressure Piping:

1. Pipe: AWWA C900, Class 200 PVC pipe with bell-and-spigot ends for gasketed joints.
2. Fittings: AWWA C900, Class 200 PVC pipe with bell ends.
3. Gaskets: ASTM F 477, elastomeric seals.

2.05 NONPRESSURE-TYPE TRANSITION COUPLINGS

A. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to be joined and corrosion-resistant-metal tension band and tightening mechanism on each end.

B. Sleeve Materials:

1. For Cast-Iron Soil Pipes: ASTM C 564, rubber.
2. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

C. Unshielded, Flexible Couplings:

1. Description: Elastomeric sleeve with stainless-steel shear ring corrosion-resistant-metal tension band and tightening mechanism on each end.

D. Shielded, Flexible Couplings:

1. Description: ASTM C 1460, elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield corrosion-resistant-metal tension band and tightening mechanism on each end.

E. Ring-Type, Flexible Couplings:

1. Description: Elastomeric compression seal with dimensions to fit inside bell of larger pipe and for spigot of smaller pipe to fit inside ring.

F. Nonpressure-Type, Rigid Couplings:

1. Description: ASTM C 1461, sleeve-type, reducing- or transition-type mechanical coupling, molded from ASTM C 1440, TPE material; with corrosion-resistant-metal tension band and tightening mechanism on each end.

2.06 PRESSURE-TYPE PIPE COUPLINGS

A. Tubular-Sleeve Couplings: AWWA C219, with center sleeve, gaskets, end rings, and bolt fasteners.

B. Metal, bolted, sleeve-type, reducing or transition coupling, for joining underground pressure piping. Include 200-psig minimum pressure rating and ends of same sizes as piping to be joined.

C. Center-Sleeve Material: Manufacturer's standard.

D. Metal Component Finish: Corrosion-resistant coating or material.

2.07 CLEANOUTS

A. Cast-Iron Cleanouts:

1. Description: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside caulk or spigot connection and countersunk, tapered-thread, brass closure plug.

2. Top-Loading Classification(s): Light Duty, Medium Duty, Heavy Duty, and Extra-Heavy Duty.

3. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.

2.08 MANHOLES

A. Standard Precast Concrete Manholes: Meet Local Jurisdiction requirements and;

1. Description: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.
2. Diameter: 48 inches minimum unless otherwise indicated.
3. Ballast: Increase thickness of precast concrete sections or add concrete to base section, as required to prevent flotation.
4. Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section; with separate base slab or base section with integral floor.
5. Riser Sections: 4-inch minimum thickness, of length to provide depth indicated.
6. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated; with top of cone of size that matches grade rings.
7. Joint Sealant: ASTM C 990, bitumen or butyl rubber.
8. Resilient Pipe Connectors: ASTM C 923, cast or fitted into manhole walls, for each pipe connection.
9. Steps: Individual FRP steps or FRP ladder per local jurisdiction; wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 16-inch intervals.
10. Adjusting Rings: Interlocking HDPE rings, with level or sloped edge in thickness and diameter matching manhole frame and cover, and with height as required to adjust manhole frame and cover to indicated elevation and slope. Include sealant recommended by ring manufacturer.
11. Grade Rings: Reinforced-concrete rings, 6- to 9-inch total thickness, with diameter matching manhole frame and cover, and with height as required to adjust manhole frame and cover to indicated elevation and slope.

B. Designed Precast Concrete Manholes: Meet Local Jurisdiction requirements and;

1. Description: ASTM C 913; designed according to ASTM C 890 for A-16 (ASSHTO HS20-44), heavy-traffic, structural loading; of depth, shape, and dimensions indicated, with provision for sealant joints.
2. Ballast: Increase thickness of one or more precast concrete sections or add concrete to manhole as required to prevent flotation.
3. Joint Sealant: ASTM C 990, bitumen or butyl rubber.
4. Resilient Pipe Connectors: ASTM C 923, cast or fitted into manhole walls, for each pipe connection.
5. Steps: Individual FRP steps or FRP ladder per local jurisdiction; wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12 to 16 inch intervals.
6. Adjusting Rings: Interlocking HDPE rings, with level or sloped edge in thickness and diameter matching manhole frame and cover, and with height as required to adjust manhole frame and cover to indicated elevation and slope. Include sealant recommended by ring manufacturer.
7. Grade Rings: Reinforced-concrete rings, 6 to 9 inch total thickness, with diameter matching manhole frame and cover, and with height as required to adjust manhole frame and cover to indicated elevation and slope.

C. Manhole Frames and Covers: Meet Local Jurisdiction requirements and;

1. Description: Ferrous; 24-inch ID by 7 to 9 inch riser, with 4-inch-minimum-width flange and 26 inch diameter cover. Include indented top design with lettering cast into cover, using wording equivalent to "SANITARY SEWER" per local jurisdiction requirements.
2. Material: ASTM A 536, Grade 60-40-18 ductile or ASTM A 48, Class 35 gray iron as required by the local jurisdiction.

