PROPOSAL FORM

BALTIMORE COUNTY
DEPARTMENT OF PUBLIC WORKS & TRANSPORTATION
TOWSON, MARYLAND

Division of Construction Contracts Administration

ARCHITECT

JP 2 Architects
2811 Dillon Street
Baltimore, Maryland 21224
Phone: 410-646-8300

STRUCTURAL ENGINEER

Columbia Engineering, Inc.
6210 Old Dobbin Lane; Ste. 150
Columbia, Maryland 21045
Phone: 410-992-9970

CIVIL ENGINEER

RK&K
700 East Pratt Street; Ste. 500
Baltimore, Maryland 21202
Phone: 410-728-9200

MEP ENGINEER

C.C. Johnson & Malotra, P.C.
400 East Pratt Street, Ste. 604
Baltimore, Maryland 21202
Phone: 410-461-9920

Contract Number 25114 GX0
Property Management Project
Northwest Regional Park Splash Pad & Supporting Facilities –
4515 Deer Park Road, Owings Mills, Maryland 21117
Owings Mills – District 2c4
Workday Number
PROJ-10000634

CONTRACT BASED ON SEPTEMBER 2023
STANDARD SPECIFICATIONS FOR CONSTRUCTION AND MATERIALS
AND STANDARD DETAILS FOR CONSTRUCTION

Bidders Information

A pre-bid meeting will be held on Wednesday, February 18, 2026 at 10:00 a.m. EST via WebEx. *Phone-In* (Audio Only) 1-415-655-0001, Meeting Number 2305 526 1239##. *Video Conference* go to https://signin.webex.com/join Meeting Number 2305 526 1239,**Password**: **KPy3V5UEG52**, for Webex link go to: www.baltimorecountymd.gov/departments/public-works/engineering/contracts/current-solicitations

Baltimore County First Source Hiring Agreement **see pages 1243-1244**. State Prevailing Wage Requirements & Wage Rates **see pages 1245-1251.**
(Contract Disclosure): "***Wage rates that are in effect as of the contract solicitation date will be the wage rates through the duration of the project***"

MBE/WBE Requirements & Forms **see pages 1252-1266**

THIS PROPOSAL FORM INCLUDES AND INCORPORATES ALL DOCUMENTS AND INFORMATION REFLECTED, LISTED, AND/OR REFERENCED IN THIS TABLE OF CONTENTS, AND ALL SUCH DOCUMENTS AND INFORMATION ARE PART OF AND INCORPORATED INTO THE CONTRACT DOCUMENTS.

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S E C T I O N I

INFORMATION FOR BIDDERS

ELECTRONIC SUBMITTAL PROCESS

To be considered, Bids (Section IV – Proposal) shall be received by the bid closing date and time to the following email address dpwbid@baltimorecountymd.gov. The contract number and company name should be referenced in the Subject Line of the email. Bids may not be submitted by any other means. Bids that are mailed or otherwise delivered to the Purchasing Division (including emails which indicate links to locations where the bid may be downloaded) and/or emails sent to any other Baltimore County email address will not be accepted.

Late Bids will not be considered. Bidders are strongly encouraged not to wait until the last minute to submit bids. The time stated on the auto-receipt (described below) will be definitive of the time of receipt. Bids received after the deadline will not be accepted. Bidders are advised that the County cannot receive email attachments greater in size than twenty-five (25) megabytes and this size limitation may be further reduced by requirements of the Bidder's email provider which are beyond the control of the County. Bidder should consider separating any large bid attachment into multiple parts and emailing each part separately. In such case, Bidder will note that each email is *1 of 2*, *2 of 2*, etc. Multiple part bids will not be considered unless all parts are received by the bid closing date and time.

After submitting a Bid to dpwbid@baltimorecountymd.gov, and upon successful receipt by the County thereof, Bidder will receive an auto-receipt email. This receipt is proof that the bid has been received by the Division of Construction Contracts Administration and should be retained for Bidder's records. In the case of a bid submitted in multiple parts as described above, an auto-receipt email will be generated for each part. The County has no obligation to consider any Bid for which an auto-receipt was not generated.

As with any system, power outages or technology problems may arise that are outside of the County's control and could affect your submission. The County will not be held accountable for such issues that may delay the transmission of any Bid.

NOTE: Electronic copy of the Bid Bond will be accepted at bid opening. The apparent low bidder is required to submit the original Bid Bond within ten (10) days after the bid opening to the Division of Construction Contracts Administration, 111 West Chesapeake Avenue, Room 300B, Towson, Maryland 21204.

INSTRUCTIONS AND SPECIFICATIONS

Refer to the enclosed proposal sheets for quantities to be bid upon. All proposals submitted on the attached form must give the price in clear figures for each item of the proposed work and be signed by the bidder with his name and address. Bidders must not change any item in the proposal for which a price has been stipulated by the County. Any change will cause rejection of the proposal.

NOTE: STATEMENT UNDER OATH FORM TO ACCOMPANY BID as per Baltimore County Purchasing Act 65-98, Section 15-94 and 15-95 which requires that the enclosed affidavit (see Proposal Affidavit pages in Section IV) be completed and submitted as part of the sealed bid.

Proposals made on any other than the attached form will not be considered. All papers included in, bound thereto, or attached to the Proposal Form are necessary parts thereof and shall not be detached, separated, or altered in their intent.

Changes in the phraseology of the proposal, additions, or limiting provisions will render the proposal informal or void and may cause its rejection.

All right is hereby reserved by the Purchasing Agent to reject any or all proposals and to waive formalities and technicalities as the interest of the County may require.

No successful bidder may withdraw his bid within NINETY (90) days after the opening thereof.

The successful bidder will be required to be bonded to Baltimore County, Maryland to the sum of One Hundred per Cent (100%) of the amount of his proposal or proposals according to the form of bond hereto attached for projects in excess of $25,000.00.

This Proposal must be accompanied by a Bid Bond in an amount of 5% of the bid, the exact amount to be determined by the difference between the low bid and the next lowest bid if two or more bids are received, or 5% of the bid if one bid is received. This guarantees payment of the amount thus determined in case of a default in any matter specified as required before award or in any matter resulting in failure to execute and deliver an Agreement, together with Payment and Performance Bonds, after award. The Bid Bond must be in the form accompanying the Proposal executed by a Surety licensed in the State of Maryland. The Surety must be currently rated "B" or better by the A. M. Best Company, and the bid must be in an amount less than, or equal to, the underwriting limitation contained in Department of Treasury Circular 570 as amended at the time of the underwriting.

All work to be performed under this contract shall be done under strict compliance with Baltimore County Department of Public Works and Transportation September 2023 Standard Specifications for Construction and Materials and Standard Details for Construction and any and all proposed revisions thereto as of the date of advertisement and copies of which are available on the County's website at www.baltimorecountymd.gov/departments/public-works/standards, and all of which are made a part hereof and incorporated herein (collectively, the "Specifications").

If the bidder to whom an award is made shall fail to execute the contract and bond hereto attached and as herein provided, the award may be annulled and the contract awarded to the lowest responsible bidder who has consented to a time extension, and such bidder shall fulfill every stipulation embraced herein as if he were the original party to whom the award was made, or the Purchasing Agent may reject all of the bids as the interest of the County may require.

The Bid Bond of the three lowest bidders is deemed to be effective until the execution and delivery of the Contract Agreement, together with Payment and Performance Bonds for projects in excess of $25,000.00 or until rejection of all bids, whereupon Surety is deemed relieved of all further obligations under the bid bonds provided.

Bidders must examine the drawings and specifications carefully and must make a personal examination of the location and nature of the proposed work. In case doubt shall arise as to the

meaning or intent of anything shown on the drawings or comprised in the specification, inquiry shall be made of the Director of Public Works and Transportation at least five (5) days prior to the date of bid opening. The submission of the Proposal shall indicate that the bidder thoroughly understands the drawings and the terms of the Specifications.

To better ensure fair competition and to permit a determination of the lowest bidder, unresponsive bids or bids obviously unbalanced may be rejected by the Purchasing Agent.

Bidders are required to fill out the total price column and total their proposals so that the result of the bidding, barring possible arithmetical errors, will be known at once. Any errors in computations will be corrected by the Engineer when the proposals are canvassed. Where the unit price and the total price are at variance, the unit price will prevail.

Bidders must be prepared to complete the work within the time stated in the proposal.

NOTE: ONLY CONTRACTORS FORMALLY PRE-QUALIFIED WITHIN THE ADVERTISED WORK CLASSIFICATION BY THE DIRECTOR OF PUBLIC WORKS AND TRANSPORTATON OF BALTIMORE COUNTY 10 CALENDAR DAYS PRIOR TO BID OPENING WILL BE ELIGIBLE TO SUBMIT BIDS.

Contracts for work under this proposal will obligate the contractors and subcontractors not to discriminate in employment practices. Bidders must, if requested, submit a compliance report concerning their employment practices and policies in order to maintain their eligibility to receive the award of the contract. Successful bidders must be prepared to comply in all respects with the Contract Provisions regarding nondiscrimination.

Baltimore County has adopted a Minority Business Enterprise (MBE) program and Women's Business Enterprise (WBE) Program. The percentage of participation applies to the contract amount awarded to the Contractor. Qualified minority subcontractors are those certified as being a Minority Business Enterprise by the following:

1. Maryland Department of Transportation Certification Committee (MDOT)

2. City of Baltimore, Minority Business Certification Council

Projects funded by the Federal Highway Administration are limited to the certification listed under #1 (MDOT).

More detailed information regarding the County's MBE/WBE Program can be obtained from the County MBE Office, telephone (410) 887-3407. See Executive Order dated December 6, 2022. MBE/WBE Participation Summary and Forms A, B, C, D and E enclosed in this proposal booklet.

NOTE: If you do not complete and submit the enclosed forms with your bid or offer to the County, the County may, in its sole discretion, deem your bid or offer **NON-RESPONSIVE** and accordingly the **COUNTY WILL NOT CONSIDER YOU FOR CONTRACT AWARD**.

The County reserves the right to require the low bidder to produce evidence indicating that the company's financial condition is equal to, or better than, that enjoyed by the company at the time of prequalification. This additional information may be in the form of a financial statement or other evidence satisfactory to the Office of Budget and Finance.

Bidders' attention is directed to the requirement that a permit must be obtained from the Baltimore County Bureau of Highways and Bureau of Traffic Engineering prior to cutting any County road for the purpose of obtaining sub-surface soils information, and permission must be obtained from the State Highways Administration prior to making any openings in a State road.

Under no circumstances shall a bidder enter upon any property outside a County or State road for the purpose of securing sub-surface soils information until permission is received from the property owner. The fact that the County has obtained a utility easement does not give the bidder the right to enter upon the property.

Prevailing index price of asphalt cement/ton $615.00**.**

INCLEMENT WEATHER POLICY: If Baltimore County General Government Offices are open or open with liberal leave the day the bids are due, the bids are due as stated in the bid documents (date and time). **ONLY** when the Baltimore County General Government Offices are **OFFICIALLY CLOSED** the day the bids are due, the bid date will be postponed and an Addendum will be issued the next business (or next day buildings are officially open) day the county offices are open with the new bid date and time.

BID TABULATIONS: All bid tabulations will be confidential until after final award, at which time the total bid amounts for all bidders, as well as the complete bid tabulations for the top three (3) bidders, can be inspected by others when requested in writing pursuant to the Maryland Public Information Act.

ALTERNATIVE SOURCES OF CONTRACT BONDS: In the event your company is unable to qualify for bonding through a traditional commercial surety company, you may qualify for the required bonds through the State of Maryland, Department of Commerce (DOC). The **Maryland Small Business Development Financing Authority (MSBDFA, pronounced Mis-Bid-Fa)**, an agency of DOC, operates a Surety Bond Program designed to assist small businesses, based in Maryland, that are unable to obtain adequate bonding on reasonable terms in the commercial marketplace. MSBDFA provides bid, payment and performance bonds for contracts funded by government agencies, regulated utilities and private entities. The penal sums of the bonds are limited to the aggregate amount of $2,500,000 and companies may pre-qualify for multiple bonds within pre-approved terms and conditions. MSBDFA also provides lines of credit, term loans and loan guarantees to help qualified businesses purchase equipment and real property, make improvements to leased property, refinance existing debt and assist them with their working capital needs. For more information on how to apply, you may contact: Meridian Management Group, Inc. (MMG), (the Program's Manager), 826 E. Baltimore Street, Baltimore, Maryland 21202, Telephone: (410) 333-4270. Or visit their website at www.mmgcapitalgroup.com for information, applications and a checklist of required documents and reports that must accompany the application.

S E C T I O N I I

SPECIAL PROVISIONS

MAINTENANCE BOND

Per the Baltimore County Department of Public Works and Transportation September 2023 Standard Specifications for Construction and Materials, Section GP – 4.10 (C) states, the contractor is required to post a maintenance bond in the amount of five (5) percent of the total cost of the contract or withhold five (5) percent retainage for two (2) years from the date of Final Acceptance.

BALTIMORE COUNTY, MARYLAND

BOND NO. _____

CONTRACT NO. _____

MAINTENANCE BOND

THIS MAINTENANCE BOND is entered into on this _____ day of _____, 20____, by and between _____ as principal ("Principal") and _____, a business entity that is authorized to transact business in the State of Maryland and is organized and existing under the laws of the State of _____, as surety ("Surety"), are held and firmly bound unto Baltimore County, Maryland, a body corporate and politic of the State of Maryland ("County"), as Obligee.

WHEREAS, the above-named Principal has entered into a written contract known as Contract Number _____ dated _____, 20___ with Obligee for _____ (the "Agreement"), the terms of which are hereby incorporated by reference; and

WHEREAS, Principal has completed construction under the Agreement; and

WHEREAS, the Agreement includes a warranty on the quality of the Work performed that runs for a period of two (2) years from the date of the County's final acceptance and that runs for two (2) additional years beyond the repair date if any repair is done during the warranty period; and

WHEREAS, Principal is required to cause this instrument to be executed and delivered to Obligee as security for maintenance during the warranty period in an amount equal to 5% of the total value of the Contract.

NOW, THEREFORE, the Principal and Surety are held and firmly bound unto the Obligee in the sum of $_____ Dollars ($ _____), lawful money of the United States of America, for the payment of which sum of money the Principal and Surety do bind themselves and their personal representatives, legal representatives, successors, and assigns, jointly and severally, firmly by this maintenance bond.

The conditions of this bond are as follows:

1. The Principal shall, for a period of two (2) years from and after the date of completion and acceptance of same by Obligee, replace all defects arising in the Work, whether resulting from defective materials, equipment, design furnished or workmanship. After such period, this obligation shall be null and void; otherwise it shall remain in full force and effect.

2. In the event of a default on the part of the Principal that may be the subject of a claim under this bond, Obligee shall mail, by certified mail, to Surety at the address listed below, a written statement that a claim is being made under the bond and, with substantial accuracy, the amount of the claim. Surety shall have no obligation to Obligee under this bond until the notice of claim is mailed.

3. When the Obligee has satisfied the condition of Paragraph 2 that a notice of claim be mailed, the Surety shall promptly and at the Surety's expense send an answer to Obligee within 30 days after the date of the claim. The answer shall state the amounts that are undisputed and the basis for challenging any amounts that are disputed. The answer shall be accompanied by payment (or arrangements for immediate payment) of any undisputed amounts.

4. Surety expressly waives any right to receive notice of extensions of time or alterations or modifications to the Agreement that may be granted by Obligee and agreed upon by Principal, and any such extensions, alterations, or modifications shall not affect the obligation of the Surety under this bond.

5. This bond is a specialty governed by the twelve-year statute of limitations period set forth in the Annotated Code of Maryland Courts and Judicial Proceedings §5-102.

WITNESS OR ATTEST:

_____

_____
(Principal – Contractor Name)

By:_____

Type Name:_____

Type Title: _____

Date: _____

_____
(Surety)

_____

By:_____

Type Name:_____

Type Title:_____

Type Address:_____

_____

Date:_____

The Contract shall be done in strict compliance with the Baltimore County Department of Public Works and Transportation September 2023 "Standard Specifications for Construction and Materials" and "Standard Details for Construction", and any and all revisions thereto as of the date of the fully executed Contract, including but not limited to the General Conditions Building Projects, as applicable, and all of which are made a part hereof and incorporated herein (collectively, the **"Specifications").** Copies of which are available on the County's website at www.baltimorecountymd.gov/departments/public-works/standards. **IN ADDITION, THE CONTRACTOR UNDERSTANDS AND AGREES THAT THE FOLLOWING SECTIONS OF THE SPECIFICATIONS (GP-1.03 AND GP-5-15) SHALL BE STRICKEN AND THE FOLLOWING SHALL BE INSERTED IN AND INCORPORATED INTO THE CONTRACT IN LIEU THEREOF:**

GP-1.03 ORGANIZATIONAL DEFINITIONS

Administration - Baltimore County.

Administrator - The Director of the Office of Budget and Finance, Baltimore County.

Baltimore County - Baltimore County, Maryland: a body corporate and politic.

Department - The word "Department" shall mean the Office of Budget and Finance of Baltimore County.

Engineer - One of the following engineering executives:

Director of Office of Budget and Finance
Chief, Property Management Division of the Office of Budget and Finance

Any delegation of the Engineer's authority must be authorized in writing by any one of the above listed officials, and such delegation of authority will pertain only to the specific contract and/or contracts shown by the authorization. The title of the specific official will appear in those cases within these specifications where the word "Engineer" as defined herein is not sufficiently specific.

Inspector - The authorized representative of the procurement officer assigned to make detailed inspection of any or all portions of the work, or materials therefor.

Procurement Officer - See Engineer.

GP-5.15 DISPUTES

(a) Except as otherwise may be provided by applicable law or regulation, all disputes arising under or as a result of a breach of this Contract that are not disposed of by mutual agreement shall be resolved in accordance with this General Provision.

(b) As used herein, "claim" means a: written demand or assertion by one of the parties seeking, as a legal right, the payment of money, adjustment or interpretation of Contract terms, or other relief, arising under or relating to this Contract.

A voucher, invoice, or request for payment that is not in dispute when submitted is not a claim under this General Provision. However, if the submission subsequently is not acted upon in a reasonable time, or is disputed either as to liability or amount, it may be converted to a claim for the purpose of this General Provision.

(c) When a claim cannot be resolved by mutual agreement, the Contractor shall submit a written request for decision to the Department's Chief of the Property Management Division for his decision in consultation with the County Office of Law. The Contractor's written request shall set forth all the facts surrounding the controversy, including, but not limited to, those items listed in GP-5.14(b). Any claim by the County shall be decided in like manner.

(d) The Contractor, at the discretion of the Engineer, may be afforded an opportunity to be heard and to offer evidence in support of his claim. Pending resolution of a claim, the Contractor shall proceed diligently with the performance of the Contract.

(e) The Department's Chief of the Property Management Division shall decide any and all claims. The decision by the Department's Chief of the Property Management Division shall be issued within ninety (90) Days on matters of less than fifty thousand dollars ($50,000) and within one hundred eighty (180) Days on matters of fifty thousand dollars ($50,000) or more. The written decision of the Department's Chief of the Property Management Division shall be final and binding unless appealed in writing to the Director of the Department within thirty (30) Days of the Chiefs written opinion to the parties. If the Chiefs decision is timely appealed in writing to the Director of the Department, the Director of the Department, serving as referee, will review the written appeal submitted to assure all reasonable attempts were made to resolve the appeal.

(f) The Director shall issue his/her decision in writing within ninety (90) Days. The Director's decision shall be final and conclusive unless a written appeal is mailed or otherwise filed with the County Administrative Officer within thirty (30) Days of the Director's written decision.

(g) When the County Administrative Officer is satisfied all efforts at the Department level were made to resolve the dispute, a claim shall be resolved as follows:

(1) Subject to, and without in any way enlarging or limiting the other provisions of the Contract, the parties to any Agreement which adopts or incorporates by reference these Standard Specifications, appoint the County Administrative Officer as an administrative hearing officer pursuant to Article 25A, "Chartered Counties of Maryland", of the Annotated Code of Maryland.

(2) The parties further grant the County Administrative Officer the right to delegate this responsibility and authority in writing to a County official who is a registered professional engineer, independent of the Department of Public Works and Transportation’s Division of Construction Contracts Administration, or to any other County official.

(3) For disputes involving ten thousand dollars ($10,000) or more the decision of the administrative hearing officer shall be final and binding on both parties, subject only to such appeals on the record as provided by Article 25A. For disputes involving less than ten thousand dollars ($10,000), the decision of the administrative hearing officer shall be final and binding on both parties.

GENERAL CONDITIONS

BUILDING PROJECTS

Revised September 1, 2024,
in compliance with September 2023
Standard Specifications for Construction and Materials

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BUILDING PROJECTS

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GENERAL CONDITIONS
DESIGN BUILD BUILDING PROJECTS

I. SPECIFICATIONS

Article 1 Applicable Specifications

All work performed under this Contract shall be done under strict compliance with the *Specifications* bound herewith, and with the *Baltimore County Standard Specifications for Construction and Materials* and the *Standard Details for Construction* dated September 2023 and subsequent addenda thereto, so far as the same may be applicable, copies of which are available on the County's website at www.baltimorecountymd.gov/departments/public-works/standards. These General Conditions are in addition to the aforementioned Specifications. Should there be any conflict with the aforementioned manuals, the *General Conditions* take preference.

II. DEFINITIONS

Article 2 Definitions

A. *Architect and/or Engineer* shall mean the registered Architect and/or Engineer commissioned by the County to prepare the plans and contract documents.

B. *Engineer* in these General Conditions and in the Construction Specifications in some instances refers to authorized representatives of the Office of Budget and Finance, Property Management.

C. *Subcontractor,* as employed herein, includes only those having a direct contract with the Contractor. It includes one who furnished material worked to a special design according to the Plans and Specifications for the "work." It excludes one who merely furnished material not so worked.

D. *Written Notice* shall be deemed to have been duly served if 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 if delivered to or sent by registered mail to the last business address known to him who gives the notice.

E. *Repair* means to restore after injury, deterioration, or wear; to mend, to renovate, by such means as appropriate, and to supply such materials and labor as necessary to render the item to be repaired sound, solid, true, plumb, square, even, smooth, and fully serviceable. Upon completion of such repair it must be, unless otherwise stated, rendered to such condition as to present a first-class finished work, or in instances where the repaired item serves as a base for additional finish, the repaired work must be such as to permit a first-class finish, to be applied without extra cost to the County. When the word "repair" is used in connection with machinery or mechanical equipment, it shall mean, in addition to the above, rendering the equipment completely serviceable and efficient, ready for the normal use for which it was originally intended.

F. Some parts of the "Construction Specifications," bound herewith are of the abbreviated or "streamlined" type and includes incomplete sentences. Omissions of words or phrases such as "the Contractor shall", "in conformity therewith", "shall be", "as noted on the drawings", "according to the plans", "a", "an", "the", and "all" are intentional. Omitted words or phrases shall be supplied by inference in the same manner as they are when a "note" occurs on the drawings. Words "shall be" or "shall" will be supplied by inference when colon (:) is used within sentences or phrases.

Article 3 Time Limits

The proposal shall indicate whether the contract limit is based on Working Days or Calendar Days. If this is not indicated in the Proposal, then the time limits will be based on Calendar Days.

Article 4 Sunday, Night and Holiday Work

If Sunday, night or holiday work is necessary due to an emergency or is permitted by the Engineer, the Contractor shall secure and pay for any and all permits required in connection with this work.

III. CONTRACT DOCUMENTS AND SHOP DRAWINGS

Article 5 Contract Documents

A. Clarification

It is assumed that the Contractor has obtained clarification of all questions which may have arisen as to intent of the contract documents, or assumed, or actual conflict between two or more items in the Contract Documents as required in "Instructions to Bidders." Should the Contractor have failed to obtain such clarification as required by the "Instructions to Bidders," then the Engineer may direct the work to proceed by any method indicated, specified or required by the Contract Documents in the interest of maintaining the best construction practice. Such direction by the Engineer shall not constitute a claim for extra by the Contractor.

B. Jargon

Work described in words that have a well-known technical or trade meaning shall be held to refer to such recognized standard use.

C. Drawings

The Contractor shall do no work without proper drawings and instructions. Drawings are, in general, drawn to scale; however, symbols are used to indicate materials and structural and mechanical requirements. When symbols are used, the drawings are, of necessity, diagrammatic, as it is not possible to indicate all connections, fittings, fastenings, etc., which are included as a part of the work. Diagrammatic indication of mechanical piping, ducts, and conduit within the buildings is subject to adjustment in order to obtain proper grading, passage over, under or past obstructions, to avoid exposure in finished rooms and unsightly and obstructing conditions. The Contractor shall coordinate these adjustments.

1. Copies no longer Furnished

   The County will no longer furnish the Contractor any copies of the Drawings and Specifications. Additional copies may be obtained by the Contractor down loading drawings and specifications from the Baltimore County Solicitation Web Page.

2. Copies of the Work

   The Contractor shall keep in the office on the job a complete set of all drawings, specifications, shop drawings, schedules, etc., in good order and available to the Engineer and representatives of the County.

3. Ownership

   All documents as furnished by the County remain the property of the County. They must not be used on other work but shall be returned to the County upon completion of the work.

D. Large Scale Detail Drawings

The Architect shall furnish, when necessary, additional instructions in the form of large scale developments of the drawings used for bidding, or to amplify Construction Specifications for the proper execution of the work. These shall be true developments of the bidding documents and reasonably inferable there from. The work shall be executed in conformity herewith. [See Article 6, Paragraph A.3.(c)]

E. Dimensions

The Contractor shall carefully check all dimensions prior to execution of the particular work affected. Whenever inaccuracies or discrepancies are found, the Contractor shall consult the Engineer prior to any construction or demolition. Should any dimensions be missing, the Engineer will be consulted and supply them prior to execution of the work. Dimensions for items to be fitted into constructed conditions at the job will be taken at the job and will be the responsibility of the Contractor. The obvious intent of the documents or obvious requirements dictated by conditions existing or being constructed supersedes dimensions or notes which may be in conflict herewith.

Whenever a stock size manufactured item or piece of equipment is specified by its nominal size, it is the responsibility of the Contractor to determine the actual space requirements for setting or entrance to the setting space. No extra will be allowed by reason of work requiring adjustment in order to accommodate the particular item of equipment.

Whenever new work, building, addition or portions thereof are not accurately located by plan dimensions, the Engineer will supply exact position prior to execution of the work.

Article 6 Shop Drawings

A. Shop Drawings (those prepared by the Contractor or Vendor of Material)

The Contractor shall submit for the Architect's approval, at such times as agreed (see Article 8), shop drawings (to include setting drawings and schedules) as required for the work of the various trades. These drawings shall be prepared in conformity with the best practice and standards for the trade concerned. Due regard shall be given to speed and economy of fabrication and erection.

1. Items to be Detailed

Shop details shall be supplied for all items which are specially fabricated for the work or when the assembly of several items is required of a working unit. Shop drawings are required for all reinforcing and structural steel, specially made or cut masonry units, miscellaneous metal work, specially made flashings or roofing and sheet metal work, specially made millwork, special rough hardware and all heating, ventilating, plumbing and electrical requiring special fabrication or detailed connections, including ducts.

2. Submissions

Shop drawings, brochures and catalog cut submissions shall consist of sufficient copies to provide for the retention by the Architect and County of five (5) copies total plus such additional copies as the Contractor may require. Drawings shall not exceed 24 in. x 36 in. in size.

3. Examination and Approval

The Contractor shall review all shop drawings, brochures and catalog cuts provided by the subcontractors and vendors prior to submitting them to the Architect. The Architect shall examine shop drawings with reasonable promptness, noting desired corrections, or granting approval.

a. Field Dimensions and Conditions

The Architect is not responsible for the checking of dimensions or existing conditions in the field. This is the sole responsibility of the Contractor.

b. Resubmission

When the Architect's notations or corrections are extensive, then the Contractor shall resubmit the drawings with changes made on the drawings.

c. Contractor's Responsibility

Unless the Contractor has in writing, notified the Architect to the contrary, at the time of submission, it will be assumed that the drawings are in conformity with the Contract Documents and do not involve any change in the Contract price or any change which will alter the space within the structure or alter the manner of operation from that contemplated in the Contract Documents.

d. Architect's Notations

Should the Contractor consider any change or notation received in compliance with paragraph (c) above as increasing the cost of the work from that contemplated in the Contract Documents, then the Contractor shall desist from further action relative to the item he/she questions and shall notify the Engineer, in writing, within five (5) days of the additional cost involved. No work shall be executed until the entire matter is cleared or a Change Order issued, or the Contractor is ordered by the Engineer to proceed under the provisions of the County's Standard Specifications. Failure of the Contractor to serve written notice, as above required, shall constitute a waiver of any claim in relation thereto.

(1) Similarly, should the Architect's notation or change involve less work than is covered by the Contract Documents, the Contractor shall allow the County the credit resulting from the change.

(2) Should the Contractor consider that any notation or change made by the Architect under provisions of this paragraph, paragraph (c), above, as involving a complete change in the subcontractor's relation or the substitution of a material different from that on which the Contract was based, then the Contractor shall act as herein stated or as in paragraph (c) above.

4. Project Completion

At the completion of the project, the Contractor shall submit a list of shop drawings for the entire project. This list shall contain the following information: title, description, specialty (Architectural, Structural, Mechanical, etc.), decision (no exceptions taken, approved, approved as noted, etc.).

Article 7 Separate Contracts

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

B. If any part of the Contractor's work depends for proper execution or results upon the work of any other contractor, the Contractor shall inspect and promptly report to the Engineer any defects in such work that render it unsuitable for such proper execution and results. Failure to inspect and report shall constitute an acceptance of the other contractor's work as fit and proper for the reception of the work, except as to the defects which may develop in the other contractor's work after the execution of the work.

C. To ensure the proper execution of his/her subsequent work, the Contractor shall verify work already in place and shall at once report to the Engineer any discrepancy between the executed work and the drawings.

IV. PAYMENTS

Article 8 Payments

A. Under this Contract payments will be made monthly on the valuation of work accomplished and on account of materials delivered on the site, for incorporation in the work, which are suitably stored.

B. At the first of each month, the Contractor shall submit to the Engineer an application for payment on a form provided by the Engineer. Prior to application for first payment, the Contractor shall submit to the Engineer a schedule of values for the various parts of the work, including quantities, aggregating to the total sum of the Contract. This shall be so divided as to facilitate payment to subcontractors in accordance with Article 28, Paragraph C.1. The form of this submission shall be such as the Contractor or Engineer have agreed upon, and, if required, shall be supported by such evidence as to its correctness as the engineer may direct. This schedule, when approved by the Engineer, shall be used as a basis for approval of payment unless it is found to be in error. In applying for payment, the Contractor shall submit a statement based upon the schedule, itemized in such form and supported by such evidence as the Engineer may require, showing the Contractor's right to the payment claimed. If required, the Contractor shall show receipts and other vouchers for the payments for materials and labor including payments to subcontractors, as required by Article 28.

C. Materials Purchased Under Allowance

The Engineer will provide schedules for all materials to be purchased from specified allowance.

Article 9 Approval of Payments

If the Contractor has made application, as above, the Engineer shall review and approve such payments as is decided to be properly due in accordance with the approved schedule. In approving such partial payments, there shall be retained no more than 10% of the total amount for the first 50% of the contract, after which only 5% of the total amount of the contract may be withheld unless the need is demonstrated for retaining more to protect the public interest.

Article 10 Payment Withheld

A. The Engineer may withhold, or on account of subsequently discovered evidence, nullify the whole or a part of any payment to such extent as may be necessary to protect the County from loss on account of:

1. Defective work not remedied.

2. Claims filed, or reasonable evidence indicating probable filing of claims, by parties other than the Contractor.

3. Failure of the Contractor to make payments properly to subcontractors or for material or labor.

4. A reasonable doubt that the Contract can be completed for the balance then unpaid.

5. Damage to another Contractor.

6. Failure of the Contractor to submit data required within the time limits stated in the Contract Documents.

Upon removal of the above, payment shall be made for the amounts withheld.

Article 11 Changes in Work

A. The County, without invalidating the Contract, may order changes in the work by altering, adding to or deduction from the work, the Contract sum being adjusted accordingly. Such change shall be executed under these *General Conditions.* Extension of time made necessary thereby shall be adjusted at the time of such Change Order.

B. The Engineer shall have authority to make minor changes in the work not involving extra cost and not inconsistent with the purpose of the project. Otherwise, except in an emergency endangering life or property, no extra work or change shall be made unless a written order for the Office Budget and Finance, Property Management signed or countersigned by the Director has been received by the Contractor. No claim for addition to the Contract sum shall be valid unless so ordered.

C. The value of any such extra work or change shall be determined in one or more of the following ways as determined by the Office of Budget and Finance, Property Management.

1. By Estimate and Acceptance of a Lump Sum

a. The prime Contractor shall furnish a breakdown of the estimated construction cost. The breakdown shall be of sufficient detail to describe the extra work and related costs for labor, material, overhead and profit.

b. Overhead and Profit

(1) Extra work by Subcontractor:

Subcontractor will be allowed 10% overhead and 10% profit added to the direct labor and material costs. The prime contractor will be allowed to increase the subcontractors total lump sum by 10% to cover his/her administration.

(2) Extra work by Prime Contractor:

The prime contractor will be allowed 10% overhead and 10% profit added to the labor and material costs.

c. The prime contractor will be allowed 1 % for the bond added to the labor and material costs.

d. The allowed overhead will include all supervision; no additional allowance will be made for it.

2. By Unit Prices Named in the Contract or Subsequently Agreed Upon

Such unit prices are to include all supervision, overhead, taxes, insurance and profit.

3. By Cost and a Fixed Fee

Added to the cost is a fixed fee portion which is to include supervision, overhead, insurance and profit.

4. By Force Account (Labor and Material Cost plus)

In accordance with the *Baltimore County Specifications for Construction and Materials* Section GP 9.02, the Contractor is allowed to add 65% mark-up.

D. Should none of the methods stated in Paragraph C. 1, 2, or 3 be determined, the Contractor shall, providing he/she receives an order as defined in Paragraph B, above, proceed with the work on the basis of Paragraph C. 4. Force Account.

The Contractor and Engineer shall keep accurate costs, in such form as the Engineer may direct, for presentation, together with vouchers, to the Office of Budget and Finance Property Management for determination of the value of the work included in each Change Order. Pending determination of the final value, the Engineer may include payments for materials and labor, as stated in Article 8, in monthly vouchers.

Article 12 Claims for Extra Cost

No claim for extra will be granted which includes cost of delays or work stoppage due to strikes, lockouts, fire, avoidable casualties or damage or delay in transportation for which the County or its agents are not responsible. (See also Article 14.)

Article 13 Deductions for Uncorrected Work

If the Engineer and County deem it expedient to correct work injured or done not in accordance with the Contract, an equitable deduction from the Contract price shall be made therefore.

Article 14 Delays and Extension of Time

If no schedule or agreement stating the dates upon which drawings shall be furnished is made (see Article 8), then no claim for delay shall be allowed on account of failure to furnish drawings until two (2) weeks after demand for such drawings, and then not unless such claim is reasonable.

Article 15 Correction of Work After Final Payment

Neither the final certificate nor payment nor any provision in the Contract Documents shall relieve the Contractor of responsibility for faulty materials and workmanship. Unless otherwise specified, the Contractor shall remedy any defects and pay for any damage to other work resulting there from that appears within the guarantee period. The County shall give notice of observed defects with reasonable promptness. All questions arising under this Article shall be decided by the Director of Budget and Finance, Property Management.

Article 16 (Deleted)

Article 17 Assignment

The Contractor shall not assign the Contract. It shall not be sublet as a whole or sublet by trades or other portions in an amount of more than 75% of the monetary value of the Contract. The remaining 25% shall be executed by the Contractor with labor and materials directly purchased and paid for by the Contractor. Costs for insurance, over-head, supervisions, etc., may not be claimed as a portion of the 25% mentioned above. The execution of work by a subsidiary of the Contractor is not considered direct employment. The Contractor shall not assign any monies due or to become due to him/her hereunder, without the previous written consent of the County.

Article 18 Maryland State Sales Tax

A. Contractors who are performing work for the State of Maryland or any of its political subdivisions are required to pay tax on materials and supplies which will be incorporated into the work.

B. The Contractor must pay the tax on all equipment which is purchased, Even though it may be used on a job for the State of any of its political subdivisions.

V. MATERIALS

Article 19 Materials

Materials include all manufactured products and processed and unprocessed natural substances required for completion of the Contract. The Contractor in accepting the Contract is assumed to be thoroughly familiar with the materials required and their limitations as to use and requirements for connections, setting, maintenance and operation.

Whenever an article, material or equipment is specified and a fastening, furring, connection (including utility connections), bed or accessory is normally considered essential to its installation in good quality construction, such shall be included as if fully specified. Nothing in the Construction Specifications shall be interpreted as authorizing any work in any manner contrary to applicable law, codes or regulations (See Article 31).

A. Approval

All materials are subject to the Architect's or Engineer's approval as to conformity with the specifications, quality, design, color, etc. No work for which approval is necessary shall be contracted for, or used, until written approval is given by the Architect or Engineer. Approval of a subcontractor, as such, does not constitute approval of a material which is other than that included in the Construction Specifications.

B. New Materials

Unless otherwise specified, all materials shall be new.

C. Quality

Unless otherwise specified, all material shall be of the best quality of the respective kinds.

D. Samples

The Contractor shall furnish for approval all samples as directed. The work shall be the same as the approved samples.

E. Painting and Color

The Architect and Contractor shall jointly prepare the paint and color schedules. The Architect shall direct the exact color, texture and finish.

F. Proof of Quality

The Contractor shall, if required, furnish satisfactory evidence as to the kind and quality of materials either before or after installation. The Contractor shall pay for any tests as may be deemed necessary in relation to "Substitutions" (Paragraph I. below).

G. Contractor's Option

When several products or manufacturers are named in the Construction Specifications for the same purpose or use, then the Contractor shall select any of those so named. However, all of the units of a thing required for a project must be the same in material and manufacture.

H. "Or Equal", "Equal", "Approved Equal"

The above terms are used as synonyms throughout the Construction Specifications. They are implied in reference to all named manufacturers. Only materials that, in the opinion of the Engineer, are fully equal in all details of construction, methods of assembly, finish and design quality will be considered. (See A, C, E, above, and I. below.)

I. Substitutions

Should the Contractor desire to substitute another material for one or more specified by name, the Contractor shall apply, in writing, for such permission and state the credit or extra involved by the use of such material. The Engineer will not consider the substitution of any material different in type or construction methods unless such substitution effects a benefit to the County. (See A. and D. above.)

The Contractor shall <u>not</u> submit for approval, materials other than those specified without a written statement why such a <u>Substitution</u> is proposed. Approval of a "substitute" material by the Architect or Engineer when the Contractor has not designated such material is a "substitute," shall not be binding on the County nor release the Contractor from any obligations of the Contract, unless the Architect or Engineer approves such "substitutions" in writing.

J. Standard Specifications

Whenever references are made in the Contract Documents to the *Baltimore County Standard Specifications for Construction and Materials* and *Standard Details for Construction,* it shall be understood that the latest standards and/or requirements are intended and shall apply. When no specification is cited and the quality, processing, composition or method of installation of a thing is only generally referred to then:

1. For things not otherwise specified below, the latest edition of the Applicable American Society for Testing Materials Specifications shall apply.

2. For things covered by the applicable portions, the National Bureau of Fire Underwriters Code shall apply.

3. For things generally considered as plumbing and those things requiring plumbing connections, the applicable portions of the latest edition of the American Society of Mechanical Engineers Code and the Baltimore County Plumbing Code shall apply.

4. For things generally considered as heating and ventilating work and not covered by A.S.M.E. Code, the applicable portions of the latest edition of the Heating and Ventilating Guide, published by the American Society of Heating and Ventilating Engineers, and the Baltimore County Building Code shall apply.

K. Storage

The contractor shall confine apparatus and storage of materials to the "off-road" area delineated as the "Limit of Contract." The Contractor shall not load or permit any part of the structure to be loaded with a weight that will endanger the safety of the structure or any part thereof.

VI. QUALIFICATION, EMPLOYEES, WORKMANSHIP, SUBCONTRACTORS AND ADVERTISING

Article 20 Qualification of Bidders

Bidders are required to be prequalified 10 days prior to bid opening, satisfactorily evidencing that they have the ability, equipment, organization and financial resources sufficient to enable completion of the work satisfactorily within the time specified in the Proposal.

Article 21 Employees and Workmanship

A. Employees

1. Qualification

Only personnel thoroughly trained and skilled in the task assigned them may be employed on any portion of the work, or they shall be removed.

2. Licensed

When County, State or Federal laws require that certain personnel (electricians, plumbers, etc.) be licensed, then all such personnel employed on the work shall be so licensed.

B. Quality of Labor

The Contractor shall employ on the work, at all times, sufficient personnel to complete the work within the time stated in the Proposal.

C. Work Areas

The Contractor shall confine the operations of his/her employees to the limits as provided by law, ordinance, permits or directions of the Office of Budget and Finance Property Management. Generally, the "off-road" area will be the same as the "limit of Contract" line.

D. Methods and Quality

1. All workmanship shall be of good quality. Whenever the method of the work or manner of procedure is not specifically stated or shown in the Contract Documents, then it is intended that the best standard practice shall be adhered to. Recommendations of the manufacturers of approved materials shall be considered as a part of Construction Specifications and all materials shall be applied, installed, connected, erected, used, cleaned and conditioned as so called for thereby. This, however, does not remove any requirement in Construction Specifications to add to the manufacturer's recommendations.

2. All materials shall be accurately assembled, set, etc., and when so required in good construction, shall be true to line, even, square, plumb, level and regularly spaced, coursed, etc. Under no circumstances, either in new or old work, shall any material be applied over another which has not been thoroughly cleaned, sanded or otherwise treated so as not to impair the finish, adhesion, or efficiency of the next applied item.

3. All methods, procedures and results are subject to the Engineer's approval as to finished result to be obtained. However, this is not to be interpreted as placing upon the Engineer any responsibility for the "work" management which is solely the responsibility of the Contractor.

E. Joining of Work

1. The Contractor shall so schedule the work as to ensure efficient and uninterrupted progress and to hold to an absolute minimum the cutting and patching of new work. All cutting, patching and digging necessary to the execution of the work is included.

2. The Contractor shall so schedule (to include subcontracts) the construction performed by each group or trade that each installation or portion of the construction shall member with and join with all other work as required for a complete installation, all according to accepted good construction practice.

F. Superintendent

The Contractor shall keep on the work, at all times during its progress, a competent superintendent and all necessary assistants, all approved by the

Office of Budget and Finance Property Management. Prior to commencement of the work, the Contractor shall submit in writing to the Office of Budget and Finance Property Management the name and qualifications of the person to be employed as Superintendent for the execution of the Contract. A written approval or rejection will be given following review of the data. Persons who have previously proved unsatisfactory on work executed for the County, or who are without proper qualifications, will not be approved. Should the Superintendent be complained of by the Office of Budget and Finance Property Management for cause, he/she shall be removed from the work. Should it be necessary to change the Superintendent, the above procedure shall be repeated. The Superintendent will represent the Contractor. All directions given to the Superintendent shall be as binding as if given to the Contractor. Important directions shall be confirmed on written request in each case.

G. Discipline

The Contractor shall at all times enforce strict discipline and good order among his/her employees and shall not employ or permit to remain on the work any unfit person. The Contractor shall enforce all instructions relative to use of water, heat, power, no smoking, and control any use of fires, as required by law and for the Office of Budget and Finance Property Management. Employees must not be allowed to loiter on the premises before or after job working hours.

Article 22 Employment Lists

The Contractor may contact MARYLAND STATE EMPLOYMENT SERVICE, Towson, MD, 21204, if so desired, for additional labor regarding this project.

Article 23 Contractor's Supervision (Also see Article 21, Paragraph F.)

The Contractor shall constantly maintain efficient supervision of the work, using his/her best skills and coordinating ability. The Contractor shall carefully study and compare all drawings, specifications, and other instructions and check them against conditions existing or being constructed on the project. The Contractor shall report to the Engineer any error inconsistency or omission which may be discovered. (See also Article 5, Paragraph E, and Instructions to Bidders.) The Contractor shall not be held responsible for the existence or discovery of such errors or conflicts and neither shall the adjustment of such errors or conflicts be grounds for claim for extra on the art of the Contractor unless such adjustment involves work not obviously contemplated by the Contract Documents or necessary to progress of the work. The Contractor shall be responsible for the coordination of the work of all subcontractors.

Article 24 The County’s Right to do Work

If the Contractor should neglect to prosecute the work properly or fail to perform any provision of this Contract, the County after three days' written notice to the Contractor may, without prejudice to any other remedy, make good such deficiencies and may deduct the cost thereof from the payment then or thereafter due the Contractor.

Article 25 County's Right to Terminate Contract

A. Terminate Contract

The Office of Budget and Finance, Property Management, upon proof that sufficient cause exists to satisfy such action, may without prejudice to any other right or remedy, and after giving the Contractor seven (7) days' written notice, terminate the employment of the Contractor and take possession of the premises and of all materials, tools, and appliances thereon and finish the work by whatever method may be deemed expedient, if any of the following conditions exists:

1. If the contractor should

   a. Be adjudged a bankrupt or make a general assignment for the benefit of creditors,

   b. Has a receiver appointed on account of insolvency.

   c. Fails to or repeatedly and persistently refuses to supply properly skilled workers or proper materials, except in cases for which extension of time is provided,

   d. Fails to make payment to subcontractors, or for materials and labor,

   e. Persistently disregards laws, ordinances or the instructions of the Engineer, or

   f. Is otherwise guilty of a substantial violation of any provision of the Contract.

2. Payment Status

   In cases such as identified above, the Contractor shall not be entitled to receive any further payment until the work is finished. If the unpaid balance of the Contract price shall exceed the expenses of finishing the work, including compensation for additional managerial and administrative services, such excess shall be paid to the Contractor. If such expense shall exceed such unpaid balance, the contractor shall pay the difference to the County. The expense incurred by the County as herein provided, and the damage incurred through the Contractor's default, shall be itemized by the Engineer and a certified copy supplied to the Contractor.

Article 26 Sanitary Conveniences

A. The Contractor shall arrange for the erection and Maintenance of temporary toilets equipped with running water and drain connection for use of employees. These conveniences shall be erected and kept clean and in good condition, as required by law, until ordered removed by the Engineer.

B. In lieu of A. above, the Contractor may install a portable approved chemical toilet at an approved location.

C. The permanent plumbing fixtures to be constructed under this Contract shall not be used during construction, under any circumstances.

Article 27 Subcontracts Deleted

Article 28 Relation of Contractor and Subcontractor

A. **The Contractor agrees** to bind every subcontractor and every subcontractor agrees to be bound by the terms of the Agreement, *Baltimore County's Standard Specifications for Construction and Materials* and *Standard Details for Construction* the *General Conditions,* the Drawings and Construction Specifications, as far as applicable, to his/her work, including the following provisions of this Article, unless specifically noted to the contrary in the subcontract approved in writing as adequate by the Office of Budget and Finance, Property Management.

B. **The Subcontractor agrees** to be bound to the Contractor by the terms of the Agreement, *Baltimore County's Standard Specifications for Construction and Materials* and *Standard Details for Construction, General Conditions,* Special Provisions, Construction Specifications, and to assume towards him/her all obligations and responsibilities that he/she, by those documents, assumes towards the County.

1. To submit to the Contractor applications for payment in such reasonable times as to enable the Contractor to apply for payment under Article 8 of these *General Conditions.*

2. To make all claims for extras, for extensions of time and for damages for delays or otherwise, to the Contractor in the manner provided in *Baltimore County's Standard Specifications for Construction and Materials* or those *General Conditions* for like claims by the Contractor upon the County, except that the time for making claims for extra cost is one (1) week.

C. **The Contractor agrees** to be bound to the Subcontractor by all the obligations the County assumes to the Contractor under Agreement, *Baltimore County's Standard Specifications for Construction and Materials, General Conditions,* Drawings and Construction Specifications, and by all the provisions thereof affording remedies and redress to the Contractor from the County.

1. To pay the Subcontractors:

   a. Upon receipt of payment, if issued under the schedule of values described in *Baltimore County's Standard Specifications for Construction and Materials,* G.P.-9.03 or Article 8 of these *General Conditions,* the amount allowed to the Contractor on account of the Subcontractor's work, to the extent of the Subcontractor's interest herein.

   b. Upon the receipt of payment, if issued otherwise than as in Paragraph C.1., above, so that at all times the total payments shall be as large in proportion to the value of the work done by him as the total amount certified to the Contractor is to the value of the work done by him/her.

   c. To such extent as may be provided by the Contract Documents or the subcontract, if either of these provides for earlier or larger payments than the above.

   d. On demand for his/her work or materials as far as executed and fixed in place, less the retained percentage, at the time the payment is requested, even though the Engineer fails to approve it for any cause not the fault of the Subcontractor.

   e. A just share of any fire insurance money received by him/her, the Contractor, under Article 35 of these *General Conditions.*

2. To make no demand for liquidated damages or penalty for delay in any sum in excess of such amount as may be specified in the subcontract.

3. That no claim for services rendered or materials furnished by the Contractor to the Subcontractor shall be valid unless written notice thereof is given by the Contractor to the Subcontractor during the first ten (10) days of the calendar month following that in which the claim was originated.

4. To give the Subcontractor an opportunity to be present and to submit evidence in any manner involving his/her rights.

5. The Contractor and the Subcontractor agree that nothing in this Article shall create any obligation on the part of the County to pay to or to see to the payment of any sums to any Subcontractor.

Article 29 Interlocking Contracts

The attention of the Contractor and all Subcontractors is specifically called to the necessity of reading the Specifications covering items of the work which connect with or are dependent upon the work specified under each heading, and each Contractor executing the work called for there under shall be responsible for arranging for proper provision for connecting and coordinating his/her work with such other items.

Article 30 Advertising Signs

A. The Contractor will furnish, erect and maintain a project sign for the duration of the project. The sign shall be placed on the site where and as directed by the Engineer. The sign shall be fastened to three posts spaced 4' apart. The posts shall be 4" x4", seven feet above ground and three feet below ground.

B. The project sign is shown on page GC-27 in this book.

VII. LAWS, PERMITS, LICENSES, INSURANCE, AND BONDS

Article 31 Laws, Permits and Regulations

A. Permit and Service Connections:

1. **BUILDING PERMIT** - The County will obtain the building permit at no cost to the Contractor.

2. **PERMANENT WATER SERVICE** - The County will apply for the water service and pay all related charges; i.e., water meter, water systems connection charge, water distribution charge and sewer systems connection charge. Total installation of the permanent water service is part of this Contract. Water service shall be installed by a County Prequalified Utility Contractor.

3. **PLUMBING PERMIT** - The Contractor shall apply for the Permit; however, the County will pay all related charges and fees.

4. **PERMANENT ELECTRIC SERVICE** - The Contractor shall apply for and pay for the electrical permit. The County shall obtain BGE permanent gas and electric service to the site at no cost to the Contractor.

   The Contractor shall coordinate the installation of permanent gas and electric service with Baltimore Gas & Electric

Company. Both the gas and electric services shall be activated at the same time under one account number showing Baltimore County as owner. The Contractor shall be responsible for payment of consumption charges for the use of gas and electric energy obtained through the permanent service until the building is accepted by the County or until agreed upon by the County in direct coordination with the Building Services Division of Baltimore County. Charges from BGE for removal of existing electric service will be paid by the County.

5. **PERMANENT TELEPHONE SERVICE** - The County shall pay for the telephone service and systems to and in the building. The Contractor is responsible for supplying and installing all conduit, cables and junction boxes as shown on the drawings or called out in the Specifications.

6. **CABLE** - The County shall pay for any cable television service into the building. The contractor is responsible for supplying and installing the remaining work as shown on the drawings and called out in the Specifications.

7. **TEMPORARY SERVICES** -All temporary services, such as water, electric, telephone, etc., shall be the Contractor's entire responsibility. (Also see Article 46.)

8. **MISCELLANEOUS PERMITS** - The Contractor shall procure any and all necessary permits not previously mentioned and pay any and all related charges and fees required and incidental to the due and lawful prosecution of the work.

B. The Contractor shall give all notices and comply with all State and Federal laws, ordinances, rules and regulations bearing on the conduct of the work as drawn and specified. If the Contractor observes that the Drawing and Contract Specifications are at variance therewith, he/she shall promptly notify the Engineer, in writing, and any necessary changes shall be adjusted as provided in the Contract for changes in the work. If the Contractor performs any work knowing it to be contrary to such laws, ordinances, rules and regulations, and without such notice to the Engineer, he/she shall bear all costs arising there from.

Article 32 Compensation, Liability, and Property Damage Insurance

(See Insurance Provision in Part VI of this Contract.)

Article 33 Builder's Risk Insurance

A. The Contractor shall, at his/her own cost, insure the work and keep it insured at all times during the period of construction, and until final acceptance of it by the County, against loss or damage covered by

an "All Risk" Builders Risk type of policy. The amount of insurance shall be the 100% estimated replacement cost of the work.

B. The policies shall be made payable to the County and the Contractor, as their interest may appear, and the policies shall be left in the possession of the Engineer, prior to the start of construction.

Article 34 Guaranty Bonds

A. Prior to signing of the Contract, the Contractor will be required to furnish bond covering the faithful performance of the Contract and the payment of all obligations arising there under, in such form as the County may prescribe with such sureties as the County may approve. The premiums shall be paid by the Contractor.

B. The Bond to be in the amount of the total Contract price.

C. At the direction of the Office of Budget and Finance, Property Management, the Contractor may be required to increase the above bond. Such addition will be paid for by the County in the amount of actual cost to the Contractor.

Article 35 Damages

A. If either party to this Contract should suffer damages in any manner because of the wrongful act or neglect of the other party or of anyone employed by him/her, then reimbursement shall be made by the other party for such damage.

B. Claims under this clause shall be made in writing to the party liable within a reasonable time at the first observance of such damage and not later than the time of final payment, except as expressly stipulated otherwise in the case of faulty work or materials, and shall be adjusted by agreement.

C. Should the Contractor cause damage to any separate contractor on the work, the Contractor agrees, upon due notice, to settle with such contractor by agreement or refer the matter to the Office of Budget and Finance, Property Management, who will render a decision after hearing all evidence in the matter. The Contractor shall pay or satisfy such decision.

VIII. INSPECTION AND SURVEYS

Article 36 Inspection

A. If the Construction Specifications, the Engineer's instructions, laws, ordinances, or any public authority require any work to be specially tested or approved, the Contractor shall give the Engineer timely notice of its readiness for inspection, and if the inspection is by another authority, the date fixed for such inspection. Inspections by

the Engineer shall be made promptly, and where practicable, at the source of supply. Any work covered without approval of the Engineer must, if required, be uncovered for examination at the Contractor's expense.

B. If initial tests and/or inspections show substandard products, materials, workmanship, etc. and the Contractor elects, with the Engineer's approval, to perform additional tests and/or inspections to prove the acceptability of the substandard products, materials, workmanship etc., he/she shall perform same at his/her expense.

Article 37 Surveys

A. The General Contractor shall, at his/her own expense, employ a registered surveyor to provide Elevation Bench Mark, and locate corners of the building and the limits of contract.

B. The General Contractor shall, at his/her own expense, employ a competent field engineer, to give the lines and levels for the building, sidewalks and footings, etc. The Contractor will be responsible for all lines and levels and will guarantee all lines and levels as are shown on drawings.

Article 38 Unauthorized Work

Work done without lines and grades being established, work done beyond the lines and grades shown on the Plans or as established, except as herein provided, or any extra work done without written authority will be considered as unauthorized and at the expense of the Contractor and will not be measured by the Engineer, or paid for by the County. Work so done may be ordered by the Engineer to be removed and replaced at the Contractor's expense.

IX. CONSTRUCTION

Article 39 Construction Schedule

The Contractor shall hold bi-weekly "progress meetings" at the site, at a time suitable to the Engineer, at which the progress of the work shall be reported upon in detail with reference to schedules. Each interested subcontractor shall be required to have present a competent representative to report the condition of his/her branch of the work and to receive instructions. Minutes of these "progress meetings" shall be taken by the Contractor who shall type them for distribution to members of the conference, the Office of Budget and Finance, Property Management, and other interested persons. These minutes shall be received by all parties prior to the next scheduled "progress meeting."

Article 40 Protection of Work and Property

A. All trees along the way of access shall be boxed, also all trees surrounding the building which are liable to injury by the moving, storing and working up of materials. No permanent tree shall be used for attachment of any ropes or derricks. Every public way, catch basin, conduit, tree, fence or things injured in carrying out this Contract, shall be replaced and put in good condition, unless the same shall be permanently done away with by order of the Engineer.

B. The Contractor shall erect and properly maintain at all times as required by the conditions and progress of the work, all necessary safeguards for the protection of workers and the public and shall post danger signs warning against the hazards created by such features of construction as protruding nails, hod hoists, well holes, elevator hatchways, scaffolding, window openings, stairways and falling material.

C. In an emergency affecting the safety of life, or of the work, or of the adjoining property, the contractor, without special instruction or authorization is hereby permitted to act, at his/her discretion, to prevent such threatened loss or injury, and he/she shall so act, without appeal, if so instructed or authorized. Any compensation claimed by the Contractor on account of emergency work shall be determined as outlined in Article 11.

Article 41 Shoring, Bracing and Sheeting

A. The Contractor shall do all necessary shoring, bracing and sheeting required, or as directed by the Engineer, to carryout the work, install the foundations and other building construction, to protect the street, sidewalks and all adjoining buildings and property. He/she shall thoroughly brace and protect all earth banks sides of pits, trenches, and other excavations to prevent danger to persons or structures, and to prevent injurious cavings or erosion of any sort. Shoring and sheeting shall be removed after, or as, the walls are built and properly set.

B. Full responsibility for both the design (by an Engineer licensed in Maryland) and the execution of all shoring, bracing, and sheeting work shall rest upon the contractor. While the Engineer shall be fully advised of all details for such work before the work itself is executed, this shall not in any way relieve the Contractor for full responsibility for all damage or expense arising from faulty installation of the said work of shoring, bracing, or sheeting.

Article 42 Tests

A. Soils testing shall be performed by an independent testing firm arranged and paid for by the County.

B. Materials testing shall be performed by an independent testing firm, paid for by the Contractor, which has previously been approved by the County and Architect/Engineer. Certified copies of all such test reports shall be submitted to the Engineer for approval.

Article 43 Cleaning Up

A. The Contractor shall at all times keep the premises free from accumulations of waste material or rubbish caused by his/her employees or work, and at the completion of the work, shall remove all his/her rubbish from and about the project site, and all his/her tools, scaffolding and surplus material.

   In case of dispute, the County may remove the rubbish and charge the cost to the several contractors as the Engineer shall determine to be just.

B. All debris shall be kept sprinkled to reduce dust and shall be promptly removed from the building, and no combustible materials shall be stored against perimeter walls.

C. The Contractor shall clean entirely the building as it is completed, wash all windows, scrub all floors at least once, and leave all floors free from spots and blemishes. The interior of the building and the project area shall be left "broom clean," or its equivalent.

Article 44 As-Built Drawings

The Contractor shall, as the project progresses, neatly record on a set of white prints any changes and all revisions to the work wherever they shall differ from the Contract Drawings. Upon completion of the work, the · Contractor shall turn over to the Architect this set of prints.

Article 45 Drainage and Pumping

The Contractor shall remove all water, including rain water, encountered during the entire progress of the work, using pumps, drains or other methods approved by the Engineer. Excavations and the project site shall be kept free from water until all backfilling is completed. The water shall be discharged to catch basins, or other drainage points as directed by the Engineer.

Article 46 Temporary Water, Electric and Other Services

A. The Contractor shall arrange for and pay for the installation of temporary connection to the County's water mains, including all incidental fees and expenses for water supply during construction of the project, and shall pay for all water used. Wasting of County water will not be permitted.

B. The Contractor shall arrange for and pay for temporary electric light and power service required during construction of the project, and shall pay for all electricity used. Gasoline or other torches for lighting will not be permitted.

C. The Contractor shall provide and pay for any other temporary services which may be required for the satisfactory completion of the project.

D. The Contractor shall provide, at his/her own expense, all cold weather protection, temporary heat and fuel as necessary to carry on the work expeditiously during inclement weather, to protect work and materials against injury from dampness and cold, to dry out the building and provide suitable working conditions. Refer to other sections for temperatures required for work under the various trades

The methods of heating and type of fuel and equipment used shall be subject to approval by Engineer.