D. Manhole-Cover Inserts: Meet Local Jurisdiction requirements and;

1. Description; Manufactured, plastic form, of size to fit between manhole frame and cover and designed to prevent stormwater inflow. Include handle for removal and gasket for gastight sealing.

2. Type: Solid or vented per local jurisdiction requirements.

2.09 CONCRETE

A. General: Cast-in-place concrete complying with ACI 318, ACI 350/350R, and the following:

1. Cement: ASTM C 150, Type II.
2. Fine Aggregate: ASTM C 33, sand.
3. Coarse Aggregate: ASTM C 33, crushed gravel.
4. Water: Potable.

B. Portland Cement Design Mix: 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio.

1. Reinforcing Fabric: ASTM A 1064, steel, welded wire fabric, plain.
2. Reinforcing Bars: ASTM A 615, Grade 60 deformed steel.

C. Manhole Channels and Benches: Factory or field formed from concrete. Portland cement design mix, 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio. Include channels and benches in manholes.

1. Channels: Concrete invert, formed to same width as connected piping, with height of vertical sides to three-fourths of pipe diameter. Form curved channels with smooth, uniform radius and slope.
   a. Invert Slope: Per local jurisdiction requirements.
2. Benches: Concrete, sloped to drain into channel.
   a. Slope: Per local jurisdiction requirements.

D. Ballast and Pipe Supports: Portland cement design mix, 3000 psi minimum, with 0.58 maximum water/cementitious materials ratio.

1. Reinforcing Fabric: ASTM A 1064, steel, welded wire fabric, plain.
2. Reinforcing Bars: ASTM A 615, Grade 60 deformed steel.

PART 3 - EXECUTION

3.01 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Division 31.

3.02 PIPING INSTALLATION

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground sanitary sewer piping. Location and arrangement of piping layout should take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for using lubricants, cements, and other installation requirements.

C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.

D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

E. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process of microtunneling.

F. Install gravity-flow, nonpressure, drainage piping according to the following:

1. Install piping pitched down in direction of flow, at minimum slope of 1 percent unless otherwise indicated.
2. Install 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 piping with minimum cover per local jurisdiction requirements.
4. Install hub-and-spigot, cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook."
5. Install hubless cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook."
6. Install ductile-iron, gravity sewer piping according to ASTM A 746.

7. Install ABS sewer piping according to ASTM D 2321 and ASTM F 1668.
8. Install PVC Type PSM sewer piping according to ASTM D 2321 and ASTM F 1668.
9. Install PVC gravity sewer piping according to ASTM D 2321 and ASTM F 1668.
10. Install nonreinforced-concrete sewer piping according to ASTM C 1479 and ACPA's "Concrete Pipe Installation Manual."
11. Install reinforced-concrete sewer piping according to ASTM C 1479 and ACPA's "Concrete Pipe Installation Manual."

G. Install force-main, pressure piping according to the following:
1. Install piping with restrained joints at tee fittings and at horizontal and vertical changes in direction. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place-concrete supports or anchors.
2. Install piping with minimum cover per local jurisdiction requirements.
3. Install ductile-iron pressure piping according to AWWA C600 or AWWA M41.
4. Install ductile-iron special fittings according to AWWA C600.
5. Install PVC pressure piping according to AWWA M23 or to ASTM D 2774 and ASTM F 1668.

H. Clear interior of piping and manholes of dirt and superfluous material as work progresses. Maintain swab or drag in piping, and pull past each joint as it is completed. Place plug in end of incomplete piping at end of day and when work stops.

3.03 PIPE JOINT CONSTRUCTION

A. Join gravity-flow, nonpressure, drainage piping according to the following:
1. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
2. Join hub-and-spigot, cast-iron soil piping with caulked joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead and oakum caulked joints.
3. Join hubless cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.
4. Join ductile-iron, gravity sewer piping according to AWWA C600 for push-on joints.

5. Join ABS sewer piping according to ASTM D 2321 and ASTM D 2751 for elastomeric-seal joints.
6. Join PVC Type PSM sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-seal joints or ASTM D 3034 for elastomeric-gasket joints.
7. Join PVC gravity sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-seal joints or ASTM D 3034 for elastomeric-gasket joints.
8. Join nonreinforced-concrete sewer piping according to ASTM C 14 and ACPA's "Concrete Pipe Installation Manual" for rubber-gasket joints.
9. Join reinforced-concrete sewer piping according to ACPA's "Concrete Pipe Installation Manual" for rubber-gasket joints.
10. Join dissimilar pipe materials with nonpressure-type, flexible or rigid couplings.

B. Join force-main, pressure piping according to the following:
1. Join ductile-iron pressure piping according to AWWA C600 or AWWA M41 for push-on joints.
2. Join ductile-iron special fittings according to AWWA C600 or AWWA M41 for push-on joints.
3. Join PVC pressure piping according to AWWA M23 for gasketed joints.
4. Join dissimilar pipe materials with pressure-type couplings.