With special permission, in writing, permanent heating system may be used to dry out building and provide suitable working conditions in all or various parts thereof as soon as practicable. If used, Contractor shall be responsible for use of permanent heating system for purpose described and all costs of fuel, attendance, etc. in connection therewith shall be borne by him/her. Such use shall not relieve Contractor of his/her responsibility to turn over system to Owner in perfect condition on completion of project, including the removal of all dust of construction from air handling units, etc., the replacing of all filters, etc., nor shall it shorten stipulated guarantee period which will commence upon the date of final acceptance of the work.

Article 47 Connecting to Existing Utilities

The Contractor shall, at his/her own cost and expense and as part of this work under the Contract, furnish all labor, materials, tools, and appliances, and do all work required for making connections to existing storm drains, sanitary sewer, water, gas and electric service connections, as shown on drawings, and the cost of making such connections shall be included in his/her bid.

Article 48 Existing Utilities Shown on Plans

Water mains, gas mains, storm drains, sanitary sewers, and other utilities are shown on the Plans, in accordance with the best information available, for the information of the Contractor. The County assumes no responsibility for accuracy or completeness of the information shown. Existing mains and services shall be carefully protected and any damage to them caused by the work shall be immediately repaired to the satisfaction of the Engineer by the Contractor at his own expense, using materials of the quality and kinds damaged.

X. MISCELLANEOUS ADDENDA

Article 49 Holidays

The word "holidays" used in these Contract Documents shall be taken to mean the below listed holidays, which in Baltimore County, occur as shown below:

January 1	New Year's Day
3rd Monday in January	Martin Luther King's Birthday
3rd Monday in February	President's Day
4th Monday in May	Memorial Day
June 19	Juneteenth Independence
July 4	Independence Day
1st Monday in September	Labor Day
2nd Monday in October	Indigenous Peoples' Day
November 11	Veteran's Day
4th Thursday in November	Thanksgiving Day
December 25	Christmas
All Days of General Elections	

If any holiday occurs on Sunday, the following Monday shall be considered a holiday. If the holiday occurs on Saturday, the Friday immediately preceding shall be considered a holiday.

Article 50 Buy American Steel Act

The State of Maryland has approved House Bill No. 1659 to "Buy American Steel" for all Public Works projects in the State of Maryland, effective July 1, 1978. Compliance with Article 20.17 Metal Pipe (Page 100) and Article 20.18 Metal for Structures (Page 102) in the *S.H.A. Specifications for Materials, Highways, Bridges and Incidental Structures* dated March 1968 will satisfy this condition. Also see *Baltimore County's Standard Specifications for Construction and Materials* Section GP 7.28.

Article 51 Guarantee

A. The Contractor guarantees all work against faulty or imperfect materials, against all imperfect or careless and/or unskilled workmanship, against all leaks and against all mechanical and electrical failure of equipment for a period of two (2) years from the date of acceptance of the project by the County. See other Sections of this Specification for other guarantees.

B. The Contractor shall remove, replace or re-execute, without cost to the Owner, any work found to be imperfect during the guarantee period.

Article 52 Offices and Telephones

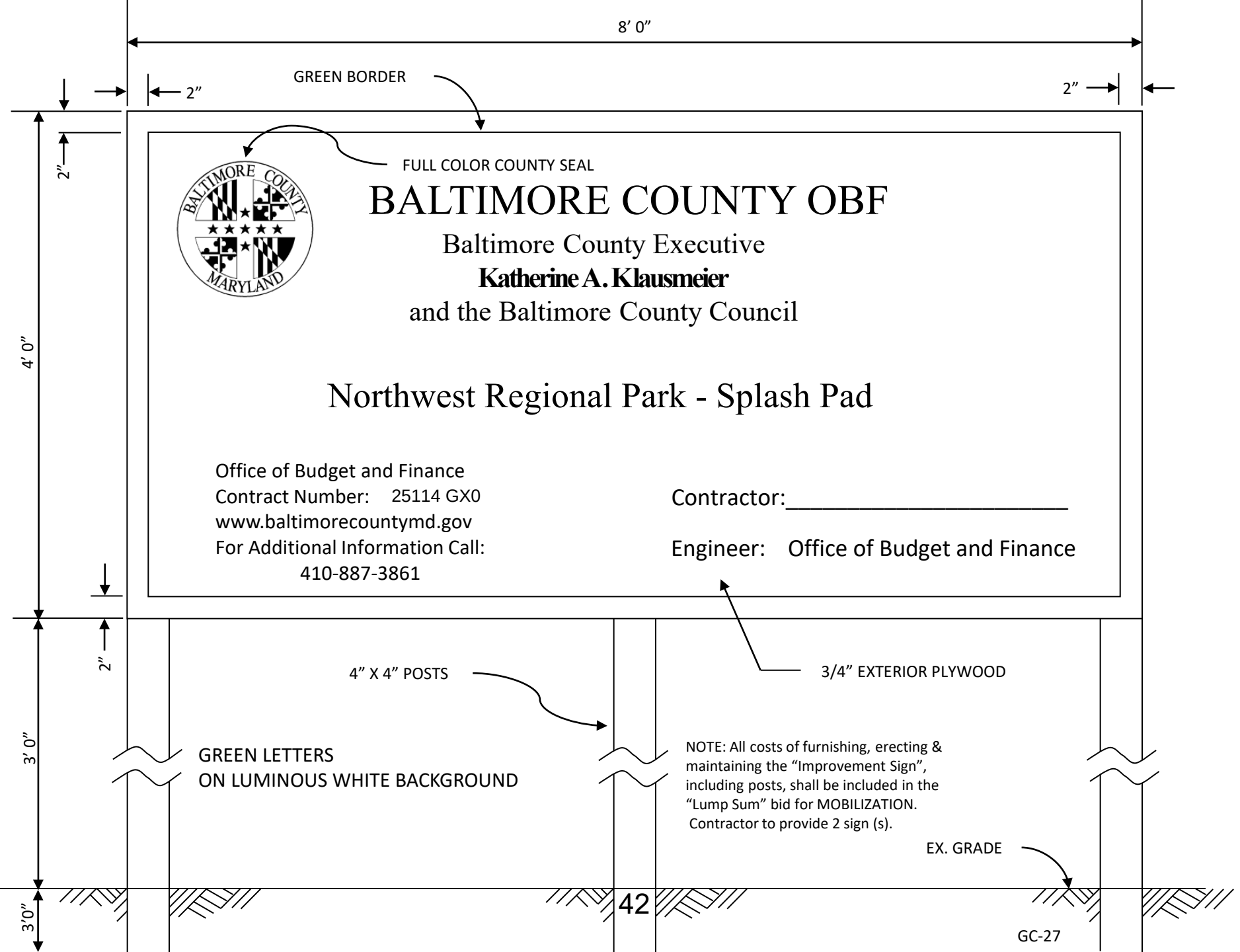
A. The Contractor shall erect and maintain upon the project site, and where directed by the Engineer, suitable offices for his/her own use and that of the Engineer.

B. A room of adequate size shall be provided and maintained in the Contractor's office to be used for "Progress Meetings," which frequently involve fifteen (15 or more persons). This space shall be so arranged that they can be held without interference with or from the other office or supervisory work. The room shall be 300 sq. ft. minimum and 10 ft. minimum width.

These offices shall be provided with adequate heating and lighting, all at the expense of the Contractor. In addition to the above requirements, air-conditioning will be required, the cost of which is to be included in the lump sum bid price. The system must be capable of maintaining a temperature of 80 degrees F dry bulb and approximately 50% relative humidity in the conditioned area when outside temperatures are 95 degrees F dry bulb and 78 degrees F wet bulb.

C. The Engineer's office shall meet or exceed all requirements for a Type 1 office in accordance with *Baltimore County's Standard Specifications for Construction and Materials,* Section 103 Engineer's Office.

The Contractor shall provide telephone and FAX service in the Office of the Engineer. The Contractor shall pay all costs of installation and all charges for local and Baltimore City calls, but will not be expected to pay for long distance calls made from the Engineer's Office.


8’ 0”
GREEN BORDER
2”
2”
2”
FULL COLOR COUNTY SEAL
BALTIMORE COUNTY OBF
Baltimore County Executive
Katherine A. Klausmeier
and the Baltimore County Council
Northwest Regional Park - Splash Pad
Office of Budget and Finance
Contract Number: 25114 GX0
www.baltimorecountymd.gov
For Additional Information Call:
410-887-3861
Contractor:_____
Engineer: Office of Budget and Finance
4’ 0”
2”
3/4” EXTERIOR PLYWOOD
4” X 4” POSTS
3’ 0”
GREEN LETTERS
ON LUMINOUS WHITE BACKGROUND
NOTE: All costs of furnishing, erecting & maintaining the “Improvement Sign”, including posts, shall be included in the “Lump Sum” bid for MOBILIZATION.
Contractor to provide 2 sign (s).
EX. GRADE
3’0”
42
GC-27

PROJECT MANUAL

FOR

NORTHWEST REGIONAL PARK – SPLASH PAD AND SUPPORTING FACILITIES

BALTIMORE COUNTY, MARYLAND

4515 Deer Park Road,
Owings Mills, Maryland 21117

Contract Number - 25114 GX0
Job Order Number - PROJ-10000634

BALTIMORE COUNTY OFFICE OF BUDGET & FINANCE – PROPERTY MANAGEMENT

100% CONSTRUCTION DOCUMENTS
July 18, 2025

A/E Design Team

Architect: **JP2 Architects**, Baltimore, MD.

Aquatic Engineer: **Cloward H2O**, Provo, UT.

Civil Engineer: **RK&K**, Baltimore, MD.

Landscape Architect: **Mahan Rykiel Associates**, Baltimore, MD.

Mechanical/Plumbing/Electrical Engineer: **CCJM**, Baltimore, MD.

Structural Engineer: **Columbia Engineering**, Columbia, MD.

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APPENDIX

A GEOTECHNICAL SUBSURFACE INVESTIGATION REPORT

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SECTION 011000

SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Project information.
2. Work covered by Contract Documents.
3. Owner-furnished/Owner-installed (OFOI) products.
4. Contractor's use of site and premises.
5. Work restrictions.
6. Specification and Drawing conventions.

B. Related Requirements:

1. Section 015000 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.3 DEFINITIONS

A. Work Package: A group of specifications, drawings, and schedules prepared by the design team to describe a portion of the Project Work for pricing, permitting, and construction.

1.4 PROJECT INFORMATION

A. Project Identification: Northwest Regional Park - Splash Pad and Supporting Facilities

B. Project Location: Owings Mills, MD

C. Project Number: 10010368

D. Owner:

1. Owner's Representative: Baltimore County Property Management – Matthew Leebel Property Management – Capital Unit Office of Budget & Finance 12200 Long Green Pike Glen Arm, MD 21057

E. Landscape Architect: Mahan Rykiel Associates

1. Landscape Architect's Representative: Mark Pelusi
3300 Clipper Mill Road
Suite 200
Baltimore
MD 21211

F. Landscape Architect's Consultants: Architect has retained the following design professionals, who have prepared designated portions of the Contract Documents:

1. JP2 Architects (Architects)

a. Jamie Pett, Principal, 410-646-8301, jpett@jp2architects.com

2. Cloward H2O (Aquatic Engineers)

a. Chris Bailey, Staff Engineer, 801-375-1223, cbailey@clowardh2o.com

3. Rummel, Klepper & Kahl; RK&K (Civil Engineers)

a. Matt Thomasson, Director, 410-462-9259, mthomasson@rkk.com

4. Rider Levett Bucknall; RLB (Cost Estimator)

a. Colin Sinclair, Cost Estimator, 410-740-1671, colin.sinclair@us.rlb.com

5. C.C. Johnson & Malhotra; CCJM (MEP)

a. Uday Patel, Vice President, 410-505-9145, upatel@ccjm.com

6. Columbia Engineering, Inc.; CEI (Structural Engineers)

a. Rodrigo Chacon, President, 410-992-9971, rchacon@columbiaengineering.com

1.5 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of Project is defined by the Contract Documents and includes, but is not limited to, the following:

B. The addition of an accessible splash feature and gender-neutral comfort station located adjacent to an existing parking lot and provides a complementary attraction to the existing Ravens playground. A new network of accessible concrete walks and flexi-

pave walks surrounding the splash feature and comfort station will connect to the existing circulation within the park. Gathering areas provided around the perimeter of the splash feature include picnic tables and shade structures to provide relief and protection from the sun. Other amenities within the fenced zone include a drinking fountain and shower/foot wash. Amenities outside of the fenced zone include bike racks and benches.

C. Type of contract:

1. Project will be constructed under a General Construction Contract.

D. Removal and disposal of materials:

1. Non-hazardous materials shall be removed in accordance with Specification Section 01 7419 – Construction and Demolition Waste Management and Disposal.
2. Asbestos containing materials and other hazardous materials have not been documented in a report as part of the contract documents. Any hazardous materials encountered shall be abated and treated as construction debris.

1.6 OWNER-FURNISHED/OWNER-INSTALLED (OFOI) PRODUCTS

A. The Owner will furnish and install products indicated as Not in Contract (NIC). All other fixtures and equipment documented in the drawings shall be provided by GC.

B. Owner-Furnished/Owner-Installed (OFOI) Products:

1. FF&E, new furnishings will be stored off-site and installed after U&O has been granted.

1.7 CONTRACTOR'S USE OF SITE AND PREMISES

A. Unrestricted Use of Site: Each Contractor shall have full use of Project site for construction operations during construction period. Contractor's use of Project site is limited only by Owner's right to perform work or to retain other contractors on portions of Project.

1. Driveways, Walkways and Entrances: Keep driveways, loading areas, and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or for storage of materials.

a. Schedule deliveries to minimize use of driveways and entrances by construction operations.
b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

B. Condition of Existing Grounds: Maintain portions of existing grounds, landscaping, and hardscaping affected by construction operations throughout construction period. Repair damage caused by construction operations.

1.8 WORK RESTRICTIONS – AS NOTED IN BID DOCUMENTS

1.9 SPECIFICATION AND DRAWING CONVENTIONS

A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.

C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:

1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
2. Abbreviations: Materials and products are identified by abbreviations scheduled on Drawings and published as part of the U.S. National CAD Standard.
3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011000

SECTION 012100

ALLOWANCES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements governing allowances.

B. Types of allowances include the following:

1. Lump-sum allowances.
2. Unit-cost allowances.
3. Quantity allowances.
4. Contingency allowances.

C. Related Requirements:

1. Section 012200 "Unit Prices" for procedures for using unit prices, including adjustment of quantity allowances when applicable.
2. Section 013300 “Submittal Procedures”

1.2 DEFINITIONS

A. Allowance: A quantity of work or dollar amount included in the Contract, established in lieu of additional requirements, used to defer selection of actual materials and equipment to a later date when direction will be provided to Contractor. If necessary, additional requirements will be issued by Change Order.

1.3 SELECTION AND PURCHASE

A. At the earliest practical date after award of the Contract, advise Architect of the date when final selection, or purchase and delivery, of each product or system described by an allowance must be completed by the Owner to avoid delaying the Work.

B. At Architect's request, obtain proposals for each allowance for use in making final selections. Include recommendations that are relevant to performing the Work.

C. Purchase products and systems selected by Architect from the designated supplier.

1.4 ACTION SUBMITTALS

A. Submit proposals for purchase of products or systems included in allowances in the

form specified for Change Orders.

1.5 INFORMATIONAL SUBMITTALS

A. Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.

B. Submit time sheets and other documentation to show labor time and cost for installation of allowance items that include installation as part of the allowance.

C. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

1.6 LUMP-SUM ALLOWANCES

A. Allowance shall include cost to Contractor of specific products and materials ordered by Owner or selected by Architect under allowance and shall include taxes, freight**,** and delivery to Project site.

B. Unless otherwise indicated, Contractor's costs for receiving and handling at Project site, labor, installation, overhead and profit, and similar costs related to products and materials ordered by Owner or selected by Architect under allowance shall be included as part of the Contract Sum and not part of the allowance.

C. Unused Materials: Return unused materials purchased under an allowance to manufacturer or supplier for credit to Owner, after installation has been completed and accepted.

1. If requested by Architect, retain and prepare unused material for storage by Owner. Deliver unused material to Owner's storage space as directed.

1.7 UNIT-COST ALLOWANCES

A. Allowance shall include cost to Contractor of specific products and materials ordered by Owner or selected by Architect under allowance and shall include taxes, freight**,** and delivery to Project site.

B. Unless otherwise indicated, Contractor's costs for receiving and handling at Project site, labor, installation, overhead and profit, and similar costs related to products and materials ordered by Owner or selected by Architect under allowance shall be included as part of the Contract Sum and not part of the allowance.

C. Unused Materials: Return unused materials purchased under an allowance to manufacturer or supplier for credit to Owner, after installation has been completed and accepted.

1. If requested by Architect, retain and prepare unused material for storage by Owner. Deliver unused material to Owner's storage space as directed.

1.8 QUANTITY ALLOWANCES

A. Allowance shall include cost to Contractor of specific products and materials ordered by Owner or selected by Architect under allowance and shall include taxes**,** freight, and delivery to Project site.

B. Unless otherwise indicated, Contractor's costs for receiving and handling at Project site, labor, installation, overhead and profit, and similar costs related to products and materials ordered by Owner or selected by Architect under allowance shall be included as part of the Contract Sum and not part of the allowance.

C. Unused Materials: Return unused materials purchased under an allowance to manufacturer or supplier for credit to Owner, after installation has been completed and accepted.

1. If requested by Architect, retain and prepare unused material for storage by Owner. Deliver unused material to Owner's storage space as directed.

1.9 CONTINGENCY ALLOWANCES

A. Use the contingency allowance only as directed by Architect for Owner's purposes and only by Change Orders that indicate amounts to be charged to the allowance.

B. Contractor's overhead, profit, and related costs for products and equipment ordered by Owner under the contingency allowance are included in the allowance and are not part of the Contract Sum. These costs include delivery, installation, taxes, insurance, equipment rental, and similar costs.

C. Change Orders authorizing use of funds from the contingency allowance will include Contractor's related costs and reasonable overhead and profit.

D. At Project closeout, credit unused amounts remaining in the contingency allowance to Owner by Change Order.

1.10 ADJUSTMENT OF ALLOWANCES

A. Allowance Adjustment: To adjust allowance amounts, prepare a Change Order proposal based on the difference between purchase amount and the allowance, multiplied by final measurement of work-in-place where applicable. If applicable, include reasonable allowances for cutting losses, tolerances, mixing wastes, normal product imperfections, required maintenance materials, and similar margins.

1. Include installation costs in purchase amount only where indicated as part of the

allowance.

2. If requested, prepare explanation and documentation to substantiate distribution of overhead costs and other markups.
3. Submit substantiation of a change in scope of Work, if any, claimed in Change Orders related to unit-cost allowances.
4. Owner reserves the right to establish the quantity of work-in-place by independent quantity survey, measure, or count.

B. Submit claims for increased costs due to a change in the scope or nature of the allowance described in the Contract Documents, whether for the purchase order amount or Contractor's handling, labor, installation, overhead, and profit.

1. Do not include Contractor's or subcontractor's indirect expense in the Change Order cost amount unless it is clearly shown that the nature or extent of Work has changed from what could have been foreseen from information in the Contract Documents.
2. No change to Contractor's indirect expense is permitted for selection of higher- or lower-priced materials or systems of the same scope and nature as originally indicated.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

3.2 PREPARATION

A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

3.3 SCHEDULE OF ALLOWANCES

A. Allowance No. 1: Quantity Allowance: Include 145 cu. yd. of unsatisfactory soil excavation and disposal off-site and replacement with satisfactory soil material from off-site, as specified in Section 312000 "Earth Moving." Refer to Spec Appendix A – Geotechnical Investigation Report – Northwest Regional Park for geotechnical report.

1. Coordinate quantity allowance adjustment with unit-price requirements in Section 012200 "Unit Prices."

B. Allowance No. 2: Quantity Allowance: Include 55 cu. yd. of trench rock removal and replacement with satisfactory soil material, as specified in Section 312000 "Earth Moving." Refer to Spec Appendix A – Geotechnical Investigation Report – Northwest Regional Park for geotechnical report.

1. Coordinate quantity allowance adjustment with unit-price requirements in Section 012200 "Unit Prices."

END OF SECTION 012100

SECTION 012200

UNIT PRICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for unit prices.

B. Related Requirements:

1. Section 012100 "Allowances" for procedures for using unit prices to adjust quantity allowances.
2. Section 012600 "Contract Modification Procedures" for procedures for submitting and handling Change Orders.

1.2 DEFINITIONS

A. Unit price is an amount incorporated into the Agreement, applicable during the duration of the Work as a price per unit of measurement for materials, equipment, or services, or a portion of the Work, added to or deducted from the Contract Sum by appropriate modification, if the scope of Work or estimated quantities of Work required by the Contract Documents are increased or decreased.

1.3 PROCEDURES

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

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

C. List of Unit Prices: A schedule of unit prices is included in Part 3. Specification Sections referenced in the Part 3 "Schedule of Unit Prices" Article contain requirements for materials described under each unit price.

PART 2 - PRODUCTS (Not Used)
PART 3 - EXECUTION

3.1 SCHEDULE OF UNIT PRICES

A. Unit Price No. 1: Removal of unsatisfactory soil and replacement with satisfactory soil material.

1. Description: Unsatisfactory soil excavation and disposal off-site and replacement with satisfactory fill material or engineered fill from off-site, as required, in accordance with Section 312000 "Earth Moving."
2. Unit of Measurement: cubic yard of soil excavated, based on in-place surveys of volume before and after removal.
3. Quantity Allowance: Coordinate unit price with allowance adjustment requirements in Section 012100 "Allowances."

B. Unit Price No. 2: Provide unit cost per cubic yard (cu. yd.) of Class III soil excavation and disposal off-site and replacement with materials from contract export, as specified in Section 31 20 00"Earth Moving" and Section 31 23 00 “Excavating and Filling. “

C. Unit Price No. 3: Provide unit cost per cubic yard (cu. yd.) of Class III soil excavation and disposal off-site and replacement with select backfill material from off-site, as specified in Section 31 2000 "Earth Moving" and Section 31 23 00 “Excavating and Filling.”

END OF SECTION 012200

SECTION 012300

ALTERNATES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for alternates.

1.2 DEFINITIONS

A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the bidding requirements that may be added to or deducted from the base bid amount if the Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.

1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternates into the Work. No other adjustments are made to the Contract Sum.

1.3 PROCEDURES

A. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.

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

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

C. Schedule: A Part 3 "Schedule of Alternates" Article is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 - PRODUCTS (Not Used)
PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

A. Add Alternate No. 1: Provide P2 Integral color concrete in four (4) locations within the fence line at the north, south, east, and west perimeter seating areas as illustrated on sheet L1.01, 'Landscape – Materials Plan – Splash Pad, and outlined in specification 32 13 16 'Decorative Concrete Paving' in lieu of standard P1 concrete paving.

B. Add Alternate No. 2: Provide seven (7) Picnic Table Type 1 (PT1) as illustrated on sheet L1.01, 'Landscape – Materials Plan – Splash Pad,' and outlined in specification 32 33 00 'Site Furnishings.'

C. Add Alternate No. 3: Provide ten (10) Picnic Table Type 2 (PT2) as illustrated on sheet L1.01, 'Landscape – Materials Plan – Splash Pad,' and outlined in specification 32 33 00 'Site Furnishings.'

D. Add Alternate No. 4: Provide seven (7) Umbrellas (U) as illustrated on sheet L1.01, 'Landscape – Materials Plan – Splash Pad,' and outlined in specification 32 33 00 'Site Furnishings.'

E. Add Alternate No. 5: Provide five (5) Shade Structures (SS) as illustrated on sheet L1.01, 'Landscape – Materials Plan – Splash Pad,' and outlined in specification 32 33 00 'Site Furnishings.'

F. Add Alternate No. 6: Provide Life Floor in color pattern defined in detail 5, sheet L5.03, 'Landscape – Hardscape Details,' and outlined in Specification 32 33 00 'Site Furnishings.'

G. Add Alternate No. 7: Provide water heater detailed and defined on Sheet W4-1.01 and W4-1.20 with flow meter and temperature indicators to the mechanical equipment within the mechanical room.

H. Add Alternate No. 8: Provide evergreen, ornamental, and shade trees as illustrated on sheet L7.01 'Landscape – Planting Plan – Splash Pad' and as defined in Add Alternate #8 – Splash Pad Schedule on sheet L7.10.

Provide additional soil depths as illustrated on sheet L6.01, 'Landscape – Soils Plan – Splash Pad' in lieu of 4" for lawn.

Provide additional mulch for plant material per planting details on sheet L8.01 'Landscape Planting Details.'

Provide credit for seed in lieu of additional planting.

I. Add Alternate No. 9: Provide evergreen, ornamental, and shade trees as illustrated on sheet L7.02 'Landscape – Planting Plan – Comfort Station' and as defined in Add Alternate #9 – Comfort Station Schedule on sheet L7.10.

Provide additional soil depths as illustrated on sheet L6.02, 'Landscape – Soils Plan – Comfort Station' in lieu of 4" for lawn.

Provide additional mulch for plant material per planting details on sheet L8.01 'Landscape Planting Details.'

Provide credit for seed in lieu of additional planting.

J. Add Alternate No. 10: Provide shrubs, perennials, groundcover, and ornamental grasses as illustrated on sheet L7.01 'Landscape – Planting Plan – Splash Pad' and as defined in Add Alternate #10 - Splash Pad Plant Schedule on Sheet L7.10.

Provide additional soil depths as illustrated on Sheet L6.01, 'Landscape – Soils Plan – Splash Pad' in lieu of 4" for lawn.

Provide additional mulch for plant material per planting details on Sheet L8.01 'Landscape Planting Details.'

Provide credit for seed in lieu of additional planting.

K. Add Alternate No. 11: Provide shrubs, perennials, groundcover, and ornamental grasses as illustrated on sheet L7.02 'Landscape – Planting Plan – Comfort Station' and as defined in Add Alternate #11 – Comfort Station Plant Schedule on Sheet L7.10.

Provide additional soil depths as illustrated on Sheet L6.02, 'Landscape – Soils Plan – Comfort Station' in lieu of 4" for lawn.

Provide additional mulch for plant material per planting details on Sheet L8.01 'Landscape Planting Details.'

Provide credit for seed in lieu of additional planting.

END OF SECTION 012300

SECTION 012500

SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for substitutions after award of contract.

B. Related Requirements:

1. Section 012100 "Allowances" for products selected under an allowance.
2. Section 012300 "Alternates" for products selected under an alternate.
3. Section 016000 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.

1.2 DEFINITIONS

A. Substitutions: Products considered to be able to perform the same function but not necessarily have the same design, arrangement, details, utility requirements and/or dimensions. Changes in products, materials, and equipment required by the Contract Documents proposed by the Contractor after award of the Contract are considered to be requests for substitutions. The following are not considered to be requests for substitutions:

1. Revisions to the Contract Documents requested by the Owner or Architect.
2. Specified options of products or “approved equals” as permitted and included in the Contract Documents.
3. The Contractor's determination of and compliance with governing regulations and orders issued by governing authorities.

B. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.

C. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required to meet other Project requirements but may offer advantage to Contractor or Owner.

1.3 ACTION SUBMITTALS

A. General: No substitution requests will be considered from manufacturer’s

representatives or product vendors unless submitted through the Contractor. No substitution requests will be considered during the bid period. Bids shall be based on products from one of the manufacturers specified or an “or equal” product.

B. Substitution Requests: Submit documentation identifying product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Substitution Request Form: Use form that is part of web-based Project management software or acceptable to Architect.
2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:

    a. Statement indicating why specified product or fabrication or installation method cannot be provided, if applicable.
    b. Coordination of information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.
    c. Detailed comparison of significant qualities of proposed substitutions with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes, such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
    d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
    e. Samples, where applicable or requested.
    f. Certificates and qualification data, where applicable or requested.
    g. List of similar installations for completed projects, with project names and addresses as well as names and addresses of architects and owners.
    h. Material test reports from a qualified testing agency, indicating and interpreting test results for compliance with requirements indicated.
    i. Detailed comparison of Contractor's construction schedule using proposed substitutions with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
    j. Cost information, including a proposal of change, if any, in the Contract Sum.
    k. Contractor's certification that proposed substitution complies with requirements in the Contract Documents, except as indicated in substitution request, is compatible with related materials and is appropriate for applications indicated.
    l. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven days of receipt of a request for substitution. Architect will notify Contractor through Construction Manager of acceptance or rejection of proposed substitution within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.

    a. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

1.4 QUALITY ASSURANCE

A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

1.5 PROCEDURES

A. Coordination: Revise or adjust affected work as necessary to integrate work of the approved substitutions.

1.6 SUBSTITUTIONS

A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 15 days prior to time required for preparation and review of related submittals.

1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:

    a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
    b. Substitution request is fully documented and properly submitted.
    c. Requested substitution will not adversely affect Contractor's construction schedule.
    d. Requested substitution has received necessary approvals of authorities having jurisdiction.
    e. Requested substitution is compatible with other portions of the Work.
    f. Requested substitution has been coordinated with other portions of the Work.
    g. Requested substitution provides specified warranty.
    h. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is

acceptable to all contractors involved.

B. Substitutions for Convenience:

1. Architect will consider requests for substitution if received within 60 days after the Notice of Award. Requests received after that time may be considered or rejected at discretion of Architect.

a. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:

1) Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
2) Requested substitution does not require extensive revisions to the Contract Documents.
3) Requested substitution is consistent with the Contract Documents and will produce indicated results.
4) Substitution request is fully documented and properly submitted.
5) Requested substitution will not adversely affect Contractor's construction schedule.
6) Requested substitution has received necessary approvals of authorities having jurisdiction.
7) Requested substitution is compatible with other portions of the Work.
8) Requested substitution has been coordinated with other portions of the Work.
9) Requested substitution provides specified warranty.
10) If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

PART 2 - PRODUCTS (Not Used)
PART 3 - EXECUTION (Not Used)

END OF SECTION 012500

SECTION 012600

CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for handling and processing Contract modifications.

B. Related Requirements:

1. Section 012500 "Substitution Procedures" for administrative procedures for handling requests for substitutions made after the Contract award.
2. Section 013100 "Project Management and Coordination" for requirements for forms for contract modifications provided as part of web-based Project management software.

1.2 MINOR CHANGES IN THE WORK

A. Architect will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time.

1.3 PROPOSAL REQUESTS

A. Owner-Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.

1. Work Change Proposal Requests issued by the Architect are not instructions either to stop work in progress or to execute the proposed change.
2. Within 7 days after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.

a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
c. Include costs of labor and supervision directly attributable to the change.
d. Include an updated Contractor's construction schedule that indicates the

effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.

B. Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Architect.

1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
4. Include costs of labor and supervision directly attributable to the change.
5. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
6. Comply with requirements in Section 012500 "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.

1.4 CHANGE ORDER PROCEDURES

A. On Owner's approval of a Work Change Proposal Request, contractor will issue a Change Order for signatures of Owner and Contractor.

1.5 CONSTRUCTION CHANGE DIRECTIVE

A. Construction Change Directive: Architect may issue a Construction Change Directive on form provided as part of web-based Project management software. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.

1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.

B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.

1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS (Not Used)
PART 3 - EXECUTION (Not Used)

END OF SECTION 012600

SECTION 012900

PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.

B. Related Requirements:

1. Section 012100 "Allowances" for procedural requirements governing the handling and processing of allowances.
2. Section 012200 "Unit Prices" for administrative requirements governing the use of unit prices.
3. Section 012600 "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
4. Section 013200 "Construction Progress Documentation" for administrative requirements governing the preparation and submittal of the Contractor's construction schedule.

1.2 DEFINITIONS

A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

1.3 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule. Cost-loaded Critical Path Method Schedule may serve to satisfy requirements for the schedule of values.

1. Coordinate line items in the schedule of values with items required to be indicated as separate activities in Contractor's construction schedule.
2. Submit the schedule of values to Architect through Construction Manager at earliest possible date, but no later than five days after the notice to proceed.

B. Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.

1. Identification: Include the following Project identification on the schedule of values:

    a. Project name and location.
    b. Owner's name.
    c. Owner's Project number.
    d. Name of Architect.
    e. Architect's Project number.
    f. Contractor's name and address.
    g. Date of submittal.

2. Arrange the schedule of values in tabular form, with separate columns to indicate the following for each item listed:

    a. Related Specification Section or division.
    b. Description of the Work.
    c. Name of subcontractor.
    d. Name of manufacturer or fabricator.
    e. Name of supplier.
    f. Change Orders (numbers) that affect value.
    g. Dollar value of the following, as a percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent. Round dollar amounts to whole dollars, with total equal to Contract Sum.

        1) Labor.
        2) Materials.
        3) Equipment.

3. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Provide multiple line items for principal subcontract amounts in excess of five percent of the Contract Sum.
4. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.

    a. Differentiate between items stored on-site and items stored off-site.

5. Temporary Facilities: Show cost of temporary facilities and other major cost items that are not direct cost of actual work-in-place as separate line items.
6. Closeout Costs. Include separate line items under Contractor and principal subcontracts for Project closeout requirements in an amount totaling five percent of the Contract Sum and subcontract amount.
7. Schedule of Values Revisions: Revise the schedule of values when Change Orders or Construction Change Directives result in a change in the Contract Sum. Include at least one separate line item for each Change Order and Construction Change Directive.

1.4 APPLICATIONS FOR PAYMENT

A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments, as certified by Architect and Construction Manager and paid for by Owner.

B. Payment Application Times: Submit Application for Payment to Architect by the 25th day of the month. The period covered by each Application for Payment is one month, ending on the last day of the month.

1. Submit draft copy of Application for Payment seven days prior to due date for review by Architect.

C. Application for Payment Forms: Use AIA Document G702 and AIA Document G703 as form for Applications for Payment.

1. Other Application for Payment forms proposed by the Contractor may be acceptable to Architect and Owner. Submit forms for approval with initial submittal of schedule of values.

D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Construction Manager will return incomplete applications without action.

1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.

E. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.

1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment for stored materials.
2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
3. Provide summary documentation for stored materials indicating the following:

    a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
    b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
    c. Value of materials stored since date of previous Application for Payment

and remaining stored as of date of current Application for Payment.

F. Transmittal: Submit three signed and notarized original copies of each Application for Payment to Construction Manager by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.

1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.

G. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from entities lawfully entitled to file a mechanic's lien arising out of the Contract and related to the Work covered by the payment, subcontractors, sub-subcontractors, and suppliers for construction period covered by the previous application.

1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
2. When an application shows completion of an item, submit conditional final or full waivers.
3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
4. Submit final Application for Payment with or preceded by conditional final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
5. Waiver Forms: Submit executed waivers of lien on forms acceptable to Owner.

H. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:

1. List of subcontractors.
2. Schedule of values.
3. Contractor's construction schedule (preliminary if not final).
4. Products list (preliminary if not final).
5. Sustainable design action plans, including preliminary project materials cost data.
6. Submittal schedule (preliminary if not final).
7. List of Contractor's staff assignments.
8. List of Contractor's principal consultants.
9. Copies of building permits.
10. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
11. Initial progress report.
12. Report of preconstruction conference.

I. Application for Payment at Substantial Completion: After Architect issues the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.

1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.

a. Complete administrative actions, submittals, and Work preceding this application, as described in Section 017700 "Closeout Procedures."

2. This application shall reflect Certificate(s) of Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
3. Administrative actions and/or submittals that shall precede or coincide with this application include:
   a. Occupancy permits and similar approvals.
   b. Warranties (guarantees) and maintenance agreements.
   c. Test/adjust/balance records.
   d. Maintenance instructions.
   e. Startup performance reports.
   f. Changeover information related to Owner's occupancy, use, operation, and maintenance.
   g. Final cleaning.
   h. Application for reduction of retainage and consent of surety.
   i. Advice on shifting insurance coverages.
4. j. List of incomplete Work, recognized as exceptions to Architect's Certificate of Substantial Completion.

J. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:

1. Evidence of completion of Project closeout requirements.
2. Certification of completion of final punch list items.
3. Completion of any commissioning items.
4. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
5. Updated final statement, accounting for final changes to the Contract Sum.
6. AIA Document G706.
7. AIA Document G706A.
8. AIA Document G707.
9. Evidence that claims have been settled.
10. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
11. Final liquidated damages settlement statement.
12. Proof that taxes, fees, and similar obligations are paid.
13. Waivers and releases.

PART 2 - PRODUCTS (Not Used)
PART 3 - EXECUTION (Not Used)

END OF SECTION 012900

SECTION 013100

PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative provisions for coordinating construction operations on Project, including, but not limited to, the following:

1. General coordination procedures.
2. Coordination drawings.
3. RFIs.
4. Digital project management procedures.
5. Web-based Project management software package.
6. Project meetings.

B. Related Requirements:

1. Section 013200 "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
2. Section 017300 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
3. Section 017700 "Closeout Procedures" for coordinating closeout of the Contract.
4. Section 019113 "General Commissioning Requirements" for coordinating the Work with Owner's Commissioning Authority.

1.2 DEFINITIONS

A. BIM: Building Information Modeling.

B. RFI: Request for Information. Request from Owner, Construction Manager, Architect, or Contractor seeking information required by or clarifications of the Contract Documents.

1.3 INFORMATIONAL SUBMITTALS

A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:

1. Name, address, telephone number, and email address of entity performing

subcontract or supplying products.
2. Number and title of related Specification Section(s) covered by subcontract.
3. Drawing number and detail references, as appropriate, covered by subcontract.

B. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses, cellular telephone numbers, and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.

1. Post copies of list in Project meeting room, in temporary field office, in web-based Project software directory, and in prominent location in each built facility. Keep list current at all times.

1.4 GENERAL COORDINATION PROCEDURES

A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations included in different Sections that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in sequence required to obtain the best results, where installation of one part of the Work depends on installation of other components, before or after its own installation.
2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.

B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.

1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.

C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and scheduled activities of other contractors and direction of Project coordinator to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

1. Preparation of Contractor's construction schedule.
2. Preparation of the schedule of values.
3. Installation and removal of temporary facilities and controls.
4. Delivery and processing of submittals.
5. Progress meetings.
6. Preinstallation conferences.

7. Project closeout activities.
8. Startup and adjustment of systems.

1.5 COORDINATION DRAWINGS

A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely indicated on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.

1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:

    a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
    b. Coordinate the addition of trade-specific information to coordination drawings by multiple contractors in a sequence that best provides for coordination of the information and resolution of conflicts between installed components before submitting for review.
    c. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
    d. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
    e. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
    f. Indicate required installation sequences.
    g. Indicate dimensions shown on Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternative sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

B. Coordination Drawing Organization: Organize coordination drawings as follows:

1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings where required to adequately represent the Work.
2. Plenum Space: Indicate subframing for support of ceiling, and wall systems, mechanical and electrical equipment, and related Work. Locate components within plenums to accommodate layout of light fixtures and other components indicated on Drawings. Indicate areas of conflict between light fixtures and other components.
3. Mechanical Rooms: Provide coordination drawings for mechanical rooms,

showing plans and elevations of mechanical, plumbing, fire-protection, fire-alarm, and electrical equipment.

4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
5. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.
6. Mechanical and Plumbing Work: Show the following:

    a. Sizes and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, and support systems.
    b. Dimensions of major components, such as dampers, valves, diffusers, access doors, cleanouts and electrical distribution equipment.
    c. Fire-rated enclosures around ductwork.

7. Electrical Work: Show the following:

    a. Runs of vertical and horizontal conduit 1-1/4 inches in diameter and larger.
    b. Light fixture, exit light, emergency battery pack, smoke detector, and other fire-alarm locations.
    c. Panel board, switchboard, switchgear, transformer, busway, generator, and motor-control center locations.
    d. Location of pull boxes and junction boxes, dimensioned from column center lines.

8. Review: Architect will review coordination drawings to confirm that, in general, the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If Architect determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, Architect will so inform Contractor, who shall make suitable modifications and resubmit.

C. Coordination Drawing Process: Prepare coordination drawings in the following manner:

1. Schedule submittal and review of Fire Sprinkler, Plumbing, HVAC, and Electrical Shop Drawings to make required changes prior to preparation of coordination drawings.
2. Commence routing of coordination drawing files with HVAC Installer, who will provide drawing plan files denoting approved ductwork. HVAC Installer will locate ductwork and piping on a single layer, using orange color. Forward drawings to Plumbing Installer.
3. Plumbing Installer will locate plumbing and equipment on a single layer, using blue color.
4. Fire Sprinkler Installer will locate piping and equipment, using red color. Fire Sprinkler Installer shall forward drawing files to Electrical Installer.
5. Electrical Installer will indicate service and feeder conduit runs and equipment in green color. Electrical Installer shall forward drawing files to Communications and Electronic Safety and Security Installer.

6. Communications and Electronic Safety and Security Installer will indicate cable trays and cabling runs and equipment in purple color. Communications and Electronic Safety and Security Installer shall forward completed drawing files to Contractor.
7. Contractor shall perform the final coordination review. As each coordination drawing is completed, Contractor will meet with Architect to review and resolve conflicts on the coordination drawings.

D. Coordination Digital Data Files: Prepare coordination digital data files according to the following requirements:

1. File Preparation Format: AutoCAD

    a. Same digital data software program, version, and operating system as original Drawings.
    b. DWG, current Version, operating in Microsoft Windows operating system.

2. File Submittal Format: Submit or post coordination drawing files using AutoCAD and PDF format.
3. BIM File Incorporation: Develop and incorporate coordination drawing files into BIM established for Project.

    a. Perform three-dimensional component conflict analysis as part of preparation of coordination drawings. Resolve component conflicts prior to submittal. Indicate where conflict resolution requires modification of design requirements by Architect.

4. Architect will furnish Contractor one set of digital data files of Drawings for use in preparing coordination digital data files.

    a. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Drawings.
    b. Digital Data Software Program: Drawings are available in AutoCAD.
    c. Contractor shall execute a data licensing agreement in the form of Agreement form acceptable to Owner and Architect.

1.6 REQUEST FOR INFORMATION (RFI)

A. General: Immediately on discovery of the need for additional information, clarification, or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.

1. Architect will return without response those RFIs submitted to Architect by other entities controlled by Contractor.
2. Coordinate and submit RFIs in a prompt manner to avoid delays in Contractor's work or work of subcontractors.

B. Content of the RFI: Include a detailed, legible description of item needing information

or interpretation and the following:

1. Project name.
2. Owner name.
3. Owner's Project number.
4. Name of Architect and Construction Manager
5. Architect's Project number.
6. Date.
7. Name of Contractor.
8. RFI number, numbered sequentially.
9. RFI subject.
10. Specification Section number and title and related paragraphs, as appropriate.
11. Drawing number and detail references, as appropriate.
12. Field dimensions and conditions, as appropriate.
13. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
14. Contractor's signature.
15. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.

    a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.

C. RFI Forms: AIA Document G716 - Software-generated form with substantially the same content as indicated above, acceptable to Architect.

    1. Attachments shall be electronic files in PDF format.

D. Architect's and Construction Manager's Action: Architect and Construction Manager will review each RFI, determine action required, and respond. Allow seven days for Architect's response for each RFI. RFIs received by Architect or Construction Manager after 1:00 p.m. will be considered as received the following working day.

    1. The following Contractor-generated RFIs will be returned without action:

        a. Requests for approval of submittals.
        b. Requests for approval of substitutions.
        c. Requests for approval of Contractor's means and methods.
        d. Requests for coordination information already indicated in the Contract Documents.
        e. Requests for adjustments in the Contract Time or the Contract Sum.
        f. Requests for interpretation of Architect's actions on submittals.
        g. Incomplete RFIs or inaccurately prepared RFIs.

    2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt by Architect or Construction Manager of additional information.
    3. Architect's action on RFIs that may result in a change to the Contract Time or the

Contract Sum may be eligible for Contractor to submit Change Proposal according to Section 012600 "Contract Modification Procedures."

a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect and Construction Manager in writing within 5 days of receipt of the RFI response.

E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Use software log that is part of web-based Project management software.

1. Project name.
2. Name and address of Contractor.
3. Name and address of Architect and Construction Manager.
4. RFI number, including RFIs that were returned without action or withdrawn.
5. RFI description.
6. Date the RFI was submitted.
7. Date Architect's and Construction Manager's response was received.
8. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.

F. On receipt of Architect's and Construction Manager's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect and Construction Manager within seven days if Contractor disagrees with response.

1.7 DIGITAL PROJECT MANAGEMENT PROCEDURES

A. Use of Architect's Digital Data Files: Digital data files of Architect's BIM model and/or CAD drawings will be provided by Architect for Contractor's use during construction.

1. Digital data files may be used by Contractor in preparing coordination drawings, Shop Drawings, and Project Record Drawings.
2. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Contract Drawings.
3. Digital Drawing Software Program: Contract Drawings are available in AutoCAD.
4. Contractor shall execute a data licensing agreement in the form of Agreement form acceptable to Owner and Architect.

a. Subcontractors and other parties granted access by Contractor to Architect's digital data files shall execute a data licensing agreement in the form of Agreement acceptable to Owner and Architect.

B. Submittals and all other CA related documents to be conveyed via County’s FTP site and/or via email.

1. At completion of Project, provide digital archive in format that is readable by common desktop software applications in format acceptable to Architect. Provide

data in locked format to prevent further changes.

C. PDF Document Preparation: Where PDFs are required to be submitted to Architect, prepare as follows:

1. Assemble complete submittal package into a single indexed file, incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
2. Name file with submittal number or other unique identifier, including revision identifier.
3. Certifications: Where digitally submitted certificates and certifications are required, provide a digital signature with digital certificate on where indicated.

1.8 PROJECT MEETINGS

A. General: Schedule and conduct meetings and conferences at Project site unless otherwise indicated.

1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times a minimum of seven days prior to meeting.
2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner, Construction Manager, and Architect, within three days of the meeting.

B. Preconstruction Conference: Schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement.

1. Attendees: Authorized representatives of Owner, Construction Manager, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Discuss items of significance that could affect progress, including the following:

a. Responsibilities and personnel assignments.
b. Tentative construction schedule.
c. Phasing.
d. Critical work sequencing and long lead items.
e. Designation of key personnel and their duties.
f. Lines of communications.
g. Use of web-based Project software.

h. Procedures for processing field decisions and Change Orders.
i. Procedures for RFIs.
j. Procedures for testing and inspecting.
k. Procedures for processing Applications for Payment.
l. Distribution of the Contract Documents.
m. Submittal procedures.
n. Sustainable design requirements.
o. Preparation of Record Documents.
p. Use of the premises
q. Work restrictions.
r. Working hours.
s. Owner's occupancy requirements.
t. Responsibility for temporary facilities and controls.
u. Procedures for moisture and mold control.
v. Procedures for disruptions and shutdowns.
w. Construction waste management and recycling.
x. Parking availability.
y. Office, work, and storage areas.
z. Equipment deliveries and priorities.
aa. First aid.
bb. Security.
cc. Progress cleaning.

3. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.

C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity when required by other Sections and when required for coordination with other construction.

1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect, Construction Manager of scheduled meeting dates.
2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:

a. Contract Documents.
b. Options.
c. Related RFIs.
d. Related Change Orders.
e. Purchases.
f. Deliveries.
g. Submittals.
h. Sustainable design requirements.
i. Review of mockups.
j. Possible conflicts.
k. Compatibility requirements.
l. Time schedules.

m. Weather limitations.
n. Manufacturer's written instructions.
o. Warranty requirements.
p. Compatibility of materials.
q. Acceptability of substrates.
r. Temporary facilities and controls.
s. Space and access limitations.
t. Regulations of authorities having jurisdiction.
u. Testing and inspecting requirements.
v. Installation procedures.
w. Coordination with other work.
x. Required performance results.
y. Protection of adjacent work.
z. Protection of construction and personnel.

3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

D. Project Closeout Conference: Schedule and conduct a project closeout conference, at a time convenient to Owner and Architect, but no later than 90 days prior to the scheduled date of Substantial Completion.

1. Conduct the conference to review requirements and responsibilities related to Project closeout.
2. Attendees: Authorized representatives of Owner, Construction Manager, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:

a. Preparation of Record Documents.
b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
c. Procedures for completing and archiving web-based Project software site data files.
d. Submittal of written warranties.
e. Requirements for completing sustainable design documentation.
f. Requirements for preparing operations and maintenance data.
g. Requirements for delivery of material samples, attic stock, and spare parts.
h. Requirements for demonstration and training.
i. Preparation of Contractor's punch list.
j. Procedures for processing Applications for Payment at Substantial

Completion and for final payment.
k. Submittal procedures.
l. Owner's partial occupancy requirements.
m. Installation of Owner's furniture, fixtures, and equipment.
n. Responsibility for removing temporary facilities and controls.

4. Minutes: Entity conducting meeting will record and distribute meeting minutes.

E. Progress Meetings: Conduct progress meetings at weekly intervals.

1. Attendees: In addition to representatives of Owner, Construction Manager, and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

1) Review schedule for next period.

b. Review present and future needs of each entity present, including the following:

1) Interface requirements.
2) Sequence of operations.
3) Resolution of BIM component conflicts.
4) Status of submittals.
5) Status of sustainable design documentation.
6) Deliveries.
7) Off-site fabrication.
8) Access.
9) Site use.
10) Temporary facilities and controls.
11) Progress cleaning.
12) Quality and work standards.
13) Status of correction of deficient items.
14) Field observations.
15) Status of RFIs.
16) Status of Proposal Requests.

17) Pending changes.
18) Status of Change Orders.
19) Pending claims and disputes.
20) Documentation of information for payment requests.

3. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.

   a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting, where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

4. Agenda: Review and correct or approve minutes of the previous coordination meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

PART 2 - PRODUCTS (Not Used)
PART 3 - EXECUTION (Not Used)

END OF SECTION 013100

SECTION 013200

CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:

1. Startup construction schedule.
2. Contractor's Construction Schedule.
3. Construction schedule updating reports.
4. Daily construction reports.
5. Material location reports.
6. Site condition reports.
7. Unusual event reports.

B. Related Requirements:

1. Section 012900 "Payment Procedures" for schedule of values and requirements for use of cost-loaded schedule for Applications for Payment.
2. Section 014000 "Quality Requirements" for schedule of tests and inspections.

1.2 DEFINITIONS

A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction Project. Activities included in a construction schedule consume time and resources.

1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
2. Predecessor Activity: An activity that precedes another activity in the network.
3. Successor Activity: An activity that follows another activity in the network.

B. Cost Loading: The allocation of the schedule of values for completing an activity as scheduled. The sum of costs for all activities must equal the total Contract Sum.

C. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine the critical path of Project and when activities can be performed.

D. Critical Path: The longest connected chain of interdependent activities through the

network schedule that establishes the minimum overall Project duration and contains no float.

E. Event: The starting or ending point of an activity.

F. Float: The measure of leeway in starting and completing an activity.

1. Float time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.
2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.

G. Resource Loading: The allocation of labor and equipment necessary for completing an activity as scheduled.

1.3 INFORMATIONAL SUBMITTALS

A. Format for Submittals: Submit required submittals in the following format:

1. Working electronic copy of schedule file.
2. PDF file.

B. Startup construction schedule.

1. Submittal of cost-loaded startup construction schedule will not constitute approval of schedule of values for cost-loaded activities.

C. Startup Network Diagram: Of size required to display entire network for entire construction period. Show logic ties for activities.

D. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.

1. Submit a working digital copy of schedule, using software indicated, and labeled to comply with requirements for submittals.

E. CPM Reports: Concurrent with CPM schedule, submit each of the following reports. Format for each activity in reports to contain activity number, activity description, cost and resource loading, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float in calendar days.

1. Activity Report: List of activities sorted by activity number and then early start date, or actual start date if known.
2. Logic Report: List of preceding and succeeding activities for each activity, sorted in ascending order by activity number and then by early start date, or actual start

date if known.

3. Total Float Report: List of activities sorted in ascending order of total float.

F. Construction Schedule Updating Reports: Submit with Applications for Payment.

G. Daily Construction Reports: Submit at weekly intervals.

H. Material Location Reports: Submit at weekly intervals.

I. Site Condition Reports: Submit at time of discovery of differing conditions.

J. Unusual Event Reports: Submit at time of unusual event.

K. Qualification Data: For scheduling consultant.

1.4 QUALITY ASSURANCE

A. Scheduling Consultant Qualifications: An experienced specialist in CPM scheduling and reporting, with capability of producing CPM reports and diagrams within 24 hours of Architect's request.

B. Prescheduling Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination." Review methods and procedures related to the preliminary construction schedule and Contractor's Construction Schedule, including, but not limited to, the following:

1. Review software limitations and content and format for reports.
2. Verify availability of qualified personnel needed to develop and update schedule.
3. Discuss constraints, including work stages, area separations and interim milestones
4. Review delivery dates for Owner-furnished products.
5. Review schedule for work of Owner's separate contracts.
6. Review submittal requirements and procedures.
7. Review time required for review of submittals and resubmittals.
8. Review requirements for tests and inspections by independent testing and inspecting agencies.
9. Review time required for Project closeout and Owner startup procedures**,** including commissioning activities.
10. Review and finalize list of construction activities to be included in schedule.
11. Review procedures for updating schedule.

1.5 COORDINATION

A. Coordinate Contractor's Construction Schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests, and other required schedules and reports.

1. Secure time commitments for performing critical elements of the Work from entities involved.
2. Coordinate each construction activity in the network with other activities, and schedule them in proper sequence.

1.6 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Computer Scheduling Software: Prepare schedules using current version of a program that is capable of managing construction schedules.

B. Scheduling Consultant: Engage a consultant to provide planning, evaluation, and reporting, using CPM scheduling.

1. In-House Option: Owner may waive requirement to retain a consultant if Contractor employs skilled personnel with experience in CPM scheduling and reporting techniques. Submit qualifications.

2. Meetings: Scheduling consultant shall attend all meetings related to Project progress, alleged delays, and time impact.

C. Time Frame: Extend schedule from date established for the Notice to Proceed to date of Final Completion.

1. Contract completion date to not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.

D. Activities: Treat each floor or separate area as a separate numbered activity for each main element of the Work. Comply with the following:

1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Architect.
2. Temporary Facilities: Indicate start and completion dates for the following as applicable:

    a. Securing of approvals and permits required for performance of the Work.
    b. Temporary facilities.
    c. Construction of mock-ups, prototypes and samples.
    d. Owner interfaces and furnishing of items.
    e. Interfaces with Separate Contracts.
    f. Regulatory agency approvals.
    g. Punch list.

3. Procurement Activities: Include procurement process activities for the following long lead-time items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
4. Submittal Review Time: Include review and resubmittal times indicated in Section 013300 "Submittal Procedures" in schedule. Coordinate submittal review times in

Contractor's Construction Schedule with submittal schedule.

5. Startup and Testing Time: Include no fewer than 15 days for startup and testing.
6. Commissioning Time: Include no fewer than 15 days for commissioning.
7. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's administrative procedures necessary for certification of Substantial Completion.
8. Punch List and Final Completion: Include not more than 30 days for completion of punch list items and Final Completion.

E. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule and show how the sequence of the Work is affected.

1. Work Restrictions: Show the effect of the following items on the schedule:

   a. Coordination with existing construction.
   b. Uninterruptible services.
   c. Partial occupancy before Substantial Completion.
   d. Use-of-premises restrictions.
   e. Provisions for future construction.
   f. Seasonal variations.
   g. Environmental control.

2. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:

   a. Subcontract awards.
   b. Submittals.
   c. Purchases.
   d. Mockups.
   e. Fabrication.
   f. Sample testing.
   g. Deliveries.
   h. Installation.
   i. Tests and inspections.
   j. Adjusting.
   k. Curing.

3. Construction Areas: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:

   a. Completion of mechanical installation.
   b. Completion of electrical installation.
   c. Substantial Completion.

F. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and Final

Completion.

G. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:

1. Unresolved issues.
2. Unanswered Requests for Information.
3. Rejected or unreturned submittals.
4. Notations on returned submittals.
5. Pending modifications affecting the Work and the Contract Time.

H. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.

1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
3. As the Work progresses, indicate Final Completion percentage for each activity.

I. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours, working days, crew sizes, equipment required to achieve compliance, and date by which recovery will be accomplished.

J. Distribution: Distribute copies of approved schedule to Architect, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.

1. Post copies in Project meeting rooms and temporary field offices.
2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

1.7 STARTUP CONSTRUCTION SCHEDULE

A. Baseline Schedule: Within thirty (30) Days after the Award of the Contract, the Contractor shall submit to the Department a detailed baseline schedule indicating the time allocated by the Contractor for performance of each portion of the Work. The baseline schedule shall show commencement of Work from the date the Notice to Proceed is issued. The baseline schedule shall show Full and Final Completion of the

Work within the Contract Time as specified in the Contract or as mutually agreed upon with the County in writing pursuant to a Contract

1.8 CPM SCHEDULE REQUIREMENTS

A. Prepare network diagrams using AON (activity-on-node) format.

B. CPM Schedule: Prepare Contractor's Construction Schedule using a cost- and resource-loaded, time-scaled CPM network analysis diagram for the Work.

1. Develop network diagram in sufficient time to submit CPM schedule, so it can be accepted for use no later than 60 days after date established for the Notice to Proceed.
   a. Failure to include any work item required for performance of this Contract shall not excuse Contractor from completing all work within applicable completion dates.
2. Conduct educational workshops to train and inform key Project personnel, including subcontractors' personnel, in proper methods of providing data and using CPM schedule information.
3. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.
4. Use "one workday" as the unit of time for individual activities. Indicate nonworking days and holidays incorporated into the schedule to coordinate with the Contract Time.

C. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the startup network diagram, prepare a skeleton network to identify probable critical paths.

1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:

   a. Preparation and processing of submittals.
   b. Mobilization and demobilization.
   c. Purchase of materials.
   d. Delivery.
   e. Fabrication.
   f. Utility interruptions.
   g. Installation.
   h. Work by Owner that may affect or be affected by Contractor's activities.
   i. Testing and inspection.
   j. Commissioning.
   k. Punch list and Final Completion.
   l. Activities occurring following Final Completion.

2. Critical Path Activities: Identify critical path activities, including those for interim completion dates. Scheduled start and completion dates shall be consistent with Contract milestone dates.
3. Processing: Process data to produce output data on a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce CPM schedule within the limitations of the Contract Time.
4. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.

    a. Subnetworks on separate sheets are permissible for activities clearly off the critical path.

5. Cost- and Resource-Loading of CPM Schedule: Assign cost to construction activities on the CPM schedule. Do not assign costs to submittal activities. Obtain Architect's approval prior to assigning costs to fabrication and delivery activities. Assign costs under main subcontracts for testing and commissioning activities, operation and maintenance manuals, punch list activities, Project record documents, sustainable design documentation, and demonstration and training (if applicable), in the amount of 5 percent of the Contract Sum.

    a. Each activity cost shall reflect an appropriate value subject to approval by Architect.
    b. Total cost assigned to activities shall equal the total Contract Sum.

D. Initial Issue of Schedule: Prepare initial network diagram from a sorted activity list indicating straight "early start-total float." Identify critical activities. Prepare tabulated reports showing the following:

1. Contractor or subcontractor and the Work or activity.
2. Description of activity.
3. Main events of activity.
4. Immediate preceding and succeeding activities.
5. Early and late start dates.
6. Early and late finish dates.
7. Activity duration in workdays.
8. Total float or slack time.
9. Average size of workforce.
10. Dollar value of activity (coordinated with the schedule of values).

E. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using a network fragment to demonstrate the effect of the proposed change on the overall Project schedule.

F. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:

1. Identification of activities that have changed.

2. Changes in early and late start dates.
3. Changes in early and late finish dates.
4. Changes in activity durations in workdays.
5. Changes in the critical path.
6. Changes in total float or slack time.
7. Changes in the Contract Time.

G. Value Summaries: Prepare two cumulative value lists, sorted by finish dates.

1. In first list, tabulate activity number, early finish date, dollar value, and cumulative dollar value.
2. In second list, tabulate activity number, late finish date, dollar value, and cumulative dollar value.
3. In subsequent issues of both lists, substitute actual finish dates for activities completed as of list date.
4. Prepare list for ease of comparison with payment requests; coordinate timing with progress meetings.

    a. In both value summary lists, tabulate "actual percent complete" and "cumulative value completed" with total at bottom.

1.9 REPORTS

A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:

1. List of subcontractors at Project site.
2. List of separate contractors at Project site.
3. Approximate count of personnel at Project site.
4. Equipment at Project site.
5. Material deliveries.
6. High and low temperatures and general weather conditions, including presence of rain or snow.
7. Testing and inspection.
8. Accidents.
9. Meetings and significant decisions.
10. Unusual events.
11. Stoppages, delays, shortages, and losses.
12. Meter readings and similar recordings.
13. Emergency procedures.
14. Orders and requests of authorities having jurisdiction.
15. Change Orders received and implemented.
16. Construction, Work Change Directives received and implemented.
17. Services connected and disconnected.
18. Equipment or system tests and startups.
19. Partial completions and occupancies.
20. Substantial Completions authorized.