C. Pipe couplings, expansion joints, and deflection fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
1. Use nonpressure flexible couplings where required to join gravity-flow, nonpressure sewer piping unless otherwise indicated.
a. Unshielded or Shielded flexible or rigid couplings for pipes of same or slightly different OD per local jurisdiction requirements.
b. Unshielded, increaser/reducer-pattern, flexible or rigid couplings for pipes with different OD per local jurisdiction requirements.
c. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.

2. Use pressure pipe couplings for force-main joints.

3.04 MANHOLE INSTALLATION

A. General: Install manholes complete with appurtenances and accessories indicated.

B. Install precast concrete manhole sections with sealants according to ASTM C 891.

C. Form continuous concrete channels and benches between inlets and outlet.

D. Set tops of frames and covers flush with finished surface of manholes that occur in pavements.

E. Install manhole-cover inserts in frame and immediately below cover.

3.05 CONCRETE PLACEMENT

A. Place cast-in-place concrete according to ACI 318.

3.06 BACKWATER VALVE INSTALLATION

A. Install horizontal-type backwater valves in piping manholes or pits.

B. Install combination horizontal and manual gate valves in piping and in manholes.

C. Install terminal-type backwater valves on end of piping and in manholes. Secure units to sidewalls.

3.07 CLEANOUT INSTALLATION

A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts, and use cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.

1. Use Light-Duty, top-loading classification cleanouts in earth or unpaved foot-traffic areas.
2. Use Medium-Duty, top-loading classification cleanouts in paved foot-traffic areas.
3. Use Heavy-Duty, top-loading classification cleanouts in vehicle-traffic service areas.
4. Use Extra-Heavy-Duty, top-loading classification cleanouts in roads.

B Set cleanout frames and covers in earth in cast-in-place-concrete block, 18 by 18 by 6 inches deep unless otherwise shown. Set with tops 1 inch above surrounding grade.

C. Set cleanout frames and covers in concrete pavement and roads with tops flush with pavement surface.

3.08 CONNECTIONS

A. Connect nonpressure, gravity-flow drainage piping to building's sanitary building drains.

B. Connect force-main piping to building's sanitary force mains. Terminate piping where indicated.

C. 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. Make branch connections from side into existing piping, NPS 21 or larger, or to underground manholes by cutting opening into existing unit large enough to allow 3 inches of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of and be flush with inside wall unless otherwise indicated. On outside of pipe or manhole wall, encase entering connection in 6 inches of concrete for minimum length of 12 inches to provide additional support of collar from connection to undisturbed ground.
    a. Use concrete that will attain a minimum 28-day compressive strength of 3000 psi unless otherwise indicated.
    b. Use epoxy-bonding compound as interface between new and existing concrete and piping materials.

4. Protect existing piping and manholes to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

D. Connect to grease, oil, and sand interceptors.

3.09 CLOSING ABANDONED SANITARY SEWER SYSTEMS

A. Abandoned Piping: Close open ends of abandoned underground piping indicated to remain in place. Include closures strong enough to withstand hydrostatic and earth pressures that may result after ends of abandoned piping have been closed. Use either procedure below as allowed by jurisdiction:

1. Close open ends of piping with at least 8-inch thick, brick masonry bulkheads.
2. Close open ends of piping with threaded metal caps, plastic plugs, or other acceptable methods suitable for size and type of material being closed. Do not use wood plugs.

B. Abandoned Manholes: Excavate around manhole as required and use either procedure below as allowed by jurisdiction:

1. Remove manhole and close open ends of remaining piping.
2. Remove top of manhole down to at least 36 inches below final grade. Fill to within 12 inches of top with stone, rubble, gravel, or compacted dirt. Fill to top with concrete.

C. Backfill to grade according to Division 31.

3.10 IDENTIFICATION

A. Materials and their installation are specified in Division 31. Arrange for installation of green warning tapes directly over piping and at outside edges of underground manholes.

1. Use detectable warning tape over ferrous piping.
2. Use detectable warning tape over nonferrous piping and over edges of underground manholes.

3.11 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.

1. Submit separate report for each system inspection and as required by Local Jurisdiction.
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. Hydrostatic Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction and the following:
    a. Fill sewer piping with water. Test with pressure of at least 10-foot head of water, and maintain such pressure without leakage for at least 15 minutes.
    b. Close openings in system and fill with water.

c. Purge air and refill with water.

d. Disconnect water supply.

e. Test and inspect joints for leaks.

6. Air Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction, UNI-B-6, and the following:

a. Option: Test plastic gravity sewer piping according to ASTM F 1417.

b. Option: Test concrete gravity sewer piping according to ASTM C 924.

7. Force Main: Perform hydrostatic test after thrust blocks, supports, and anchors have hardened. Test at pressure not less than 1-1/2 times the maximum system operating pressure, but not less than 150 psig.

a. Ductile-Iron Piping: Test according to AWWA C600, "Hydraulic Testing" Section.

b. PVC Piping: Test according to AWWA M23, "Testing and Maintenance" Chapter.

8. Manholes: Perform hydraulic test according to ASTM C 969.

C. Leaks and loss in test pressure constitute defects that must be repaired.

D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

3.12 CLEANING

A. Clean dirt and superfluous material from interior of piping. Flush with potable water.

END OF SECTION