B. Material Location Reports: At monthly intervals, prepare and submit a comprehensive list of materials delivered to and stored at Project site. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from Project site. Indicate the following categories for stored materials:

1. Material stored prior to previous report and remaining in storage.

2. Material stored prior to previous report and since removed from storage and installed.

3. Material stored following previous report and remaining in storage.

C. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

D. Unusual Event Reports: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, responses by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.

1. Submit unusual event reports directly to Owner within one day(s) of an occurrence. Distribute copies of report to parties affected by the occurrence.

PART 2 - PRODUCTS (Not Used)
PART 3 - EXECUTION (Not Used)

END OF SECTION 013200

SECTION 013233

PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for the following:

1. Preconstruction photographs.
2. Periodic construction photographs.
3. Final Completion construction photographs.

B. Related Requirements:

1. Section 017700 "Closeout Procedures" for submitting photographic documentation as Project Record Documents at Project closeout.

1.2 INFORMATIONAL SUBMITTALS

A. Key Plan: Submit key plan of Project site and building with notation of vantage points marked for location and direction of each photograph and video recording. Indicate elevation or story of construction. Include same information as corresponding photographic documentation.

B. Digital Photographs: Submit image files within three days of taking photographs.

1. Submit photos by uploading to web-based Project management software site. Include copy of key plan indicating each photograph's location and direction.
2. Identification: Provide the following information with each image description in web-based Project management software site:

a. Name of Project.
b. Name and contact information for photographer.
c. Name of Architect
d. Name of Contractor.
e. Date photograph was taken.
f. Description of location, vantage point, and direction.
g. Unique sequential identifier keyed to accompanying key plan.

1.3 QUALITY ASSURANCE

A. Photographer Qualifications: An individual who has been regularly engaged as a

professional photographer of construction projects for not less than three years.

1.4 FORMATS AND MEDIA

A. Digital Photographs: Provide color images in JPG format, produced by a digital camera with minimum sensor size of 12 megapixels, and at an image resolution of not less than 3200 by 2400 pixels, and with vibration-reduction technology. Use flash in low light levels or backlit conditions.

B. Digital Images: Submit digital media as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.

1.5 CONSTRUCTION PHOTOGRAPHS

A. Photographer: Engage a qualified photographer to take construction photographs.

B. General: Take photographs with maximum depth of field and in focus.

1. Maintain key plan with each set of construction photographs that identifies each photographic location.

C. Preconstruction Photographs: Before commencement of the Work, take photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points, as directed by Architect.

1. Flag excavation areas before taking construction photographs.
2. Take 20 photographs to show existing conditions adjacent to property before starting the Work.
3. Take 20 photographs of existing buildings either on or adjoining property, to accurately record physical conditions at start of construction.
4. Take additional photographs as required to record settlement or cracking of adjacent structures, pavements, and improvements.

D. Concealed Work Photographs: Before proceeding with installing work that will conceal other work, take photographs sufficient in number, with annotated descriptions, to record nature and location of concealed Work, including, but not limited to, the following:

1. Underground utilities.
2. Underslab services.
3. Piping.
4. Electrical conduit.
5. Waterproofing and weather-resistant barriers.

E. Periodic Construction Photographs: Take 20 photographs weekly. Select vantage points to show status of construction and progress since last photographs were taken.

F. Final Completion Construction Photographs: Take 100 photographs after date of Substantial Completion for submission as Project Record Documents. Architect, Construction Manager will inform photographer of desired vantage points.

PART 2 - PRODUCTS (Not Used)
PART 3 - EXECUTION (Not Used)

END OF SECTION 013233

SECTION 013300

SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Submittal schedule requirements.
2. Administrative and procedural requirements for submittals.

B. Related Requirements:

1. Section 012900 "Payment Procedures" for submitting Applications for Payment and the schedule of values.
2. Section 013100 "Project Management and Coordination" for submitting coordination drawings and subcontract list and for requirements for web-based Project software.
3. Section 013200 "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
4. Section 014000 "Quality Requirements" for submitting test and inspection reports, and schedule of tests and inspections.
5. Section 017700 "Closeout Procedures" for submitting closeout submittals and maintenance material submittals.
6. Section 017823 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
7. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
8. Section 017900 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.

1.2 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require Architect's and Construction Manager's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."

B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's and Construction Manager's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."

1.3 SUBMITTAL SCHEDULE

A. Submittal Schedule: Submit, as an action submittal, a list of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and Construction Manager and additional time for handling and reviewing submittals required by those corrections.

1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
2. Initial Submittal Schedule: Submit concurrently with startup construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
3. Final Submittal Schedule: Submit concurrently with the first complete submittal of Contractor's construction schedule.

    a. Submit revised submittal schedule as required to reflect changes in current status and timing for submittals.

4. Format: Arrange the following information in a tabular format:

    a. Scheduled date for first submittal.
    b. Specification Section number and title.
    c. Submittal Category: Action; informational.
    d. Name of subcontractor.
    e. Description of the Work covered.
    f. Scheduled date for Architect's and Construction Manager's final release or approval.
    g. Scheduled date for purchasing.
    h. Scheduled date for fabrication.
    i. Scheduled dates for installation.
    j. Activity or event number.

1.4 SUBMITTAL FORMATS

A. Submittal Information: Include the following information in each submittal:

1. Project name.
2. Date.
3. Name of Architect.
4. Name of Contractor.
5. Name of firm or entity that prepared submittal.
6. Names of subcontractor, manufacturer, and supplier.
7. Unique submittal number, including revision identifier. Include Specification Section number with sequential alphanumeric identifier and alphanumeric suffix for resubmittals.

8. Category and type of submittal.
9. Submittal purpose and description.
10. Number and title of Specification Section, with paragraph number and generic name for each of multiple items.
11. Drawing number and detail references, as appropriate.
12. Indication of full or partial submittal.
13. Location(s) where product is to be installed, as appropriate.
14. Other necessary identification.
15. Remarks.
16. Signature of transmitter.

B. Options: Identify options requiring selection by Architect.

C. Deviations and Additional Information: On each submittal, clearly indicate deviations from requirements in the Contract Documents, including minor variations and limitations; include relevant additional information and revisions, other than those requested by Architect on previous submittals. Indicate by highlighting on each submittal or noting on attached separate sheet.

D. Submittals Utilizing Web-Based Project Software: Prepare submittals as PDF files or other format indicated by Project management software.

1.5 SUBMITTAL PROCEDURES

A. Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.

1. Email: Prepare submittals as PDF package and transmit to Architect by sending via email. Include PDF transmittal form. Include information in email subject line as requested by Architect.

    a. Architect will return annotated file. Annotate and retain one copy of file as a digital Project Record Document file.

2. Web-Based Project Management Software: Prepare submittals in PDF form, and upload to web-based Project management software website. Enter required data in web-based software site to fully identify submittal.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.

4. Coordinate transmittal of submittals for related parts of the Work specified in different Sections, so processing will not be delayed because of need to review submittals concurrently for coordination.

    a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.

1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
3. Resubmittal Review: Allow 15 days for review of each resubmittal.
4. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow 21 days for initial review of each submittal.
5. Concurrent Consultant Review: Where the Contract Documents indicate that submittals may be transmitted simultaneously to Architect and to Architect's consultants, allow 15 days for review of each submittal. Submittal will be returned to Architect, through Architect, before being returned to Contractor.

D. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.

1. Note date and content of previous submittal.
2. Note date and content of revision in label or title block, and clearly indicate extent of revision.
3. Resubmit submittals until they are marked with approval notation from Architect's action stamp.

E. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

F. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's action stamp.

1.6 SUBMITTAL REQUIREMENTS

A. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

1. If information must be specially prepared for submittal because standard published data are unsuitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable.
3. Include the following information, as applicable:

    a. Manufacturer's catalog cuts.
    b. Manufacturer's product specifications.
    c. Standard color charts.
    d. Statement of compliance with specified referenced standards.
    e. Testing by recognized testing agency.
    f. Application of testing agency labels and seals.
    g. Notation of coordination requirements.
    h. Availability and delivery time information.

4. For equipment, include the following in addition to the above, as applicable:

    a. Wiring diagrams that show factory-installed wiring.
    b. Printed performance curves.
    c. Operational range diagrams.
    d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.

5. Submit Product Data before Shop Drawings, and before or concurrently with Samples.

B. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data unless submittal based on Architect's digital data drawing files is otherwise permitted.

1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:

    a. Identification of products.
    b. Schedules.
    c. Compliance with specified standards.
    d. Notation of coordination requirements.
    e. Notation of dimensions established by field measurement.
    f. Relationship and attachment to adjoining construction clearly indicated.
    g. Seal and signature of professional engineer if specified.

2. BIM Incorporation: Develop and incorporate Shop Drawing files into BIM established for Project.

C. Samples: Submit Samples for review of type, color, pattern, and texture for a check of these characteristics with other materials.

1. Transmit Samples that contain multiple, related components, such as accessories together in one submittal package.
2. Identification: Permanently attach label on unexposed side of Samples that includes the following:

    a. Project name and submittal number.
    b. Generic description of Sample.
    c. Product name and name of manufacturer.
    d. Sample source.
    e. Number and title of applicable Specification Section.
    f. Specification paragraph number and generic name of each item.

3. Email Transmittal: Provide PDF transmittal. Include digital image file illustrating Sample characteristics and identification information for record.
4. Web-Based Project Management Software: Prepare submittals in PDF form, and upload to web-based Project software website. Enter required data in web-based software site to fully identify submittal.
5. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.

    a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
    b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.

6. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units, showing the full range of colors, textures, and patterns available.

    a. Number of Samples: Submit one full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line to architect and one set to client. Architect will return submittal with options selected.

7. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.

    a. Number of Samples: Submit three sets of Samples. Architect will retain two Sample sets; remainder will be returned. Mark up and retain one returned Sample set as a project record Sample.

1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.

D. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:

1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
2. Manufacturer and product name, and model number if applicable.
3. Number and name of room or space.
4. Location within room or space.

E. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.

F. Design Data: Prepare and submit written and graphic information indicating compliance with indicated performance and design criteria in individual Specification Sections. Include list of assumptions and summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Number each page of submittal.

G. Certificates:

1. Certificates and Certifications Submittals: Submit a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity. Provide a notarized signature where indicated.
2. Installer Certificates: Submit written statements on manufacturer's letterhead, certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
3. Manufacturer Certificates: Submit written statements on manufacturer's letterhead, certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
4. Material Certificates: Submit written statements on manufacturer's letterhead, certifying that material complies with requirements in the Contract Documents.
5. Product Certificates: Submit written statements on manufacturer's letterhead, certifying that product complies with requirements in the Contract Documents.
6. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of AWS B2.1/B2.1M on AWS forms. Include names of firms and personnel

certified.

H. Test and Research Reports:

1. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for substrate preparation and primers required.
2. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
3. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
4. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
5. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
6. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:

    a. Name of evaluation organization.
    b. Date of evaluation.
    c. Time period when report is in effect.
    d. Product and manufacturers' names.
    e. Description of product.
    f. Test procedures and results.
    g. Limitations of use.

1.7 DELEGATED DESIGN SERVICES

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.

1. If criteria indicated are insufficient to perform services or certification required, submit a written request for additional information to Architect.

B. Delegated Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF file and three paper copies

of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.

1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

1.8 CONTRACTOR'S REVIEW

A. Action Submittals and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.

B. Contractor's Approval: Indicate Contractor's approval for each submittal with a uniform approval stamp and an indication in web-based Project management software. Include name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

1. Architect will not review submittals received from Contractor that do not have Contractor's review and approval.

1.9 ARCHITECT'S REVIEW

A. Contractor will preview all submittals, verify compliance, and then submit to Architect for review.

B. Incomplete submittals will be returned to Contractor.

C. Action Submittals: Architect will review each submittal, indicate corrections or revisions required**,** and return.

1. Submittals by Web-Based Project Management Software: Architect will indicate, on Project management software website, the appropriate action.

D. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.

E. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.

F. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.

G. Architect will return without review submittals received from sources other than Contractor.

H. Submittals not required by the Contract Documents will be returned by Architect without action.

PART 2 - PRODUCTS (Not Used)
PART 3 - EXECUTION (Not Used)

END OF SECTION 013300

SECTION 014000

QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for quality assurance and quality control.

B. Testing and inspection services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.

1. Specific quality-assurance and quality-control requirements for individual work results are specified in their respective Specification Sections. Requirements in individual Sections may also cover production of standard products.
2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and quality-control procedures that facilitate compliance with the Contract Document requirements.
3. Requirements for Contractor to provide quality-assurance and quality-control services required by Architect, Owner, Commissioning Authority, or authorities having jurisdiction are not limited by provisions of this Section.

1.2 DEFINITIONS

A. Experienced: When used with an entity or individual, "experienced," unless otherwise further described, means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

B. Field Quality-Control Tests and Inspections: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

C. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, subcontractor, or sub-subcontractor, to perform a particular construction operation, including installation, erection, application, assembly, and similar operations.

1. Use of trade-specific terminology in referring to a Work result does not require that certain construction activities specified apply exclusively to specific trade(s).

D. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or

compliance with specified criteria. Unless otherwise indicated, copies of reports of tests or inspections performed for other than the Project do not meet this definition.

E. Product Tests: Tests and inspections that are performed by a nationally recognized testing laboratory (NRTL) in accordance with 29 CFR 1910.7, by a testing agency accredited in accordance with NIST's National Voluntary Laboratory Accreditation Program (NVLAP), or by a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.

F. Source Quality-Control Tests and Inspections: Tests and inspections that are performed at the source (e.g., plant, mill, factory, or shop).

G. Testing Agency: An entity engaged to perform specific tests, inspections, or both. The term "testing laboratory" has the same meaning as the term "testing agency."

H. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work, to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.

I. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work, to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Contractor's quality-control services do not include contract administration activities performed by Architect or Construction Manager.

1.3 DELEGATED DESIGN SERVICES

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.

1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

B. Delegated Design Services Statement: Submit a statement signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional, indicating that the products and systems are in compliance with performance and design criteria indicated. Include list of codes, loads, and other factors used in performing these services.

1.4 CONFLICTING REQUIREMENTS

A. Conflicting Standards and Other Requirements: If compliance with two or more standards or requirements is specified and the standards or requirements establish

different or conflicting requirements for minimum quantities or quality levels, inform the Architect regarding the conflict and obtain clarification prior to proceeding with the Work. Refer conflicting requirements that are different, but apparently equal, to Architect for clarification before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified is the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.5 ACTION SUBMITTALS

A. Mockup Shop Drawings:

1. Include plans, sections, elevations, and details, indicating materials and size of mockup construction.
2. Indicate manufacturer and model number of individual components.
3. Provide axonometric drawings for conditions difficult to illustrate in two dimensions.

1.6 INFORMATIONAL SUBMITTALS

A. Contractor's Quality-Control Plan: For quality-assurance and quality-control activities and responsibilities.

B. Qualification Data: For Contractor's quality-control personnel.

C. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

D. Schedule of Tests and Inspections: Prepare in tabular form and include the following:

1. Specification Section number and title.
2. Entity responsible for performing tests and inspections.
3. Description of test and inspection.
4. Identification of applicable standards.
5. Identification of test and inspection methods.
6. Number of tests and inspections required.
7. Time schedule or time span for tests and inspections.
8. Requirements for obtaining samples.
9. Unique characteristics of each quality-control service.

E. Reports: Prepare and submit certified written reports and documents as specified.

F. Permits, Licenses, and Certificates: For Owner's record, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents established for compliance with standards and regulations bearing on performance of the Work.

1.7 CONTRACTOR'S QUALITY-CONTROL PLAN

A. Quality-Control Plan, General: Submit quality-control plan within 10 days of Notice to Proceed, and not less than five days prior to preconstruction conference. Submit in format acceptable to Architect. Identify personnel, procedures, controls, instructions, tests, records, and forms to be used to carry out Contractor's quality-assurance and quality-control responsibilities and to coordinate Owner's quality-assurance and quality-control activities. Coordinate with Contractor's Construction Schedule.

B. Quality-Control Personnel Qualifications: Engage qualified personnel trained and experienced in managing and executing quality-assurance and quality-control procedures similar in nature and extent to those required for Project.

C. Submittal Procedure: Describe procedures for ensuring compliance with requirements through review and management of submittal process. Indicate qualifications of personnel responsible for submittal review.

D. Testing and Inspection: In quality-control plan, include a comprehensive schedule of Work requiring testing or inspection, including the following:

1. Contractor-performed tests and inspections, including subcontractor-performed tests and inspections. Include required tests and inspections and Contractor-elected tests and inspections. Distinguish source quality-control tests and inspections from field quality-control tests and inspections.
2. Special inspections required by authorities having jurisdiction and indicated on the Statement of Special Inspections.
3. Owner-performed tests and inspections indicated in the Contract Documents, including tests and inspections indicated to be performed by Commissioning Authority.

E. Continuous Inspection of Workmanship: Describe process for continuous inspection during construction to identify and correct deficiencies in workmanship in addition to testing and inspection specified. Indicate types of corrective actions to be required to bring the Work into compliance with standards of workmanship established by Contract requirements and approved mockups.

F. Monitoring and Documentation: Maintain testing and inspection reports, including log of approved and rejected results. Include Work Architect has indicated as nonconforming or defective. Indicate corrective actions taken to bring nonconforming Work into compliance with requirements. Comply with requirements of authorities having jurisdiction.

1.8 REPORTS AND DOCUMENTS

A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:

1. Date of issue.
2. Project title and number.
3. Name, address, telephone number, and email address of testing agency.
4. Dates and locations of samples and tests or inspections.
5. Names of individuals making tests and inspections.
6. Description of the Work and test and inspection method.
7. Identification of product and Specification Section.
8. Complete test or inspection data.
9. Test and inspection results and an interpretation of test results.
10. Record of temperature and weather conditions at time of sample-taking and testing and inspection.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and reinspecting.

B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:

1. Name, address, telephone number, and email address of technical representative making report.
2. Statement on condition of substrates and their acceptability for installation of product.
3. Statement that products at Project site comply with requirements.
4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
6. Statement of whether conditions, products, and installation will affect warranty.
7. Other required items indicated in individual Specification Sections.

C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:

1. Name, address, telephone number, and email address of factory-authorized service representative making report.
2. Statement that equipment complies with requirements.
3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
4. Statement of whether conditions, products, and installation will affect warranty.
5. Other required items indicated in individual Specification Sections.

1.9 QUALITY ASSURANCE

A. Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units. As applicable, procure products from manufacturers able to meet qualification requirements, warranty requirements, and technical or factory-authorized service representative requirements.

C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

D. Installer Qualifications: A firm or individual experienced in installing, erecting, applying, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that is similar in material, design, and extent to those indicated for this Project.

F. Specialists: Certain Specification Sections require that specific construction activities be performed by entities who are recognized experts in those operations. Specialists will satisfy qualification requirements indicated and engage in the activities indicated.

    1. Requirements of authorities having jurisdiction supersede requirements for specialists.

G. Testing and Inspecting Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspection indicated, as documented in accordance with ASTM E329, and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.

H. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

I. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect, demonstrate, repair, and perform service on installations of manufacturer's products that are similar in material, design, and extent to those indicated for this

Project.

J. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:

1. Build mockups of size indicated.
2. Build mockups in location indicated or, if not indicated, as directed by Architect
3. Notify Architect seven days in advance of dates and times when mockups will be constructed.
4. Employ supervisory personnel who will oversee mockup construction. Employ workers who will be employed to perform same tasks during the construction at Project.
5. Demonstrate the proposed range of aesthetic effects and workmanship.
6. Obtain Architect's approval of mockups before starting corresponding Work, fabrication, or construction.

    a. Allow seven days for initial review and each re-review of each mockup.

7. Promptly correct unsatisfactory conditions noted by Architect's preliminary review, to the satisfaction of the Architect, before completion of final mockup.
8. Approval of mockups by the Architect does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
9. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
10. Demolish and remove mockups when directed unless otherwise indicated.

K. Specialty Mockups: See Section 014339 "Mockups" for additional construction requirements for integrated exterior mockups

1.10 QUALITY CONTROL

A. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities, whether specified or not, to verify and document that the Work complies with requirements.

1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
2. Engage a qualified testing agency to perform quality-control services.

    a. Contractor will not employ same entity engaged by Owner, unless agreed to in writing by Owner.

3. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspection will be performed.
4. Where quality-control services are indicated as Contractor's responsibility, submit

a certified written report, in duplicate, of each quality-control service.

5. Testing and inspection requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

B. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.

C. Testing Agency Responsibilities: Cooperate with Architect, Commissioning Authority and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.

1. Notify Architect, Commissioning Authority and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
2. Determine the locations from which test samples will be taken and in which in-situ tests are conducted.
3. Conduct and interpret tests and inspections, and state in each report whether tested and inspected Work complies with or deviates from requirements.
4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
6. Do not perform duties of Contractor.

D. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Section 013300 "Submittal Procedures."

E. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.

F. Contractor's Associated Requirements and Services: Cooperate with agencies and representatives performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:

1. Access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Adequate quantities of representative samples of materials that require testing

and inspection. Assist agency in obtaining samples.
4. Facilities for storage and field curing of test samples.
5. Delivery of samples to testing agencies.
6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
7. Security and protection for samples and for testing and inspection equipment at Project site.

G. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and quality-control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspection.

1. Schedule times for tests, inspections, obtaining samples, and similar activities.

H. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents as a component of Contractor's quality-control plan. Coordinate and submit concurrently with Contractor's Construction Schedule. Update and submit with each Application for Payment.

1. Schedule Contents: Include tests, inspections, and quality-control services, including Contractor- and Owner-retained services, commissioning activities, and other Project-required services paid for by other entities.
2. Distribution: Distribute schedule to Owner, Architect, Commissioning Authority testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

1.11 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: Contractor will engage a qualified testing agency to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner**,** as indicated in the Statement of Special Inspections attached to this Section, and as follows:

1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures, and reviewing the completeness and adequacy of those procedures to perform the Work.
2. Notifying Architect**,** Commissioning Authority, and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect and Commissioning Authority with copy to Contractor and to authorities having jurisdiction.
4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
5. Interpreting tests and inspections, and stating in each report whether tested and inspected Work complies with or deviates from the Contract Documents.
6. Retesting and reinspecting corrected Work.

PART 2 - PRODUCTS (Not Used)
PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:

1. Date test or inspection was conducted.
2. Description of the Work tested or inspected.
3. Date test or inspection results were transmitted to Architect.
4. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's**,** Commissioning Authority's, authorities' having jurisdiction reference during normal working hours.

1. Submit log at Project closeout as part of Project Record Documents.

3.2 REPAIR AND PROTECTION

A. General: On completion of testing, inspection, sample-taking, and similar services, repair damaged construction and restore substrates and finishes.

1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 017300 "Execution."

B. Protect construction exposed by or for quality-control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 014000

SECTION 014200

REFERENCES

PART 1 - GENERAL

1.1 DEFINITIONS

A. General: Basic Contract definitions are included in the Conditions of the Contract.

B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.

C. "Directed": A command or instruction by Architect. Other terms, including "requested," "authorized," "selected," "required," and "permitted," have the same meaning as "directed."

D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms, including "shown," "noted," "scheduled," and "specified," have the same meaning as "indicated."

E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.

F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

G. "Install": Unload, temporarily store, unpack, assemble, erect, place, anchor, apply, work to dimension, finish, cure, protect, clean, and similar operations at Project site.

H. "Provide": Furnish and install, complete and ready for the intended use.

I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.2 INDUSTRY STANDARDS

A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.

1. For standards referenced by applicable building codes, comply with dates of standards as listed in building codes.

C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.

1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.3 ABBREVIATIONS AND ACRONYMS

A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they are to mean the recognized name of the entities indicated in Gale's "Encyclopedia of Associations: National Organizations of the U.S." or in Columbia Books' "National Trade & Professional Associations of the United States."

B. Industry Organizations, List: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they are to mean the recognized name of the entities in the following list. Abbreviations and acronyms not included in this list are to mean the recognized name of the entities indicated in Gale's "Encyclopedia of Associations: National Organizations of the U.S." or in Columbia Books' "National Trade & Professional Associations of the United States."The information in this list is subject to change and is believed to be accurate as of the date of the Contract Documents.

1. AABC - Associated Air Balance Council; www.aabc.com.
2. AAMA - American Architectural Manufacturers Association; (see FGIA).
3. AAPFCO - Association of American Plant Food Control Officials; www.aapfco.org.
4. AASHTO - American Association of State Highway and Transportation Officials; www.transportation.org.
5. AATCC - American Association of Textile Chemists and Colorists; www.aatcc.org.
6. ABMA - American Bearing Manufacturers Association; www.americanbearings.org.
7. ABMA - American Boiler Manufacturers Association; www.abma.com.
8. ACI - American Concrete Institute; www.concrete.org.
9. ACP - American Clean Power; (Formerly: American Wind Energy Association); www.cleanpower.org.
10. ACPA - American Concrete Pipe Association; www.concretepipe.org.
11. AEIC - Association of Edison Illuminating Companies, Inc. (The); www.aeic.org.
12. AF&PA - American Forest & Paper Association; www.afandpa.org.
13. AGA - American Gas Association; www.aga.org.

14. AHAM - Association of Home Appliance Manufacturers; www.aham.org.
15. AHRI - Air-Conditioning, Heating, and Refrigeration Institute (The); www.ahrinet.org.
16. AI - Asphalt Institute; www.asphaltinstitute.org.
17. AIA - American Institute of Architects (The); www.aia.org.
18. AISC - American Institute of Steel Construction; www.aisc.org.
19. AISI - American Iron and Steel Institute; www.steel.org.
20. AITC - American Institute of Timber Construction; (see PLIB).
21. AMCA - Air Movement and Control Association International, Inc.; www.amca.org.
22. AMPP - Association for Materials Protection and Performance; www.ampp.org.
23. ANSI - American National Standards Institute; www.ansi.org.
24. AOSA/SCST - Association of Official Seed Analysts (The)/Society of Commercial Seed Technologists (The); www.analyzeseeds.com.
25. APA - APA - The Engineered Wood Association; www.apawood.org.
26. APA - Architectural Precast Association; www.archprecast.org.
27. API - American Petroleum Institute; www.api.org.
28. ARMA - Asphalt Roofing Manufacturers Association; www.asphaltroofing.org.
29. ASA - Acoustical Society of America; www.acousticalsociety.org.
30. ASCE - American Society of Civil Engineers; www.asce.org.
31. ASCE/SEI - American Society of Civil Engineers/Structural Engineering Institute; (see ASCE).
32. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers; www.ashrae.org.
33. ASME - ASME International; American Society of Mechanical Engineers (The); www.asme.org.
34. ASSE - ASSE International; (American Society of Sanitary Engineering); www.asse-plumbing.org.
35. ASSP - American Society of Safety Professionals; www.assp.org.
36. ASTM - ASTM International; www.astm.org.
37. ATIS - Alliance for Telecommunications Industry Solutions; www.atis.org.
38. AVIXA - Audiovisual and Integrated Experience Association; www.avixa.org.
39. AWI - Architectural Woodwork Institute; www.awinet.org.
40. AWMAC - Architectural Woodwork Manufacturers Association of Canada; www.awmac.com.
41. AWPA - American Wood Protection Association; www.awpa.com.
42. AWS - American Welding Society; www.aws.org.
43. AWWA - American Water Works Association; www.awwa.org.
44. BHMA - Builders Hardware Manufacturers Association; www.buildershardware.com.
45. BIA - Brick Industry Association (The); www.gobrick.com.
46. BICSI - BICSI, Inc.; www.bicsi.org.
47. BIFMA - Business and Institutional Furniture Manufacturer's Association; www.bifma.org.
48. BISSC - Baking Industry Sanitation Standards Committee; www.bissc.org.
49. BSI - British Standards Institution; www.bsigroup.com.
50. BWF - Badminton World Federation; www.bwfbadminton.com.
51. CARB - California Air Resources Board; www.arb.ca.gov.
52. CDA - Copper Development Association Inc.; www.copper.org.

53. CE - Conformite Europeenne (European Commission); www.ec.europa.eu/growth/single-market/ce-marking.
54. CEA - Canadian Electricity Association; www.electricity.ca.
55. CFFA - Chemical Fabrics and Film Association, Inc.; www.chemicalfabricsandfilm.com.
56. CFSEI - Cold-Formed Steel Engineers Institute; www.cfsei.org.
57. CGA - Compressed Gas Association; www.cganet.com.
58. CIMA - Cellulose Insulation Manufacturers Association; www.cellulose.org.
59. CISCA - Ceilings & Interior Systems Construction Association; www.cisca.org.
60. CISPI - Cast Iron Soil Pipe Institute; www.cispi.org.
61. CLFMI - Chain Link Fence Manufacturers Institute; www.chainlinkinfo.org.
62. CMHA - Concrete Masonry & Hardscape Association; (Formerly: National Concrete Masonry Association); www.masonryandhardscapes.org.
63. CPA - Composite Panel Association; www.compositepanel.org.
64. CRI - Carpet and Rug Institute (The); www.carpet-rug.org.
65. CRRC - Cool Roof Rating Council; www.coolroofs.org.
66. CRSI - Concrete Reinforcing Steel Institute; www.crsi.org.
67. CSA - CSA Group; www.csagroup.org.
68. CSI - Cast Stone Institute; www.caststone.org.
69. CSI - Construction Specifications Institute (The); www.csiresources.org.
70. CSSB - Cedar Shake & Shingle Bureau; www.cedarbureau.org.
71. CTA - Consumer Technology Association; www.cta.tech.
72. CTI - Cooling Technology Institute; www.coolingtechnology.org.
73. DASMA - Door and Access Systems Manufacturers Association; www.dasma.com.
74. DHA - Decorative Hardwoods Association; www.decorativehardwoods.org.
75. DHI - Door and Hardware Institute; www.dhi.org.
76. ECIA - Electronic Components Industry Association; www.ecianow.org.
77. EIMA - EIFS Industry Members Association; www.eima.com.
78. EJMA - Expansion Joint Manufacturers Association, Inc.; www.ejma.org.
79. EOS/ESD - EOS/ESD Association, Inc.; Electrostatic Discharge Association; www.esda.org.
80. ESTA - Entertainment Services and Technology Association; www.esta.org.
81. EVO - Efficiency Valuation Organization; www.evo-world.org.
82. FCI - Fluid Controls Institute; www.fluidcontrolsinstitute.org.
83. FGIA - Fenestration and Glazing Industry Alliance; https://fgiaonline.org.
84. FIBA - Federation Internationale de Basketball; (The International Basketball Federation); www.fiba.com.
85. FIVB - Federation Internationale de Volleyball; (The International Volleyball Federation); www.fivb.org.
86. FM Approvals - FM Approvals LLC; www.fmapprovals.com.
87. FM Global - FM Global; www.fmglobal.com.
88. FRSA - Florida Roofing and Sheet Metal Contractors Association, Inc.; www.floridaroof.com.
89. FSA - Fluid Sealing Association; www.fluidsealing.com.
90. FSC - Forest Stewardship Council U.S.; www.fscus.org.
91. GA - Gypsum Association; www.gypsum.org.
92. GS - Green Seal; www.greenseal.org.
93. HI - Hydraulic Institute; www.pumps.org.

94. HMMA - Hollow Metal Manufacturers Association; (see NAAMM).
95. IAPSC - International Association of Professional Security Consultants; www.iapsc.org.
96. IAS - International Accreditation Service; www.iasonline.org.
97. ICC - International Code Council; www.iccsafe.org.
98. ICEA - Insulated Cable Engineers Association, Inc.; www.icea.net.
99. ICPA - International Cast Polymer Association (The); www.theicpa.com.
100. ICRI - International Concrete Repair Institute, Inc.; www.icri.org.
101. IEC - International Electrotechnical Commission; www.iec.ch.
102. IEEE SA - IEEE Standards Association; https://standards.ieee.org.
103. IES - Illuminating Engineering Society; www.ies.org.
104. IEST - Institute of Environmental Sciences and Technology; www.iest.org.
105. IGMA - Insulating Glass Manufacturers Alliance; (see FGIA).
106. IGSHPA - International Ground Source Heat Pump Association; www.igshpa.org.
107. ILI - Indiana Limestone Institute of America, Inc.; www.iliai.com.
108. Intertek - Intertek Group; www.intertek.com.
109. ISA - International Society of Automation (The); www.isa.org.
110. ISFA - International Surface Fabricators Association; www.isfanow.org.
111. ISO - International Organization for Standardization; www.iso.org.
112. ITU - International Telecommunication Union; www.itu.int.
113. KCMA - Kitchen Cabinet Manufacturers Association; www.kcma.org.
114. LPI - Lightning Protection Institute; www.lightning.org.
115. MBMA - Metal Building Manufacturers Association; www.mbma.com.
116. MCA - Metal Construction Association; www.metalconstruction.org.
117. MFMA - Maple Flooring Manufacturers Association, Inc.; www.maplefloor.org.
118. MFMA - Metal Framing Manufacturers Association, Inc.; www.metalframingmfg.org.
119. MHI - Material Handling Industry; www.mhi.org.
120. MMPA - Moulding & Millwork Producers Association; www.wmmpa.com.
121. MPI - Master Painters Institute; www.paintinfo.com.
122. MSS - Manufacturers Standardization Society of The Valve and Fittings Industry, Inc.; www.msshq.org.
123. NAAMM - National Association of Architectural Metal Manufacturers; www.naamm.org.
124. NACE - NACE International; (National Association of Corrosion Engineers International); (see AMPP).
125. NADCA - National Air Duct Cleaners Association; www.nadca.com.
126. NAIMA - North American Insulation Manufacturers Association; www.insulationinstitute.org.
127. NALP - National Association of Landscape Professionals; www.landscapeprofessionals.org.
128. NBGQA - National Building Granite Quarries Association, Inc.; www.nbgqa.com.
129. NBI - New Buildings Institute; www.newbuildings.org.
130. NCAA - National Collegiate Athletic Association (The); www.ncaa.org.
131. NCMA - National Concrete Masonry Association; (see CMHA).
132. NEBB - National Environmental Balancing Bureau; www.nebb.org.
133. NECA - National Electrical Contractors Association; www.necanet.org.
134. NeLMA - Northeastern Lumber Manufacturers Association; www.nelma.org.
135. NEMA - National Electrical Manufacturers Association; www.nema.org.

136. NETA - InterNational Electrical Testing Association; www.netaworld.org.
137. NFHS - National Federation of State High School Associations; www.nfhs.org.
138. NFPA - National Fire Protection Association; www.nfpa.org.
139. NFPA - NFPA International; (see NFPA).
140. NFRC - National Fenestration Rating Council; www.nfrc.org.
141. NGA - National Glass Association; www.glass.org.
142. NHLA - National Hardwood Lumber Association; www.nhla.com.
143. NLGA - National Lumber Grades Authority; www.nlga.org.
144. NOFMA - National Oak Flooring Manufacturers Association; (see NWFA).
145. NOMMA - National Ornamental & Miscellaneous Metals Association; www.nomma.org.
146. NRCA - National Roofing Contractors Association; www.nrca.net.
147. NRMCA - National Ready Mixed Concrete Association; www.nrmca.org.
148. NSF - NSF International; www.nsf.org.
149. NSI - Natural Stone Institute; www.naturalstoneinstitute.org.
150. NSPE - National Society of Professional Engineers; www.nspe.org.
151. NSSGA - National Stone, Sand & Gravel Association; www.nssga.org.
152. NTMA - National Terrazzo & Mosaic Association, Inc. (The); www.ntma.com.
153. NWFA - National Wood Flooring Association; www.nwfa.org.
154. NWRA - National Waste & Recycling Association; www.wasterecycling.org.
155. PCI - Precast/Prestressed Concrete Institute; www.pci.org.
156. PDI - Plumbing & Drainage Institute; www.pdionline.org.
157. PLASA - PLASA; www.plasa.org.
158. PLIB - Pacific Lumber Inspection Bureau; www.plib.org.
159. PVCPA - Uni-Bell PVC Pipe Association; www.uni-bell.org.
160. RCSC - Research Council on Structural Connections; www.boltcouncil.org.
161. RFCI - Resilient Floor Covering Institute; www.rfci.com.
162. RIS - Redwood Inspection Service; (see WWPA).
163. SAE - SAE International; www.sae.org.
164. SCTE - Society of Cable Telecommunications Engineers; www.scte.org.
165. SDI - Steel Deck Institute; www.sdi.org.
166. SDI - Steel Door Institute; www.steeldoor.org.
167. SEFA - Scientific Equipment and Furniture Association (The); www.sefalabs.com.
168. SEI/ASCE - Structural Engineering Institute/American Society of Civil Engineers; (see ASCE).
169. SIA - Security Industry Association; www.securityindustry.org.
170. SJI - Steel Joist Institute; www.steeljoist.org.
171. SMA - Screen Manufacturers Association; www.smainfo.org.
172. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association; www.smacna.org.
173. SMPTE - Society of Motion Picture and Television Engineers; www.smpte.org.
174. SPFA - Spray Polyurethane Foam Alliance; www.sprayfoam.org.
175. SPIB - Southern Pine Inspection Bureau; www.spib.org.
176. SPRI - Single Ply Roofing Industry; www.spri.org.
177. SRCC - Solar Rating & Certification Corporation; www.solar-rating.org.
178. SSINA - Specialty Steel Industry of North America; www.ssina.com.
179. SSPC - SSPC: The Society for Protective Coatings; (see AMPP).
180. STI/SPFA - Steel Tank Institute/Steel Plate Fabricators Association;

www.steeltank.com.
181. SWI - Steel Window Institute; www.steelwindows.com.
182. SWPA - Submersible Wastewater Pump Association; www.swpa.org.
183. TCA - Tilt-Up Concrete Association; www.tilt-up.org.
184. TCNA - Tile Council of North America, Inc.; www.tcnatile.com.
185. TEMA - Tubular Exchanger Manufacturers Association, Inc.; www.kbcdco.tema.org.
186. TIA - Telecommunications Industry Association; www.tiaonline.org.
187. TMS - The Masonry Society; www.masonrysociety.org.
188. TPI - Truss Plate Institute; www.tpinst.org.
189. TPI - Turfgrass Producers International; www.turfgrasssod.org.
190. TRI - Tile Roofing Industry Alliance; www.tileroofing.org.
191. ULSE - UL Standards & Engagement Inc.; www.ulse.org.
192. UL - UL Solutions Inc.; www.ul.com.
193. USAV - USA Volleyball; www.usavolleyball.org.
194. USGBC - U.S. Green Building Council; www.usgbc.org.
195. USITT - United States Institute for Theatre Technology, Inc.; www.usitt.org.
196. WA - Wallcoverings Association; www.wallcoverings.org.
197. WCLIB - West Coast Lumber Inspection Bureau; (see PLIB).
198. WCMA - Window Covering Manufacturers Association; www.wcmanet.org.
199. WDMA - Window & Door Manufacturers Association; www.wdma.com.
200. WI - Woodwork Institute; www.woodworkinstitute.com.
201. WSRCA - Western States Roofing Contractors Association; www.wsrca.com.
202. WWPA - Western Wood Products Association; www.wwpa.org.

C. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they are to mean the recognized name of the entities in the following list. This information is believed to be accurate as of the date of the Contract Documents.

1. DIN - Deutsches Institut fur Normung e.V.; www.din.de.
2. IAPMO - International Association of Plumbing and Mechanical Officials; www.iapmo.org.
3. ICC - International Code Council; www.iccsafe.org.
4. ICC-ES - ICC Evaluation Service, LLC; www.icc-es.org.

D. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they are to mean the recognized name of the entities in the following list. Information is subject to change and is up to date as of the date of the Contract Documents.

1. CPSC - U.S. Consumer Product Safety Commission; www.cpsc.gov.
2. DOC - U.S. Department of Commerce; www.commerce.gov.
3. DOD - U.S. Department of Defense; www.defense.gov.
4. DOE - U.S. Department of Energy; www.energy.gov.
5. DOJ - U.S. Department of Justice; www.ojp.usdoj.gov
6. DOS - U.S. Department of State; www.state.gov.
7. EPA - United States Environmental Protection Agency; www.epa.gov.
8. FAA - Federal Aviation Administration; www.faa.gov.

9. GPO - U.S. Government Publishing Office; www.gpo.gov.
10. GSA - U.S. General Services Administration; www.gsa.gov.
11. HUD - U.S. Department of Housing and Urban Development; www.hud.gov.
12. LBNL - Lawrence Berkeley National Laboratory; Energy Technologies Area; www.lbl.gov/.
13. NIST - National Institute of Standards and Technology; www.nist.gov.
14. OSHA - Occupational Safety & Health Administration; www.osha.gov.
15. TRB - Transportation Research Board; National Cooperative Highway Research Program; The National Academies; www.trb.org.
16. USACE - U.S. Army Corps of Engineers; www.usace.army.mil.
17. USDA - U.S. Department of Agriculture; Agriculture Research Service; U.S. Salinity Laboratory; www.ars.usda.gov.
18. USDA - U.S. Department of Agriculture; Rural Utilities Service; www.usda.gov.
19. USP - U.S. Pharmacopeial Convention; www.usp.org.
20. USPS - United States Postal Service; www.usps.com.

E. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they are to mean the recognized name of the standards and regulations in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.

1. CFR - Code of Federal Regulations; Available from U.S. Government Publishing Office; www.govinfo.gov.
2. DOD - U.S. Department of Defense; Military Specifications and Standards; Available from DLA Document Services; www.dsp.dla.mil/Specs-Standards/.
3. DSCC - Defense Supply Center Columbus; (see FS).
4. FED-STD - Federal Standard; (see FS).
5. FS - Federal Specification; Available from DLA Document Services; www.dsp.dla.mil/Specs-Standards/.

    a. Available from Defense Standardization Program; www.dsp.dla.mil.
    b. Available from U.S. General Services Administration; www.gsa.gov.
    c. Available from National Institute of Building Sciences/Whole Building Design Guide; www.wbdg.org.

6. MILSPEC - Military Specifications and Standards; (see DOD).
7. USAB - United States Access Board; www.access-board.gov.
8. USATBCB - U.S. Architectural & Transportation Barriers Compliance Board; (see USAB).

F. State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they are to mean the recognized name of the entities in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.

1. BEARHFTI; California Bureau of Electronic and Appliance Repair, Home Furnishings and Thermal Insulation; (see BHGS).
2. BHGS; State of California Bureau of Household Goods and Services; (Formerly: California Bureau of Electronic and Appliance Repair, Home Furnishings and

Thermal Insulation); www.bhgs.dca.ca.gov.

3. CCR; California Code of Regulations; Office of Administrative Law; California Title 24 Energy Code; www.oal.ca.gov/publications/ccr/.
4. CDPH; California Department of Public Health; Indoor Air Quality Program; www.cdph.ca.gov/Programs/CCDPHP/DEODC/EHLB/IAQ/Pages/Main-Page.aspx.
5. CPUC; California Public Utilities Commission; www.cpuc.ca.gov.
6. SCAQMD; South Coast Air Quality Management District; www.aqmd.gov.
7. TFS; Texas A&M Forest Service; Sustainable Forestry and Economic Development; https://tfsweb.tamu.edu/.

PART 2 - PRODUCTS (Not Used)
PART 3 - EXECUTION (Not Used)

END OF SECTION 014200

SECTION 014339

MOCKUPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Integrated exterior mockups.

B. Related Requirements:

1. Section 014000 "Quality Requirements" for quality assurance requirements for aesthetic and workmanship mockups specified in other Sections.

1.2 DEFINITIONS

A. Integrated Exterior Mockups: Mockups of the exterior envelope constructed on-site as part of permanent construction, consisting of multiple products, assemblies, and subassemblies.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Meet with Owner, Architect, testing and inspecting agency representative, and installers of major systems whose Work is included in integrated exterior mockups.
2. Review locations and extent of mockups.
3. Review testing procedures to be performed on mockups.
4. Review and finalize schedule for mockups, and verify availability of materials, personnel, equipment, and facilities needed to complete mockups and testing and maintain schedule for the Work.

1.4 ACTION SUBMITTALS

A. Shop Drawings: For integrated exterior mockups.

1. Include plans, elevations, sections, and mounting, attachment and support details.
2. Indicate manufacturer and model number of individual components, subassemblies, and assemblies.

3. Include site location drawing indicating orientation of mockup.
4. Revise and resubmit Shop Drawings to reflect approved modifications in details and component interfaces resulting from changes made during testing procedures.

B. Delegated Design Submittal: For temporary structural supports for mockups not attached to building structure, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified in accordance with ASTM E699 for testing indicated and accredited by IAS or ILAC Mutual Recognition Arrangement as complying with ISO/IEC 17025 and acceptable to Owner and Architect.

B. Build mockups to do the following:

1. Verify selections made under Sample submittals.
2. Demonstrate aesthetic effects.
3. Demonstrate the qualities of products and workmanship.
4. Demonstrate acceptable coordination between components and systems.
5. Perform preconstruction testing, such as window air- and water-leakage testing.
6. Demonstrate compliance with specified installation tolerances.

C. Fabrication: Before fabricating or installing portions of the Work requiring mockups, build mockups for each form of construction and finish required. Use materials and installation methods as required for the Work.

1. Build mockups of size indicated.
2. Build mockups in location indicated or, if not indicated, as directed by Owner/ Architect.
3. Employ supervisory personnel who will oversee mockup construction. Employ workers who will be employed to perform same tasks during the construction at Project.
4. Demonstrate the proposed range of aesthetic effects and workmanship.
5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
6. Demolish and remove mockups when directed unless otherwise indicated.

D. Notifications:

1. Notify Architect seven days in advance of the dates and times when mockups will be constructed.
2. Allow seven days for initial review and each re-review of each mockup.

E. Approval: Obtain Architect's approval of mockups before starting fabrication or construction of corresponding Work.

1. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 COORDINATION

A. Coordinate schedule for construction of mockups, so construction, testing, and review of mockups do not impact Project schedule.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design support structure for free-standing mockups.

B. Structural Performance:

1. Wind Loads: As indicated on Drawings.

C. Mockup Testing Performance Requirements: Perform tests using design pressures and performance criteria indicated for assemblies and products that are specified in other Sections and incorporated into integrated exterior mockups.

2.2 INTEGRATED EXTERIOR MOCKUPS

A. Construct integrated exterior mockups according to approved mockup Shop Drawings and as indicated on Drawings. Construct mockups to demonstrate constructability, coordination of trades, and sequencing of Work; and to ensure materials, components, subassemblies, assemblies, and interfaces integrate into a system complying with indicated performance and aesthetic requirements.

B. Design and construct foundation and superstructure to support free-standing integrated exterior mockups.

C. Build integrated exterior mockups using installers and construction methods that will be used in completed construction.

D. Use specified products that have been approved by Architect. Coordinate installation of materials and products specified in individual Specification Sections that include Work included in integrated exterior mockups.

E. The Work of integrated exterior mockups includes, but is not limited to, the following:

1. Precast architectural concrete.
2. Masonry veneer.
3. Stone cladding.
4. Air and weather barriers.
5. Thermal insulation.
6. Through-wall flashing.
7. Flashing and sheet metal trim.
8. Joint sealants.

F. Provide and document modifications to construction details and interfaces between components and systems required to properly sequence the Work, or to pass performance testing requirements. Obtain Architect's approval for modifications.

G. Retain approved mockups constructed in place. Incorporate fully into the Work.

PART 3 - EXECUTION

3.1 TESTING OF INTEGRATED EXTERIOR MOCKUPS

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

1. Testing and inspecting agency will interpret tests and state in each report whether tested Work complies with or deviates from requirements.

B. Integrated Exterior Mockup Testing Services: Perform the following tests in the following order:

1. Water-Spray Test: Before installation of interior finishes has begun, test areas designated by Architect in accordance with AAMA 501.2 for evidence of water penetration.

a. Perform a minimum of three tests in areas as directed by Architect.

2. Air Leakage: Test in accordance with ASTM E783 at 1.5 times the rate specified in "Mockup Testing Performance Requirements" Paragraph in "Performance Requirements" Article, but not more than 0.09 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft.

a. Perform a minimum of three tests in areas as directed by Architect.

3. Water Penetration: Test in accordance with ASTM E1105 at a minimum uniform and cyclic static-air-pressure differential of 0.67 times the static-air-pressure differential specified for laboratory testing in "Mockup Testing Performance Requirements" Paragraph in "Performance Requirements" Article, but not less

than 6.24 lbf/sq. ft. , and verify no evidence of water penetration.

C. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and installations, including connections, and also to observe testing for the following systems and assemblies.

D. Integrated exterior mockup will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

END OF SECTION 014339

SECTION 015000

TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.

B. Related Requirements:

1. Section 011000 "Summary" for work restrictions and limitations on utility interruptions.
2. Section 012100 "Allowances" for allowance for metered use of temporary utilities.

1.2 USE CHARGES

A. General: Cost or use charges for temporary facilities are not chargeable to the Owner or Architect unless specifically noted otherwise. The Owner will not accept a Contractor's cost or use charges for temporary services or facilities as a basis of claim for an adjustment in the Contract Sum or the Contract Time

B. Installation, removal, and use charges for temporary facilities to be included in the Contract Sum unless otherwise indicated. Allow other entities engaged in the Project to use temporary services and facilities without cost, including, but not limited to, Architect, testing agencies, and authorities having jurisdiction.

C. Water Service: Contractor to Pay water-service use charges for water used by all entities for construction operations.

D. Electric Power Service: Contractor to Pay electric-power-service use charges for electricity used by all entities for construction operations.

E. Electric Power Service from Existing System: Electric power from Owner's existing system is available for use with metering and contractor to pay for this. Provide connections and extensions of services and metering as required for construction operations.

1.3 INFORMATIONAL SUBMITTALS

A. Site Utilization Plan: Show temporary facilities, temporary utility lines and connections, staging areas, construction site entrances, vehicle circulation, and parking areas for

construction personnel.

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

C. Project Identification and Temporary Signs: Show fabrication and installation details, including plans, elevations, details, layouts, typestyles, graphic elements, and message content.

D. Erosion- and Sedimentation-Control Plan: Show compliance with requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.

E. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire-prevention program.

1.4 QUALITY ASSURANCE

A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

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

1.5 PROJECT CONDITIONS

A. Temporary Use of Permanent Facilities: Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

B. Conditions of Use: Keep temporary services and facilities clean and neat in appearance. Operate in a safe and efficient manner. Relocate temporary services and facilities as the Work progresses. Do not overload facilities or permit them to interfere with progress. Take necessary fire-prevention measures. Do not allow hazardous, dangerous, or unsanitary conditions, or public nuisances to develop or persist on-site.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Temporary Fencing: By Contractor

B. Dust-Control Adhesive-Surface Walk-Off Mats: Provide mats, minimum 36 by 60 inches.

C. Lumber and Plywood: Comply with the requirements of Div 06 Section “Rough Carpentry”

2.2 TEMPORARY FACILITIES

A. Field Offices:

1. Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.

B. Common-Use Field Office: Contractor to provide field office for Architect.

1. Job Meetings to occur in Contractor’s field office. Location to be decided.

C. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.

1. Store combustible materials apart from building.

D. Temporary Toilet Units: Provide self-contained, single-occupant toilet units of the chemical, aerated recirculation, or combustion type. Provide units properly vented and fully enclosed with a glass-fiber-reinforced polyester shell or similar nonabsorbent material.

2.3 EQUIPMENT

A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.

B. Water Hoses: Provide 3/4-inch heavy-duty, abrasion-resistant, flexible rubber hoses 100 feet long, with pressure rating greater than the maximum pressure of the water distribution system. Provide adjustable shutoff nozzles at hose discharge.

C. Electrical Outlets: Provide properly configured, NEMA-polarized outlets to prevent insertion of 110- to 120-V plugs into higher voltage outlets. Provide 120-V, single phase, receptacle outlets equipped with ground-fault circuit interrupters, reset button, and pilot light for connection of power tools and equipment.

D. Electrical Power Cords: Provide grounded extension cords. Use hard-service cords where exposed to abrasion and traffic. Provide waterproof connectors to connect separate lengths of electric cords if single lengths will not reach areas where construction activities are in progress. Do not exceed safe length-voltage ratio.

E. Lamps and Light Fixtures: Provide general service incandescent lamps of wattage

required for adequate illumination. At a minimum, install weather-proof sockets complete with 100 watt lamps at 20' on center in all corridor areas, circulation areas and all spaces over 400 square feet. Provide guard cages or tempered-glass enclosures, where exposed to breakage. Provide exterior fixtures where exposed to moisture

PART 3 - EXECUTION

3.1 TEMPORARY FACILITIES, GENERAL

A. Conservation: Coordinate construction and use of temporary facilities with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.

1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. See other Sections for disposition of salvaged materials that are designated as Owner's property.

3.2 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.

B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed.

3.3 TEMPORARY UTILITY INSTALLATION

A. General: Install temporary service or connect to existing service.

1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.

B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.

1. Connect temporary sewers to municipal system as directed by authorities having jurisdiction.

C. Water Service:

1. Install water service and distribution piping in sizes and pressures adequate for construction.
2. Connect to Owner's existing water service facilities. Clean and maintain water service facilities in a condition acceptable to Owner. At Substantial Completion,

restore these facilities to condition existing before initial use.

D. Sanitary Facilities: Provide temporary toilets, wash facilities, safety shower and eyewash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.

1. Use of Permanent Toilets: Use of Owner's existing or new toilet facilities is not permitted

E. Electric Power Service:

1. Connect to Owner's existing electric power service. Maintain equipment in a condition acceptable to Owner.
2. Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.

a. Connect temporary service to Owner's existing power source, as directed by Owner.

F. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.

1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.

G. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel. Install WiFi cell phone access equipment and one land-based telephone line(s) for each field office.

1. Provide additional telephone lines for the following:
2. At each telephone, post a list of important telephone numbers.

a. Police and fire departments.
b. Ambulance service.
c. Contractor's home office.
d. Contractor's emergency after-hours telephone number.
e. Landscape architect’s office.
f. Architect's office.
g. Engineers' offices.
h. Owner's office.
i. Principal subcontractors' field and home offices.

3.4 SUPPORT FACILITIES INSTALLATION

A. Comply with the following:

1. Provide construction for temporary field offices, shops, and sheds located within construction area or within 30 feet of building lines that is noncombustible in accordance with ASTM E136. Comply with NFPA 241.
2. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

B. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate for construction operations. Locate temporary roads and paved areas as indicated on Drawings.

1. Provide dust-control treatment that is nonpolluting and nontracking. Reapply treatment as required to minimize dust.

C. Temporary Use of Planned Permanent Roads and Paved Areas: Locate temporary roads and paved areas in same location as permanent roads and paved areas. Construct and maintain temporary roads and paved areas adequate for construction operations. Extend temporary roads and paved areas, within construction limits indicated, as necessary for construction operations.

1. Coordinate elevations of temporary roads and paved areas with permanent roads and paved areas.
2. Prepare subgrade and install subbase and base for temporary roads and paved areas in accordance with Section 312000 "Earth Moving."
3. Recondition base after temporary use, including removing contaminated material, regrading, proofrolling, compacting, and testing.
4. Delay installation of final course of permanent hot-mix asphalt pavement until immediately before Substantial Completion. Repair hot-mix asphalt base-course pavement before installation of final course in accordance with Section 321216 "Asphalt Paving."

D. Traffic Controls: Comply with requirements of authorities having jurisdiction.

1. Protect existing site improvements to remain, including curbs, pavement, and utilities.
2. Maintain access for fire-fighting equipment and access to fire hydrants.

E. Parking: Use designated areas of Owner's existing parking areas for construction personnel.

F. Storage and Staging: Use designated areas of Project site for storage and staging needs.

G. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.

1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities.

2. Remove snow and ice as required to minimize accumulations.

H. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.

1. Identification Signs: Provide Project identification signs as indicated on Drawings.
2. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.

a. Provide temporary, directional signs for construction personnel and visitors.

3. Maintain and touch up signs, so they are legible at all times.

I. Waste Disposal Facilities:

1. Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."
2. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

3.5 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.

1. Where access to adjacent properties is required in order to affect protection of existing facilities, obtain written permission from adjacent property owner to access property for that purpose.

B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.

1. Comply with work restrictions specified in Section 011000 "Summary."

C. Temporary Erosion and Sedimentation Control:

1. Comply with requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent and requirements specified in Section 311000 "Site Clearing."
2. Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to undisturbed areas and to adjacent properties and walkways, in accordance with erosion- and sedimentation-control Drawings, requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.

a. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross tree- or plant-protection zones.
b. Inspect, repair, and maintain erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
c. Clean, repair, and restore adjoining properties and roads affected by erosion and sedimentation from Project site during the course of Project.
d. Remove erosion and sedimentation controls, and restore and stabilize areas disturbed during removal.

D. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.

E. Tree and Plant Protection:

1. Comply with requirements specified in Section 015639 "Temporary Tree and Plant Protection."
2. Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.

F. Rodent and Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals, so Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using materials approved by authorities having jurisdiction.

G. Site Enclosure Fence: Contractor to provide site enclosure fence.

H. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each workday.

I. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.

J. Temporary Egress: Provide temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction. Provide signage directing occupants to temporary egress.

K. Covered Walkway: Contractor to provide covered walkways.

L. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.

M. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire-prevention program.

1. Prohibit smoking in construction areas. Comply with additional limits on smoking specified in other Sections.
2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition in accordance with requirements of authorities having jurisdiction.
3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.

3.6 OPERATION, TERMINATION, AND REMOVAL

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

B. Maintenance: Maintain facilities in good operating condition until removal.

C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.

D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
2. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
3. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 017700 "Closeout Procedures."

END OF SECTION 015000

SECTION 015639

TEMPORARY TREE AND PLANT PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

A. The Work of this Section Includes: General protection and pruning of existing trees and plants that are affected by execution of the Work, whether temporary or permanent construction.

1. Provide preconstruction evaluations
2. Provide tree and plant protection fencing.
3. Provide protection of root zones and above ground tree and plants
4. Provide the pruning of existing trees and plants.
5. Coordinate with the requirements of Section Planting Soil for modifications to the soil within the root zone of existing trees and plants.
6. Provide all insect and disease control.
7. Remove tree protection fencing and other protection from around and under trees and plants.
8. Clean up and disposal of all excess and surplus material.

B. Related Requirements:

1. Section 015000 "Temporary Facilities and Controls" for temporary controls, utilities, support facilities, temporary site fencing, and, if applicable, temporary erosion and sedimentation controls if not specified in Section 311000 "Site Clearing".
2. Refer to Baltimore County Landscape Manual/ specifications.

1.2 CONTRACT DOCUMENTS

A. Shall consist of specifications and general conditions and the drawings. The intent of these documents is to include all labor, materials, and services necessary for the proper execution of the work. The documents are to be considered as one. Whatever is called for by any parts shall be as binding as if called for in all parts.

B. It is the intent of this section that the requirements apply to all sections of the project specification such that any subcontractor must comply with the restrictions on work within designated Tree and Plant Protection Areas.

1.3 REFERENCES

A. The following specifications and standards of the organizations and documents listed in this paragraph form a part of the specification to the extent required by the references thereto. If the requirements of the following referenced standards and specification conflict with this specification section the requirements of this specification shall prevail. If the requirements of any of the following referenced standards and specifications conflict with each other the more stringent requirement shall prevail.

1. ANSI A 300 (Part 5) – Standard Practices for Tree, Shrub and other Woody Plant Maintenance, most current editions.
2. Pruning practices shall conform with recommendations “Structural Pruning: A Guide For The Green Industry”; Published by Urban Tree Foundation, Visalia, California; most current edition.
3. Glossary of Arboricultural Terms, International Society of Arboriculture, Champaign II, most current edition.

1.4 PERMITS AND REGULATIONS

A. The Contractor shall obtain and pay for all permits related to this section of the work unless previously excluded under provision of the contract or general conditions. The Contractor shall comply with all laws and ordinances bearing on the operation or conduct of the work as drawn and specified. If the Contractor observes that a conflict exists between permit requirements and the work outlined in the contract documents, the Contractor shall promptly notify the Owner’s Representative in writing including a description of any necessary changes and changes to the contract price resulting from changes in the work.
B. Wherever references are made to standards or codes in accordance with which work is to be performed or tested, the edition or revision of the standards and codes current on the effective date of this contract shall apply, unless expressly set forth.
C. In case of conflict among any referenced standards or codes or between any referenced standards and codes and the specifications, the more restrictive standard shall apply, or Owner’s Representative shall determine which shall govern.

1.5 PROTECTION OF WORK, PROPERTY AND PERSON

A. The Contractor shall protect the work, adjacent property, and the public, and shall be responsible for any damages or injury due to his/her actions.

1.6 CHANGES IN THE WORK

A. The Owner’s Representative may order changes in the work, and the contract sum should be adjusted accordingly. All such orders and adjustments plus claims by the Contractor for extra compensation must be made and approved in writing before executing the work involved.

1.7 CORRECTION OF WORK

A. The Contractor shall re-execute any work that fails to conform to the requirements of the contract and shall remedy defects due to faulty materials or workmanship upon written notice from the Owner's Representative, at the soonest possible time that can be coordinated with other work and seasonal weather demands.

1.8 DEFINITIONS

A. Caliper: Diameter of a trunk measured by a diameter tape at a height 6 inches above the ground for trees up to and including 4-inch size at this height and measured at a height of 12 inches above the ground for trees larger than 4-inch size.

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

C. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction and indicated on Drawings defined by a circle concentric with each tree with a radius 1.5 times the diameter of the drip line unless otherwise indicated

D. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.9 ACTION SUBMITTALS

A. Product Data:

1. General protection and pruning of existing trees and plants that are affected by execution of the Work, whether temporary or permanent construction

B. Shop Drawings:

1. Include plans, elevations, and sections showing trees and plants to be protected, locations of protection-zone fencing and signage, and the relationship between equipment-movement routes and material storage locations with protection zones.
2. Detail fabrication and assembly of protection-zone fencing and signage.
3. Indicate extent of utility boring and trenching by hand or with air spade within protection zones.

C. Samples: For each type of the following:

1. Organic Mulch: 1-quart volume of organic mulch; in sealed plastic bags labeled with composition of materials by percentage of weight and source of mulch.
2. Protection-Zone Fencing: Assembled Samples of manufacturer's standard size made from full-size components
3. Protection-Zone Signage: Full-size Samples of each size and text, ready for installation.

D. Tree-Pruning Schedule: Written schedule detailing scope and extent of pruning of trees to remain that interfere with or are affected by construction.

1. Species and size of tree.
2. Location on site plan. Include unique identifier for each.
3. Reason for pruning.
4. Description of pruning to be performed.
5. Description of maintenance following pruning.

E. Maintenance Recommendations: From arborist, for care and protection of trees affected by construction during and after completing the Work.

F. Mitigation Requirements: As required by jurisdiction or as developed by arborist, for mitigation of damage to trees and other plantings. Include the following:

1. Local ordinances governing tree mitigation.
2. Standards established under the approved tree mitigation report developed by the arborist.
3. "Digital Guide for Plant Appraisal" by Council of Tree and Landscape Appraisers.

1.10 INFORMATIONAL SUBMITTALS

A. Qualification Statements: For arborist and tree service firm.

B. Certification: From arborist, certifying that trees indicated to remain have been protected during construction in accordance with recognized standards and that trees were promptly and properly treated and repaired when damaged.

C. Maintenance Recommendations: From arborist, for care and protection of trees affected by construction during and after completing the Work.

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

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 plants designated to remain.

E. Quality-control program.

1.11 QUALITY ASSURANCE

A. Arborist Qualifications: Certified Arborist as certified by ISA

B. Quality-Control Program: Prepare a written program to systematically demonstrate the ability of personnel to properly follow procedures and handle materials and equipment

during the Work without damaging trees and plantings. Include dimensioned diagrams for placement of protection-zone fencing and signage, the arborist's and tree-service firm's responsibilities, instructions given to workers on the use and care of protection zones, and enforcement of requirements for protection zones.

1.12 FIELD CONDITIONS

A. The following practices are prohibited within protection zones:

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

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

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

D. Take precautions to protect plants from airborne contaminants, such as paint or fireproofing overspray.

PART 2 - PRODUCTS

2.1 MATERIALS

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

1. Mixture: Well-blended mix of 2 parts stockpiled soil to 1 part planting soil.
2. Planting Soil: Planting soil as specified in Section 329115 "Soil Preparation (Performance Specification)."

B. Organic Mulch: Free from deleterious materials and suitable as a top dressing for trees and shrubs, consisting of one of the following:

1. Type: Shredded hardwood
2. Size Range: 3 inches maximum
3. Color: Natural.

C. Protection-Zone Fencing: Fencing fixed in position and meeting one of the following requirements:

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

a. Height: 72 inches
b. Polymer-Coating Color: Dark green or Black

D. MATTING

A. Matting for vehicle and work protection shall be heavy duty matting designed for vehicle loading over tree roots, Alturnamats as manufactured by Alturnamats, Inc. Franklin, PA 16323 or approved equal.
B. Submit supplier’s product data that product meets the requirements for approval.

E. GEOGRID

A. Geogrid shall be woven polyester fabric with PVC coating, Uni-axial or biaxial geogrid, inert to biological degradation, resistant to naturally occurring chemicals, alkalis, acids.

B. Geogrid shall be Miragrid 2XT as manufactured by Ten Cate Nicolon, Norcross, GA. http://www.tencate.com or approved equal.

C. Submit supplier’s product data that product meets the requirements for approval.

F. FILTER FABRIC

A. Filter Fabric shall be nonwoven polypropylene fibers, inert to biological degradation and resistant of naturally occurring chemicals, alkalis and acids.

B. Mirafi 135 N as manufactured by Ten Cate Nicolon, Norcross, GA. http://www.tencate.com or approved equal.

C. Submit supplier’s product data that product meets the requirements for approval.

G. Protection-Zone Signage: Shop-fabricated, rigid plastic or metal sheet with attachment holes pre-punched and reinforced; legibly printed with nonfading lettering and as follows:

1. Size and Text: As indicated on Drawings
2. Lettering: 3-inch-high minimum, black characters on white background unless required otherwise by permit agency.

PART 3 - EXECUTION

3.1 EXAMINATION

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

B. Prepare written report, endorsed by arborist, listing conditions detrimental to tree and plant protection.

3.2 PREPARATION

A. Locate and clearly identify trees, shrubs, and other vegetation to remain. Tie a 1-inch blue vinyl tape around each tree trunk at 54 inches above the ground.

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

3.3 TREE PROTECTION

A. Tree-Protection Zones: Mulch areas inside tree-protection zones and other areas indicated. Do not exceed indicated thickness of mulch.

1. Apply 2-inch uniform thickness of organic mulch unless otherwise indicated. Do not place mulch within 6 inches of tree trunks.
2. Install temporary root-protection matting over mulch to the extent indicated.

B. Trunk Protection: Protect the trunk of each tree to remain as follows:

1. Install 2-by-6-inch wood planks around trunk at maximum 3 inches apart. Minimum three planks per tree. Band together with no less than three steel bands stapled to the planks to hold them securely in place. Wrap orange plastic construction fencing to a minimum of three layers outside slats. Fasten wrap with wire.

a. Height: 48 inches from lowest branch

3.4 PROTECTION ZONES

A. Protection-Zone Fencing: Install protection-zone fencing along edges of protection zones before materials or equipment are brought on the site and construction operations begin in a manner that will prevent people and animals from easily entering

protected areas except by entrance gates. Construct fencing so as not to obstruct safe passage or visibility at vehicle intersections where fencing is located adjacent to pedestrian walkways or in close proximity to street intersections, drives, or other vehicular circulation.

1. Chain-Link Fencing: Install to comply with ASTM F567 and with manufacturer's written instructions.
2. Posts: Set or drive posts into ground one-third the total height of the fence without concrete footings. Where a post is located on existing paving or concrete to remain, provide appropriate means of post support acceptable to Architect.
3. Access Gates: Install where indicated; adjust 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. Protection-Zone Signage: Install protection-zone signage in visibly prominent locations in a manner approved by Architect. Install one sign spaced approximately every 20 ft. on protection-zone fencing, but no fewer than four signs with each facing a different direction.

C. Maintain protection zones free of weeds and trash.

D. Maintain hydration of plants to assure plant survival.

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

1. Do not remove protection-zone fencing, even temporarily, to allow deliveries or equipment access through the protection zone.
2. Temporary access is permitted subject to preapproval in writing by arborist if a root buffer effective against soil compaction is constructed as directed by arborist. Maintain root buffer so long as access is permitted.

3.5 SOIL MOISTURE

A. Volumetric soil moisture level, in all soils within the Tree and Plant Protection Area shall be maintained above permanent wilt point to a depth of at least 8 inches. No soil work or other activity shall be permitted within the Tree and Plant Protection Area when the volumetric soil moisture is above field capacity. The permanent wilt point and field capacity for each type of soil texture shall be defined as follows (numbers indicate percentage volumetric soil moisture).

Soil Type	Permanent wilt point v/v	Field capacity v/v
Sand, Loamy sand, Sandy loam	5-8%	12-18%

Loam, Sandy clay, Sandy clay loam	14-25%	27-36%
Clay loam, Silt loam	11-22%	31-36%
Silty clay, Silty clay loam	22-27%	38-41%

1. Volumetric soil moisture shall be measured with a digital, electric conductivity meter. The meter shall be the Digital Soil Moisture Meter, DSMM500 by General Specialty Tools and Instruments, or approved equivalent meter.

B. The Contractor shall confirm the soil moisture levels with a moisture meter. If the moisture is too high, suspend operations until the soil moisture drains to below field capacity.

3.6 EXCAVATION

A. General: Excavate at edge of protection zones and for trenches indicated within protection zones in accordance with requirements in Section 312000 "Earth Moving" unless otherwise indicated.

B. Trenching within Protection Zones: Where utility trenches are required within protection zones, excavate under or around tree roots by hand or with air spade, or tunnel under the roots by drilling, auger boring, or pipe jacking. Do not cut main lateral tree roots or taproots; cut only smaller roots that interfere with installation of utilities. Cut roots as required for root pruning. If excavating by hand, use narrow-tine spading forks to comb soil and expose roots.

3.7 ROOT PRUNING

A. Prune tree roots that are affected by temporary and permanent construction. Prune roots as follows:

1. Cut roots manually by digging a trench and cutting exposed roots with sharp pruning instruments; do not break, tear, chop, or slant the cuts. Do not use a backhoe or other equipment that rips, tears, or pulls roots.
2. Cut Ends: Do not paint cut root ends.
3. Temporarily support and protect roots from damage until they are permanently covered with soil.
4. Cover exposed roots with burlap and water regularly.
5. Backfill as soon as possible in accordance with requirements in Section 312000 "Earth Moving."

B. Root Pruning at Edge of Protection Zone: Prune tree roots flush with the edge of the protection zone by cleanly cutting all roots to the depth of the required excavation.

C. Root Pruning within Protection Zone: Clear and excavate by hand or with air spade to the depth of the required excavation to minimize damage to tree root systems. If

excavating by hand, use narrow-tine spading forks to comb soil to expose roots. Cleanly cut roots as close to excavation as possible.

3.8 CROWN PRUNING

A. Prune branches that are affected by temporary and permanent construction. Prune branches as indicated on Drawings, under direction of arborist.

1. Prune to remove only injured, broken, dying, or dead branches unless otherwise indicated. Do not prune for shape unless otherwise indicated.
2. Do not remove or reduce living branches to compensate for root loss caused by damaging or cutting root system.
3. Pruning Standards: Prune trees in accordance with ANSI A300 (Part 1) and as indicated on Drawings.

    a. Type of Pruning: Cleaning, raising and thinning where indicated.

B. Unless otherwise directed by arborist and acceptable to Architect, do not cut tree leaders.

C. Cut branches with sharp pruning instruments; do not break or chop.

D. Do not paint or apply sealants to wounds.

E. Provide subsequent maintenance pruning during Contract period as recommended by arborist.

F. Chip removed branches and spread over areas identified by Architect.

3.9 INSTALLATION OF GEOGRIDS, FILTER FABRIC, MATTING, WOOD CHIPS AND OR MULCH

A. Install Geogrids, Filter Fabric, matting, Wood Chips and or Mulch in areas and depths shown on the plans and details or as directed by the Owner's representative. In general, it is the intent of this specification to provide the following levels of protection:

1. All areas within the Tree and Plant Protection area provide a minimum of 5 inches of Wood Chips or Mulch.
2. Areas where foot traffic or storage of lightweight materials is anticipated to be unavoidable provide a layer of Filter Fabric under the 5 inches of Wood Chips or Mulch.
3. Areas where occasional light vehicle traffic is anticipated to be unavoidable provide a layer of Geogrids under 8 inches of Wood Chips or Mulch.
4. Areas where heavy vehicle traffic is unavoidable provide a layer of Geogrids under 8 - 12
inches of Wood Chips or Mulch and a layer of matting over the Wood Chips or Mulch.

B. The Owner's Representative shall approve the appropriate level of protection.

C. In the above requirements, light vehicles are defined as a track skid steer with a ground pressure of 4 psi or lighter. A heavy vehicle is any vehicle with a tire or track pressure of greater than 4 psi. Lightweight materials are any packaged materials that can be physically moved by hand into the location. Bulk materials such as soil, or aggregate shall never be stored within the Tree and Plant Protection Area.

3.10 PROTECTION

A. Always Protect the Tree and Plant Protection Area from compaction of the soil; damage of any kind to trunks, bark, branches, leaves and roots of all plants; and contamination of the soil, bark or leaves with construction materials, debris, silt, fuels, oils, and any chemicals substance. Notify the Owner’s Representative of any spills, compaction or damage and take corrective action immediately using methods approved by the Owner’s Representative.

3.11 GENERAL REQUIREMENTS AND LIMITATIONS FOR OPERATIONS WITHIN THE TREE AND PLANT PROTECTION AREA

A. The Contractor shall not engage in any construction activity within the Tree and Plant Protection Area without the approval of the Owner's Representative including operating, moving or storing equipment; storing supplies or materials; locating temporary facilities including trailers or portable toilets and shall not permit employees to traverse the area to access adjacent areas of the project or use the area for lunch or any other work breaks. Permitted activity, if any, within the Tree and Plant Protection Area may be indicated on the drawings along with any required remedial activity as listed below.
B. If construction activity is unavoidable within the Tree and Plant Protection Area, notify the Owner’s Representative and submit a detailed written plan of action for approval. The plan shall include: a statement detailing the reason for the activity including why other areas are not suited; a description of the proposed activity; the time period for the activity, and a list of remedial action that will reduce the impact on the Tree and Plant Protection Area from the activity. Remedial actions shall include but shall not be limited to the following:

    1. In general, demolition and excavation within the drip line of trees and shrubs shall proceed with extreme care either by the use of hand tools, directional boring and or Air Knife excavation where indicated or with other low impact equipment that will not cause damage to the tree, roots or soil.
    2. When encountered, exposed roots, 1 inch and larger in diameter shall be worked around in a manner that does not break the outer layer of the root surface (bark). These roots shall be covered in Wood Chips and shall be maintained above permanent wilt point at all times. Roots one inch and larger in diameter shall not be cut without the approval of the owner’s representative. Excavation shall be tunneled under these roots without cutting them. In the areas where roots are

encountered, work shall be performed and scheduled to close excavations as quickly as possible over exposed roots.

3. Tree branches that interfere with the construction may be tied back or pruned to clear only to the point necessary to complete the work. Other branches shall only be removed when specifically indicated by the Owner's Representative. Tying back or trimming of all branches and the cutting of roots shall be in accordance with accepted arboricultural practices (ANSI A300, part 8) and be performed under supervision of the arborist.
4. Matting: Install temporary matting over the Wood Chips or Mulch to the extent indicated. Do not permit foot traffic, scaffolding or the storage of materials within the Tree and Plant Protection Area to occur off of the temporary matting.
5. Trunk Protection: Protect the trunk of each tree to remain by covering it with a ring of 8 foot long 2-inch x 6 - inch planks loosely banded onto the tree with 3 steel bands. Staple the bands to the planks as necessary to hold them securely in place. Trunk protection must be kept in place no longer than 12 months. If construction requires work near a particular tree to continue for longer than 12 months, the steel bands shall be inspected every six months and loosened if they are found to have become tight.
6. Air Excavation Tool: If excavation for footings or utilities is required within the Tree and Plant Protection Area, air excavation tool techniques shall be used where practical or as designed on the drawings.

a) Remove the Wood Chips from an area approximately 18 inches beyond the limits of the hole or trench to be excavated. Cover the Wood Chips for a distance of not less than 15 feet around the limit of the excavation area with Filter Fabric or plastic sheeting to protect the Wood Chips from silt. Mound the Wood Chips so that the plastic slopes towards the excavation.

b) Using a sprinkler or soaker hose, apply water slowly to the area of the excavation for a period of at least 4 hours, approximately 12 hours prior to the work so that the ground water level is at or near field capacity at the beginning of the work. For excavations that go beyond the damp soil, rewet the soil as necessary to keep soil moisture near field capacity.

c) Using an air excavation tool specifically designed and manufactured for the intended purpose, and at pressures recommended by the manufacturer of the equipment, fracture the existing soil to the shape and the depths required. Work at rates and using techniques that do not harm tree roots. Air pressure shall be a maximum of 90-100 psi.

- The air excavation tool shall be "Air-Spade" as manufactured by Concept Engineering Group, Inc., Verona, PA (412) 826-8800, or Air Knife as manufactured by Easy Use Air Tools, Inc. Allison Park, Pa (866) 328-5723 or approved equal.

d) Using a commercial, high-powered vacuum truck if required, remove the soil from the excavation produced by the Air Knife excavation. The vacuum truck should generally operate simultaneously with the hose operator, such that the soil produced is picked up from the excavation hole, and the exposed roots can be observed and not damaged by the ongoing operation. Do not drive the vacuum truck into the Tree and Plant Protection Area unless the area is protected from compaction as approved in advance by the Owner's Representative.

e) Remove all excavated soil and excavated Wood Chips, and contaminated soil at the end of the excavation.

f) Schedule the work so that foundations or utility work is completed immediately after the excavation. Do not let the roots dry out. Mist the roots several times during the day. If the excavated area must remain open overnight, mist the roots and cover the excavation with black plastic.

g) Dispose of all soil in a manner that meets local laws and regulations.

h) Restore soil within the trench as soon as the work is completed. Utilize soil of similar texture to the removed soil and lightly compact with hand tools. Leave soil mounded over the trench to a height of approximately 10% of the trench depth to account for settlement.

- Restore any Geogrids, Filter Fabric, Wood Chips or Mulch and or matting that was previously required for the area.

3.12 REGRADING

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

B. Lowering Grade within Protection Zone: Where new finish grade is indicated below existing grade around trees, slope grade away from trees as recommended by arborist unless otherwise indicated.

   1. Root Pruning: Prune tree roots exposed by lowering the grade. Do not cut main lateral roots or taproots; cut only smaller roots. Cut roots as required for root pruning.

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

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

3.13 CLEAN-UP

A. During tree and plant protection work, keep the site free of trash, pavements reasonably clean and work area in an orderly condition at the end of each day. Remove trash and debris in containers from the site no less than once a week.
B. Immediately clean up any spilled or tracked soil, fuel, oil, trash or debris deposited by the Contractor from all surfaces within the project or on public right of ways and neighboring property.
C. Once tree protection work is complete, wash all soil from pavements and other structures. Ensure that Mulch is confined to planting beds.
D. Make all repairs to grades, ruts, and damage to the work or other work at the site.

E. Remove and dispose of all excess Mulch, Wood Chips, packaging, and other material brought to the site by the Contractor.

3.14 FIELD QUALITY CONTROL

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

3.15 REMOVAL OF FENCING AND OTHER TREE AND PLANT PROTECTION

A. At the end of the construction period or when requested by the Owner’s Representative remove all fencing, Wood Chips or Mulch, Geogrids and Filter Fabric, trunk protection and or any other Tree and Plant Protection material.

3.16 REPAIR AND REPLACEMENT

A. General: Repair or replace trees, shrubs, and other vegetation indicated to remain or to be relocated that are damaged by construction operations, in a manner approved by Architect.

1. Submit details of proposed pruning and repairs.
2. Perform repairs of damaged trunks, branches, and roots within 24 hours in accordance with arborist's written instructions.
3. Replace trees and other plants that cannot be repaired and restored to full-growth status, as determined by Architect.

B. Trees: Remove and replace trees indicated to remain that are more than 25 percent dead or in an unhealthy condition before the end of the corrections period or are damaged during construction operations that Architect determines are incapable of restoring to normal growth pattern.

1. Small Trees: Provide new trees of same size and species as those being replaced for each tree that measures 4 inches or smaller in caliper size.
2. Large Trees: Provide two new tree(s) of 6-inch caliper size for each tree being replaced those measures more than 6 inches in caliper size.

    a. Species: As selected by Architect.

3. Plant and maintain new trees as specified in Section 329300 "Plants."

END OF SECTION 015639

SECTION 015723

TEMPORARY STORM WATER POLLUTION CONTROL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Temporary stormwater pollution controls.

1.2 STORMWATER POLLUTION PREVENTION PLAN

A. The Stormwater Pollution Prevention Plan (SWPPP) is part of the Contract Documents and is bound into this Project Manual.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site

1. Meet with Owner, Architect, and earthwork subcontractor.
2. Review requirements of the SWPPP, including permitting process, worker training, and inspection and maintenance requirements.

1.4 INFORMATIONAL SUBMITTALS

A. Stormwater Pollution Prevention Plan (SWPP): Within 15 days of date established for commencement of the Work, submit completed SWPPP.

B. EPA authorization under the EPA's "2017 Construction General Permit (CGP)."

C. Stormwater Pollution Prevention (SWPP) Training Log: For each individual performing Work under the SWPPP.

D. Inspection reports.

1.5 QUALITY ASSURANCE

A. Stormwater Pollution Prevention Plan (SWPPP) Coordinator: Experienced individual or firm with a record of successful water pollution control management coordination of projects with similar requirements.

1. SWPPP Coordinator shall complete and finalize the SWPPP form.
2. SWPPP Coordinator shall be responsible for inspections and maintaining of all requirements of the SWPPP.

B. Installers: Trained as indicated in the SWPPP.

PART 2 - PRODUCTS

2.1 TEMPORARY STORMWATER POLLUTION CONTROLS

A. Provide temporary stormwater pollution controls as required by the SWPPP.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with all best management practices, general requirements, performance requirements, reporting requirements, and all other requirements included in the SWPPP.

B. Locate stormwater pollution controls in accordance with the SWPPP.

C. Conduct construction as required to comply with the SWPPP and that minimize possible contamination or pollution or other undesirable effects.

1. Inspect, repair, and maintain SWPPP controls during construction.

a. Inspect all SWPPP controls not less than every seven days, and after each occurrence of a storm event, as outlined in the SWPPP.

D. Remove SWPPP controls at completion of construction and restore and stabilize areas disturbed during construction.

END OF SECTION 015723

SECTION 016000

PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. The Work of This Section Includes: Administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.

B. Related Requirements:

1. Section 011000 "Summary" for Contractor requirements related to Owner-furnished products.
2. Section 012500 "Substitution Procedures" for requests for substitutions.
3. Section 017700 "Closeout Procedures" for submitting warranties.

1.2 DEFINITIONS

A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.

1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
2. New Products: Items that have not previously been incorporated into another project or facility. Salvaged items or items reused from other projects are not considered new products. Items that are manufactured or fabricated to include recycled content materials are considered new products unless otherwise indicated.
3. Comparable Product: Product by named manufacturer that is demonstrated and approved through the comparable product submittal process described in "Comparable Products" Article, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

B. Basis-of-Design Product Specification: A specification in which a single manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation. Published attributes and characteristics of basis-of-design product establish salient characteristics of products.

1. Evaluating Comparable Products: In addition to the basis-of-design product description, product attributes and characteristics may be listed to establish the significant qualities related to type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other special features and requirements for purposes of evaluating comparable products of additional manufacturers named in the specification. Manufacturer's published attributes and characteristics of basis-of-design product also establish salient characteristics of products for purposes of evaluating comparable products.

C. Subject to Compliance with Requirements: Where the phrase "Subject to compliance with requirements" introduces a product selection procedure in an individual Specification Section, provide products qualified under the specified product procedure. In the event that a named product or product by a named manufacturer does not meet the other requirements of the specifications, select another named product or product from another named manufacturer that does meet the requirements of the specifications; submit a comparable product request or substitution request, if applicable.

D. Comparable Product Request Submittal: An action submittal requesting consideration of a comparable product, including the following information:

1. Identification of basis-of-design product or fabrication or installation method to be replaced, including Specification Section number and title and Drawing numbers and titles.
2. Data indicating compliance with the requirements specified in "Comparable Products" Article.

E. Basis-of-Design Product Specification Submittal: An action submittal complying with requirements in Section 013300 "Submittal Procedures."

F. Substitution: Refer to Section 012500 "Substitution Procedures" for definition and limitations on substitutions.

1.3 QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.

B. Identification of Products: Except for required labels and operating data, do not attach or imprint manufacturer or product names or trademarks on exposed surfaces of products or equipment that will be exposed to view in occupied spaces or on the exterior.

1. Labels: Locate required product labels and stamps on a concealed surface, or, where required for observation following installation, on a visually accessible surface that is inconspicuous.
2. Equipment Nameplates: Provide a permanent nameplate on each item of

service- or power-operated equipment. Locate on a visually accessible but inconspicuous surface. Include information essential for operation, including the following:

a. Name of product and manufacturer.
b. Model and serial number.
c. Capacity.
d. Speed.
e. Ratings.

3. See individual identification Sections in Divisions 21, 22, 23, and 26 for additional equipment identification requirements.

1.4 COORDINATION

A. Modify or adjust affected work as necessary to integrate work of approved comparable products and approved substitutions.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

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

B. Delivery and Handling:

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

C. Storage:

1. Provide a secure location and enclosure at Project site for storage of materials and equipment.
2. Store products to allow for inspection and measurement of quantity or counting of units.
3. Store materials in a manner that will not endanger Project structure.
4. Store products that are subject to damage by the elements under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation and with adequate protection from wind.

5. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
6. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
7. Protect stored products from damage and liquids from freezing.
8. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.6 PRODUCT WARRANTIES

A. Warranties specified in other Sections are to be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

1. Manufacturer's Warranty: Written standard warranty form furnished by individual manufacturer for a particular product and issued in the name of Owner or endorsed by manufacturer to Owner.
2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner and issued in the name of Owner or endorsed by manufacturer to Owner.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.

1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
2. Specified Form: When specified forms are included in the Project Manual, prepare a written document, using indicated form properly executed.
3. See other Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Section 017700 "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.

1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been

produced and used successfully in similar situations on other projects.

3. Owner reserves the right to limit selection to products with warranties meeting requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected," Architect will make selection.
5. Descriptive, performance, and reference standard requirements in Specifications establish salient characteristics of products.
6. Or Equal: For products specified by name and accompanied by the term "or equal," "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.

    a. Submit additional documentation required by Architect in order to establish equivalency of proposed products. Unless otherwise indicated, evaluation of "or equal" product status is by Architect, whose determination is final.

B. Product Selection Procedures:

1. Sole Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.

    a. Sole product may be indicated by the phrase "Subject to compliance with requirements, provide the following."

2. Sole Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.

    a. Sole manufacturer/source may be indicated by the phrase "Subject to compliance with requirements, provide products by the following."

3. Limited List of Products: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.

    a. Limited list of products may be indicated by the phrase "Subject to compliance with requirements, provide one of the following."

4. Non-Limited List of Products: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed or an unnamed product that complies with requirements.

    a. Non-limited list of products is indicated by the phrase "Subject to compliance with requirements, available products that may be incorporated in the Work include, but are not limited to, the following."
    b. Provision of an unnamed product is not considered a substitution, if the product complies with requirements.

5. Limited List of Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.

    a. Limited list of manufacturers is indicated by the phrase "Subject to compliance with requirements, provide products by one of the following."

6. Non-Limited List of Manufacturers: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed or a product by an unnamed manufacturer that complies with requirements.

    a. Non-limited list of manufacturers is indicated by the phrase "Subject to compliance with requirements, available manufacturers whose products may be incorporated in the Work include, but are not limited to, the following."
    b. Provision of products of an unnamed manufacturer is not considered a substitution, if the product complies with requirements.

7. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications may additionally indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.

    a. For approval of products by unnamed manufacturers, comply with requirements in Section 012500 "Substitution Procedures" for substitutions for convenience.

C. Visual Matching Specification: Where Specifications require the phrase "match Architect's sample," provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.

    1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Section 012500 "Substitution Procedures" for proposal of product.

D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or a similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

E. Sustainable Product Selection: Where Specifications require product to meet sustainable product characteristics, select products complying with indicated requirements. Comply with requirements in Division 01 sustainability requirements

Section and individual Specification Sections.

1. Select products for which sustainable design documentation submittals are available from manufacturer.

2.2 COMPARABLE PRODUCTS

A. Conditions for Consideration of Comparable Products: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with the following requirements:

1. Evidence that proposed product does not require revisions to the Contract Documents, is consistent with the Contract Documents, will produce the indicated results, and is compatible with other portions of the Work.
2. Detailed comparison of significant qualities of proposed product with those of the named basis-of-design product. Significant product qualities include attributes such as type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other specific features and requirements.
3. Evidence that proposed product provides specified warranty.
4. List of similar installations for completed projects, with project names and addresses and names and addresses of architects and owners, if requested.
5. Samples, if requested.

B. Architect's Action on Comparable Products Submittal: If necessary, Architect will request additional information or documentation for evaluation within seven days of receipt of a request for a comparable product. Architect will notify Contractor of approval or rejection of proposed comparable product within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.

1. Architect's Approval of Submittal: Marked with approval notation from Architect's action stamp, Indication of approval in web-based Project management software. See Section 013300 "Submittal Procedures."
2. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.

C. Submittal Requirements, Single-Step Process: When acceptable to Architect, incorporate specified submittal requirements of individual Specification Section in combined submittal for comparable products. Approval by Architect of Contractor's request for use of comparable product and of individual submittal requirements will also satisfy other submittal requirements.

PART 3 - EXECUTION (Not Used)

END OF SECTION 016000

SECTION 017300

EXECUTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes general administrative and procedural requirements governing execution of the Work, including, but not limited to, the following:

1. Construction layout.
2. Field engineering.
3. Installation.
4. Cutting and patching.
5. Coordination of Owner's portion of the Work.
6. Progress cleaning.
7. Starting and adjusting.
8. Protection of installed construction.
9. Correction of the Work.

B. Related Requirements:

1. Section 011000 "Summary" for coordination of Owner-furnished products and limits on use of Project site.
2. Section 013300 "Submittal Procedures" for submitting surveys.
3. Section 017700 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, replacing defective work, and final cleaning.

1.2 DEFINITIONS

A. Cutting: Removal of in-place construction necessary to permit installation or performance of subsequent work.

B. Patching: Fitting and repair work required to restore construction to original conditions after installation of subsequent work.

1.3 PREINSTALLATION MEETINGS

A. Layout Conference: Conduct conference at Project site

1. Prior to establishing layout of new perimeter and structural column grid(s), review building location requirements. Review benchmark, control point, and layout and

dimension requirements. Inform Architect of scheduled meeting. Require representatives of each entity directly concerned with Project layout to attend, including the following:

a. Contractor's superintendent.
b. Professional engineer responsible for performing Project surveying and layout.
c. Professional engineer responsible for performing site survey serving as basis for Project design.

2. Review meanings and intent of dimensions, notes, terms, graphic symbols, and other layout information indicated on the Drawings.
3. Review requirements for including layouts on Shop Drawings and other submittals.
4. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For professional engineer

B. Certified Surveys: Submit two copies signed by professional engineer.

C. Certificates: Submit certificate signed by professional engineer, certifying that location and elevation of improvements comply with requirements.

1.5 CLOSEOUT SUBMITTALS

A. Final Property Survey: Submit 10 copies showing the Work performed and record survey data.

1.6 QUALITY ASSURANCE

A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.

B. Professional Engineer Qualifications: Refer to Section 014000 "Quality Requirements."

C. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.

1. Structural Elements: When cutting and patching structural elements, or when encountering the need for cutting and patching of elements whose structural function is not known, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural

elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection.

2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operational elements include the following:

    a. Primary operational systems and equipment.
    b. Fire separation assemblies.
    c. Air or smoke barriers.
    d. Fire-suppression systems.
    e. Plumbing piping systems.
    f. Mechanical systems piping and ducts.
    g. Control systems.
    h. Communication systems.
    i. Fire-detection and -alarm systems.
    j. Conveying systems.
    k. Electrical wiring systems.
    l. Operating systems of special construction.

3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety. Other construction elements include but are not limited to the following:

    a. Water, moisture, or vapor barriers.
    b. Membranes and flashings.
    c. Sprayed fire-resistive material.
    d. Equipment supports.
    e. Piping, ductwork, vessels, and equipment.
    f. Noise- and vibration-control elements and systems.

4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

D. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of specified products and equipment.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Comply with requirements specified in other Sections.

1. For projects requiring compliance with sustainable design and construction practices and procedures, use products for patching that comply with sustainable design requirements.

B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials. Use materials that are not considered hazardous.

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

PART 3 - EXECUTION

3.1 EXAMINATION

A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, mechanical and electrical systems**,** and other construction affecting the Work.

1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, gas service piping, and water-service piping; underground electrical services; and other utilities.
2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
2. Examine walls, floors, and roofs for suitable conditions where products and

systems are to be installed.

3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

C. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Existing Utility Information: Furnish information to local utility and Owner that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to Architect in accordance with requirements in Section 013100 "Project Management and Coordination."

3.3 CONSTRUCTION LAYOUT

A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks and existing conditions. If discrepancies are discovered, notify Architect promptly.

B. Engage a land surveyor professional engineer experienced in laying out the Work, using the following accepted surveying practices:

1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
2. Establish limits on use of Project site.
3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
4. Inform installers of lines and levels to which they must comply.
5. Check the location, level and plumb, of every major element as the Work progresses.
6. Notify Architect when deviations from required lines and levels exceed allowable tolerances.

7. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.

C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.

D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.

E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect.

3.4 FIELD ENGINEERING

A. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.

1. Do not change or relocate existing benchmarks or control points without prior written approval of Architect. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect before proceeding.
2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.

B. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.

1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.

C. Certified Survey: On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and sitework.

3.5 INSTALLATION

A. Locate the Work and components of the Work accurately, in correct alignment and

elevation, as indicated.

1. Make vertical work plumb, and make horizontal work level.
2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
4. Maintain minimum headroom clearance of 96 inches in occupied spaces and 90 inches in unoccupied spaces, unless otherwise indicated on Drawings.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure satisfactory results as judged by Architect. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations, so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy of type expected for Project.

E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on-site and placement in permanent locations.

F. Tools and Equipment: Select tools or equipment that minimize production of excessive noise levels.

G. Templates: Obtain and distribute to the parties involved templates for Work specified to be factory prepared and field installed. Check Shop Drawings of other portions of the Work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions with manufacturer.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
2. Allow for building movement, including thermal expansion and contraction.
3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

I. Joints: Make joints of uniform width. Where joint locations in exposed Work are not indicated, arrange joints for the best visual effect, as judged by Architect. Fit exposed connections together to form hairline joints.

3.6 CUTTING AND PATCHING

A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.

C. Temporary Support: Provide temporary support of Work to be cut.

D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

E. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to minimize interruption to occupied areas.

F. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
5. Proceed with patching after construction operations requiring cutting are complete.

G. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as practicable, as judged by Architect. Provide materials and comply with installation requirements specified in other Sections, where applicable.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish

restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.

a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
b. Restore damaged pipe covering to its original condition.

3. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.

H. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.7 COORDINATION OF OWNER'S PORTION OF THE WORK

A. Site Access: Provide access to Project site for Owner's construction personnel.

1. Provide temporary facilities required for Owner-furnished, Contractor-installed products.
2. Refer to Section 011000 "Summary" for other requirements for Owner-furnished, Contractor-installed products.

B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction personnel.

1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.
2. Preinstallation Conferences: Include Owner's construction personnel at preinstallation conferences covering portions of the Work that are to receive Owner's work. Attend preinstallation conferences conducted by Owner's construction personnel if portions of the Work depend on Owner's construction.

3.8 PROGRESS CLEANING

A. Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.

1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F.
3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, in accordance with regulations.

a. Use containers intended for holding waste materials of type to be stored.

B. Site: Maintain Project site free of waste materials and debris.

C. Work Areas: Clean areas where Work is in progress to the level of cleanliness necessary for proper execution of the Work.

1. Remove liquid spills promptly.
2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

D. Installed Work: Keep installed work clean. Clean installed surfaces in accordance with written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

F. Exposed Surfaces: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Section 015000 "Temporary Facilities and Controls. "Section 017419 "Construction Waste Management and Disposal."

H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

J. Limiting Exposures: Supervise construction operations to ensure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.9 STARTING AND ADJUSTING

A. Coordinate startup and adjusting of equipment and operating components with requirements in Section 019113 "General Commissioning Requirements."

B. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

C. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.

D. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

E. Manufacturer's Field Service: Comply with qualification requirements in Section 014000 "Quality Requirements."

3.10 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

B. Protection of Existing Items: Provide protection and ensure that existing items to remain undisturbed by construction are maintained in condition that existed at commencement of the Work.

C. Comply with manufacturer's written instructions for temperature and relative humidity.

3.11 CORRECTION OF THE WORK

A. Repair or remove and replace damaged, defective, or nonconforming Work. Restore damaged substrates and finishes.

1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.

B. Repair Work previously completed and subsequently damaged during construction period. Repair to like-new condition.

C. Restore permanent facilities used during construction to their specified condition.

D. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.

E. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.

F. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION 017300

SECTION 017419

CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 SUMMARY

A. The Work of this Section includes administrative and procedural requirements for the following:

1. Salvaging nonhazardous demolition and construction waste.
2. Recycling nonhazardous demolition and construction waste.
3. Disposing of nonhazardous demolition and construction waste.

1.2 DEFINITIONS

A. CMU: Concrete masonry units.

B. Construction Waste: Building, structure, and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.

C. Demolition Waste: Building, structure, and site improvement materials resulting from demolition operations.

D. Disposal: Removal of demolition or construction waste and subsequent salvage, sale, recycling, or deposit in landfill, incinerator acceptable to authorities having jurisdiction, or designated spoil areas on Owner's property.

E. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.

F. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.

G. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

1.3 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition and construction waste becomes property of Contractor.

B. Historic items, relics, antiques, and similar objects including, but not limited to,

cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.

1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.4 ACTION SUBMITTALS

A. Waste Management Plan: Submit plan within 30 days of date established for the Notice of Award. Plan must include the following:

1. Strategies to reduce the generation of waste during Project design and construction.
2. Waste diversion goals for Project, identifying the materials (both structural and nonstructural) targeted for recycling, reuse, or salvage and identifying the target diversion percentage (at least 50 percent).
3. Where materials will be taken, including expected diversion rates for each material.

1.5 INFORMATIONAL SUBMITTALS

A. Waste Reduction Calculations: Before request for Substantial Completion, submit calculated end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.

B. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.

C. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.

D. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

E. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

1.6 QUALITY ASSURANCE

A. Waste Management Coordinator Qualifications: Experienced firm, or individual employed and assigned by General Contractor, with a record of successful waste management coordination of projects with similar requirements. Superintendent may serve as Waste Management Coordinator.

B. Regulatory Requirements: Comply with transportation and disposal regulations of authorities having jurisdiction.

C. Waste Management Conference(s): Conduct conference(s) at Project site to comply with requirements in Section 013100 "Project Management and Coordination." Review methods and procedures related to waste management including, but not limited to, the following:

1. Review and discuss waste management plan including responsibilities of each contractor and waste management coordinator.
2. Review requirements for documenting quantities of each type of waste and its disposition.
3. Review and finalize procedures for materials separation, and verify availability of containers and bins needed to avoid delays.
4. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
5. Review waste management requirements for each trade.

1.7 WASTE MANAGEMENT PLAN

A. Waste Identification: Indicate anticipated types and quantities of site-clearing and construction waste generated by the Work. Include estimated quantities and assumptions for estimates.

B. Cost/Revenue Analysis: Indicate total cost of waste disposal as if there were no waste management plan and net additional cost or net savings resulting from implementing waste management plan:

1. Total quantity of waste.
2. Estimated cost of disposal (cost per unit). Include transportation and tipping fees and cost of collection containers and handling for each type of waste.
3. Total cost of disposal (with no waste management).
4. Revenue from salvaged materials.
5. Revenue from recycled materials.
6. Savings in transportation and tipping fees by donating materials.
7. Savings in transportation and tipping fees that are avoided.
8. Handling and transportation costs. Include cost of collection containers for each type of waste.
9. Net additional cost or net savings from waste management plan.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during entire duration of the Contract.

1. Comply with operation, termination, and removal requirements in Section 015000 "Temporary Facilities and Controls."

B. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work.

1. Distribute waste management plan to everyone concerned within three days of submittal return.
2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.

C. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged and recycled.
2. Comply with Section 015000 "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

3.2 SALVAGING DEMOLITION WASTE

A. Salvaged Items for Reuse in the Work: Handle as follows:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
3. Store items in a secure area until installation.
4. Protect items from damage during transport and storage.
5. Install salvaged items to comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make items functional for use indicated.

B. Salvaged Items for Sale or Donation: Not permitted on Project site.

C. Salvaged Items for Owner's Use: Handle as follows:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area designated by Owner.
5. Protect items from damage during transport and storage.

D. Lighting Fixtures: Separate lamps by type and protect from breakage.

3.3 RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

A. General: Recycle paper and beverage containers used by on-site workers.

B. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials to be shared equally by Owner and Contractor.

C. Preparation of Waste: Prepare and maintain recyclable waste materials in accordance with recycling or reuse facility requirements. Maintain materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process.

D. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to maximum extent practical in accordance with approved construction waste management plan.

1. Provide appropriately marked containers or bins for controlling recyclable waste until removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.

    a. Inspect containers and bins for contamination and remove contaminated materials if found.

2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
4. Store components off the ground and protect from the weather.
5. Remove recyclable waste from Owner's property and transport to recycling receiver or processor as often as required to prevent overfilling bins.

3.4 DISPOSAL OF WASTE

A. Except for items or materials to be salvaged or recycled, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.

1. Unless otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Except for items or materials to be salvaged or recycled, remove waste materials and legally dispose of at designated spoil areas on Owner's property.

C. Burning:

1. Do not burn waste materials.

END OF SECTION 017419

SECTION 017700

CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for Contract closeout, including, but not limited to, the following:

1. Substantial Completion procedures.
2. Final Completion procedures.
3. Submittal of Project warranties.
4. Final cleaning.

B. Related Requirements:

1. Section 012900 "Payment Procedures" for requirements for Applications for Payment for Substantial Completion and Final Completion.
2. Section 017823 "Operation and Maintenance Data" for additional operation and maintenance manual requirements.
3. Section 017839 "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.

1.2 DEFINITIONS

A. List of Incomplete Items: Contractor-prepared list of items to be completed or corrected, prepared for the Architect's use prior to Architect's inspection, to determine if the Work is substantially complete.

1.3 ACTION SUBMITTALS

A. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.

B. Certified List of Incomplete Items: Final submittal at Final Completion.

1.4 CLOSEOUT SUBMITTALS

A. Certificates of Release: From authorities having jurisdiction.

B. Certificate of Insurance: For continuing coverage.

C. Field Report: For pest-control inspection.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Schedule of Maintenance Material Items: For maintenance material submittal items required by other Sections.

1.6 SUBSTANTIAL COMPLETION PROCEDURES

A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's "punch list"), indicating the value of each item on the list and reasons why the Work is incomplete.

B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction, permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
2. Submit closeout submittals specified in other Division 01 Sections, including Project Record Documents, operation and maintenance manuals, damage or settlement surveys, property surveys, and similar final record information.
3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Architect. Label with manufacturer's name and model number.

    a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Architect's and Owner's signature for receipt of submittals.

5. Submit testing, adjusting, and balancing records.
6. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
7. Submit a list of shop drawings for the entire project for all disciplines.

C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Advise Owner of pending insurance changeover requirements.
2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
3. Complete startup and testing of systems and equipment.

4. Perform preventive maintenance on equipment used prior to Substantial Completion.
5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Section 017900 "Demonstration and Training."
6. Advise Owner of changeover in utility services.
7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
9. Complete final cleaning requirements.
10. Touch up paint and otherwise repair and restore marred exposed finishes to eliminate visual defects.

D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.

1. Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Results of completed inspection will form the basis of requirements for Final Completion.

1.7 FINAL COMPLETION PROCEDURES

A. Submittals Prior to Final Completion: Before requesting final inspection for determining Final Completion, complete the following:

1. Submit a final Application for Payment in accordance with Section 012900 "Payment Procedures."
2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list will state that each item has been completed or otherwise resolved for acceptance.
3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
4. Submit pest-control final inspection report.
5. Submit Final Completion photographic documentation.

B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be

completed or corrected before certificate will be issued.

1. Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.8 LIST OF INCOMPLETE ITEMS

A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

1. Organize list of spaces in sequential order, starting with exterior areas.
2. Organize items applying to each space by major element, including categories for ceilings, individual walls, floors, equipment, and building systems.
3. Include the following information at the top of each page:

    a. Project name.
    b. Date.
    c. Name of Architect
    d. Name of Contractor.
    e. Page number.

1.9 SUBMITTAL OF PROJECT WARRANTIES

A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where warranties are indicated to commence on dates other than date of Substantial Completion, or when delay in submittal of warranties might limit Owner's rights under warranty.

B. Warranty Electronic File: Provide warranties and bonds in PDF format. Assemble complete warranty and bond submittal package into a single electronic PDF file with bookmarks enabling navigation to each item. Provide bookmarked table of contents at beginning of document.

1. Submit by uploading to web-based project software site and by email to Architect.

C. Provide additional copies of each warranty to include in operation and maintenance manuals.

D. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.

PART 2 - PRODUCTS

2.1 MATERIALS

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

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:

    a. Clean Project site of rubbish, waste material, litter, and other foreign substances.
    b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
    c. Rake grounds that are not planted, mulched, or paved to a smooth, even-textured surface.
    d. Remove tools, construction equipment, machinery, and surplus material from Project site.
    e. Remove snow and ice to provide safe access to building.
    f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
    g. Remove debris and surface dust from limited-access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
    h. Clean flooring, removing debris, dirt, and staining; clean in accordance with manufacturer's instructions.
    i. Vacuum and mop concrete.
    j. Remove labels that are not permanent.
    k. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.

l. Clean luminaires, lamps, globes, and reflectors to function with full efficiency.
m. Clean strainers.
n. Leave Project clean and ready for occupancy.

C. Pest Control: Comply with pest control requirements in Section 015000 "Temporary Facilities and Controls." Prepare written report.

D. Construction Waste Disposal: Comply with waste-disposal requirements in Section 015000 "Temporary Facilities and Controls. "Section 017419 "Construction Waste Management and Disposal."

3.2 CORRECTION OF THE WORK

A. Complete repair and restoration operations required by "Correction of the Work" Article in Section 017300 "Execution" before requesting inspection for determination of Substantial Completion.

END OF SECTION 017700

SECTION 017823

OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Administrative and procedural requirements for preparing operation and maintenance manuals, including the following:

1. Operation and maintenance documentation directory manuals.
2. Emergency manuals.
3. Systems and equipment operation manuals.
4. Systems and equipment maintenance manuals.
5. Product maintenance manuals.

B. Related Requirements:

1. Section 013300 "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.

1.2 DEFINITIONS

A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.

B. Subsystem: A portion of a system with characteristics similar to a system.

1.3 CLOSEOUT SUBMITTALS

A. Submit operation and maintenance manuals indicated. Provide content for each manual as specified in individual Specification Sections, and as reviewed and approved at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.

1. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

B. Format: Submit operation and maintenance manuals in the following format:

1. Submit by uploading to web-based project software site and by email to Architect. Enable reviewer comments on draft submittals.

C. Initial Manual Submittal: Submit draft copy of each manual at least 30 days before

commencing demonstration and training. Architect and commissioning agent will comment on whether general scope and content of manual are acceptable.

D. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect and commissioning agent will return copy with comments.

1. Correct or revise each manual to comply with Architect's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's comments and prior to commencing demonstration and training.

E. Comply with Section 017700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

1.4 FORMAT OF OPERATION AND MAINTENANCE MANUALS

A. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.

1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
2. File Names and Bookmarks: Bookmark individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.
3. Supplementary Text: Prepared on 8-1/2-by-11-inch white bond paper.
4. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.

    a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
    b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

1.5 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

A. Organization of Manuals: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual to contain the following materials, in the order listed:

1. Title page.
2. Table of contents.
3. Manual contents.

B. Title Page: Include the following information:

1. Subject matter included in manual.
2. Name and address of Project.
3. Name and address of Owner.
4. Date of submittal.
5. Name and contact information for Contractor.
6. Name and contact information for Architect.
7. Name and contact information for Commissioning Authority.
8. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
9. Cross-reference to related systems in other operation and maintenance manuals.

C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.

D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.

E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation in accordance with ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

1.6 EMERGENCY MANUALS

A. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.

B. Content: Organize manual into a separate section for each of the following:

1. Type of emergency.
2. Emergency instructions.
3. Emergency procedures.

C. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:

1. Fire.

2. Flood.
3. Gas leak.
4. Water leak.
5. Power failure.
6. Water outage.
7. System, subsystem, or equipment failure.
8. Chemical release or spill.

D. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.

E. Emergency Procedures: Include the following, as applicable:

1. Instructions on stopping.
2. Shutdown instructions for each type of emergency.
3. Operating instructions for conditions outside normal operating limits.
4. Required sequences for electric or electronic systems.
5. Special operating instructions and procedures.

1.7 SYSTEMS AND EQUIPMENT OPERATION MANUALS

A. Systems and Equipment Operation Manual: Assemble a complete set of data indicating operation of each system, subsystem, and piece of equipment not part of a system. Include information required for daily operation and management, operating standards, and routine and special operating procedures.

1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

B. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:

1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
2. Performance and design criteria if Contractor has delegated design responsibility.
3. Operating standards.
4. Operating procedures.
5. Operating logs.
6. Wiring diagrams.
7. Control diagrams.
8. Piped system diagrams.
9. Precautions against improper use.
10. License requirements including inspection and renewal dates.

C. Descriptions: Include the following:

1. Product name and model number. Use designations for products indicated on Contract Documents.
2. Manufacturer's name.
3. Equipment identification with serial number of each component.
4. Equipment function.
5. Operating characteristics.
6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

D. Operating Procedures: Include the following, as applicable:

1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

E. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

F. Piped Systems: Diagram piping as installed and identify color coding where required for identification.

1.8 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

A. Systems and Equipment Maintenance Manuals: Assemble a complete set of data indicating maintenance of each system, subsystem, and piece of equipment not part of a system. Include manufacturers' maintenance documentation, preventive maintenance procedures and frequency, repair procedures, wiring and systems diagrams, lists of spare parts, and warranty information.

1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

B. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source

information, maintenance service contracts, and warranties and bonds as described below.

C. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

D. Manufacturers' Maintenance Documentation: Include the following information for each component part or piece of equipment:

1. Standard maintenance instructions and bulletins; include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

    a. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
3. Identification and nomenclature of parts and components.
4. List of items recommended to be stocked as spare parts.

E. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:

1. Test and inspection instructions.
2. Troubleshooting guide.
3. Precautions against improper maintenance.
4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
5. Aligning, adjusting, and checking instructions.
6. Demonstration and training video recording, if available.

F. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.

1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.

G. Spare Parts List and Source Information: Include lists of replacement and repair parts,

with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

H. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

I. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

J. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.

1. Do not use original project record documents as part of maintenance manuals.

1.9 PRODUCT MAINTENANCE MANUALS

A. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

B. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

C. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

D. Product Information: Include the following, as applicable:

1. Product name and model number.
2. Manufacturer's name.
3. Color, pattern, and texture.
4. Material and chemical composition.
5. Reordering information for specially manufactured products.

E. Maintenance Procedures: Include manufacturer's written recommendations and the following:

1. Inspection procedures.
2. Types of cleaning agents to be used and methods of cleaning.
3. List of cleaning agents and methods of cleaning detrimental to product.
4. Schedule for routine cleaning and maintenance.

5. Repair instructions.

F. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

G. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

PART 2 - PRODUCTS (Not Used)
PART 3 - EXECUTION (Not Used)

END OF SECTION 017823

SECTION 017839

PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for Project Record Documents, including the following:

1. Record Drawings.
2. Record Product Data.
3. Miscellaneous record submittals.

B. Related Requirements:

1. Section 017700 "Closeout Procedures" for general closeout procedures.
2. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.

1.2 CLOSEOUT SUBMITTALS

A. Record Drawings: Comply with the following:

1. Number of Copies: Submit copies of Record Drawings as follows:

a. Initial Submittal:

1) Submit Record Digital Data Files.
2) Submit PDF electronic files of scanned record prints.
3) Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.

b. Final Submittal:

1) Submit PDF electronic files of scanned Record Prints.
2) Submit one (1) paper copy of marked-up record prints.
3) Submit record digital data files.
4) Print each drawing, whether or not changes and additional information were recorded.

B. Record Product Data: Submit annotated PDF electronic files and directories of each submittal.

1. Where record Product Data are required as part of operation and maintenance

manuals, submit duplicate marked-up Product Data as a component of manual.

C. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit annotated PDF electronic files and directories of each submittal.

D. Record Samples: Immediately prior to date of Substantial Completion meet with the Architect and the Owner's personnel at the site to determine which of the Samples maintained during the construction period shall be transmitted to the Owner for record purposes. Comply with the Architect's instructions for packaging, identification marking, and delivery to the Owner's Sample storage space. Dispose of other Samples in a manner specified for disposing surplus and waste materials.

1.3 RECORD DRAWINGS

A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.

1. Preparation: Mark record prints to show the actual installation, where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.

    a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
    b. Accurately record information in an acceptable drawing technique.
    c. Record data as soon as possible after obtaining it.
    d. Record and check the markup before enclosing concealed installations.
    e. Cross-reference record prints to corresponding photographic documentation.

2. Content: Types of items requiring marking include, but are not limited to, the following:

    a. Dimensional changes to Drawings.
    b. Revisions to details shown on Drawings.
    c. Depths of foundations.
    d. Locations and depths of underground utilities.
    e. Revisions to routing of piping and conduits.
    f. Revisions to electrical circuitry.
    g. Actual equipment locations.
    h. Duct size and routing.
    i. Locations of concealed internal utilities.
    j. Changes made by Change Order or Construction/ Work Change Directive.
    k. Changes made following Architect's written orders.
    l. Details not on the original Contract Drawings.
    m. Field records for variable and concealed conditions.

n. Record information on the Work that is shown only schematically.

3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
4. Mark record prints with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
5. Mark important additional information that was either shown schematically or omitted from original Drawings.
6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

B. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Architect. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:

1. Format: Annotated PDF electronic file with comment function enabled.
2. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
3. Refer instances of uncertainty to Architect for resolution.
4. Architect will furnish Contractor with one set of digital data files of the Contract Drawings for use in recording information.

    a. See Section 013100 "Project Management and Coordination" for requirements related to use of Architect's digital data files.
    b. Architect will provide data file layer information. Record markups in separate layers.

C. Format: Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.

1. Record Prints: Organize record prints into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
2. Format: Annotated PDF electronic file with comment function enabled
3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
4. Identification: As follows:

    a. Project name.
    b. Date.
    c. Designation "PROJECT RECORD DRAWINGS."
    d. Name of Architect
    e. Name of Contractor.

1.4 RECORD SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation, where installation varies from that indicated in Specifications, addenda, and Contract modifications.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
4. For each principal product, indicate whether Record Product Data has been submitted in operation and maintenance manuals instead of submitted as Record Product Data.
5. Note related Change Orders**,** Record Product Data, and Record Drawings where applicable.

B. Format: Submit record specifications as annotated PDF electronic file

1.5 RECORD PRODUCT DATA

A. Recording: Maintain one copy of each submittal during the construction period for Project Record Document purposes. Post changes and revisions to Project Record Documents as they occur; do not wait until end of Project.

B. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
3. Note related Change Orders**,** Record Specifications, and Record Drawings where applicable.

C. Format: Submit Record Product Data as annotated PDF electronic file

1. Include Record Product Data directory organized by Specification Section number and title, electronically linked to each item of Record Product Data.

1.6 MISCELLANEOUS RECORD SUBMITTALS

A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

B. Format: Submit miscellaneous record submittals as PDF electronic file

1. Include miscellaneous record submittals directory organized by Specification Section number and title, electronically linked to each item of miscellaneous record submittals.

1.7 MAINTENANCE OF RECORD DOCUMENTS

A. Maintenance of Record Documents: Store Record Documents in the field office apart from the Contract Documents used for construction. Do not use Project Record Documents for construction purposes. Maintain Record Documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to Project Record Documents for Architect's reference during normal working hours.

PART 2 - PRODUCTS (Not Used)
PART 3 - EXECUTION (Not Used)

END OF SECTION 017839

SECTION 017900

DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:

1. Instruction in operation and maintenance of systems, subsystems, and equipment.

1.2 INFORMATIONAL SUBMITTALS

A. Attendance Record: For each training module, submit list of participants and length of instruction time.

1.3 QUALITY ASSURANCE

A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.

B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 014000 "Quality Requirements," experienced in operation and maintenance procedures and training.

1.4 COORDINATION

A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.

B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.

C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data have been reviewed and approved by Architect.

1.5 INSTRUCTION PROGRAM

A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.

B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:

1. Basis of System Design, Operational Requirements, and Criteria: Include the following:

    a. System, subsystem, and equipment descriptions.
    b. Performance and design criteria if Contractor is delegated design responsibility.
    c. Operating standards.
    d. Regulatory requirements.
    e. Equipment function.
    f. Operating characteristics.
    g. Limiting conditions.
    h. Performance curves.

2. Documentation: Review the following items in detail:

    a. Emergency manuals.
    b. Systems and equipment operation manuals.
    c. Systems and equipment maintenance manuals.
    d. Product maintenance manuals.
    e. Project Record Documents.
    f. Identification systems.
    g. Warranties and bonds.
    h. Maintenance service agreements and similar continuing commitments.

3. Emergencies: Include the following, as applicable:

    a. Instructions on meaning of warnings, trouble indications, and error messages.
    b. Instructions on stopping.
    c. Shutdown instructions for each type of emergency.
    d. Operating instructions for conditions outside of normal operating limits.
    e. Sequences for electric or electronic systems.
    f. Special operating instructions and procedures.

4. Operations: Include the following, as applicable:

    a. Startup procedures.
    b. Equipment or system break-in procedures.

c. Routine and normal operating instructions.
d. Regulation and control procedures.
e. Control sequences.
f. Safety procedures.
g. Instructions on stopping.
h. Normal shutdown instructions.
i. Operating procedures for emergencies.
j. Operating procedures for system, subsystem, or equipment failure.
k. Seasonal and weekend operating instructions.
l. Required sequences for electric or electronic systems.
m. Special operating instructions and procedures.

5. Adjustments: Include the following:

a. Alignments.
b. Checking adjustments.
c. Noise and vibration adjustments.
d. Economy and efficiency adjustments.

6. Troubleshooting: Include the following:

a. Diagnostic instructions.
b. Test and inspection procedures.

7. Maintenance: Include the following:

a. Inspection procedures.
b. Types of cleaning agents to be used and methods of cleaning.
c. List of cleaning agents and methods of cleaning detrimental to product.
d. Procedures for routine cleaning.
e. Procedures for preventive maintenance.
f. Procedures for routine maintenance.
g. Instruction on use of special tools.

8. Repairs: Include the following:

a. Diagnosis instructions.
b. Repair instructions.
c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
d. Instructions for identifying parts and components.
e. Review of spare parts needed for operation and maintenance.

1.6 PREPARATION

A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 017823 "Operation and Maintenance Data."

B. Set up instructional equipment at instruction location.

1.7 INSTRUCTION

A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.

B. Scheduling: Provide instruction at mutually agreed-on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.

1. Schedule training with Owner, through Architect, with at least seven days' advance notice.

C. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.

D. Cleanup: Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

PART 2 - PRODUCTS (Not Used)
PART 3 - EXECUTION (Not Used)

END OF SECTION 017900

SECTION 018116

FACILITY ENVIRONMENTAL REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section specifies basis-of-design environmental conditions and performance criteria that are applicable to product selection and installation of the Work on the Project unless more stringent requirements are specified in the Contract Documents for individual products.

1. Note: Installed products may assume that the environments specified in this Section exist for determining optimum performance. Installed products, however, must survive and operate in a manner that protects property and ensures safety of occupants in the event that a failure or unforeseen event causes the environment to exceed the specified limits. When necessary, more stringent environmental performance requirements have been specified in the Contract Documents for individual products to mitigate potential hazards that might occur due to failure to maintain the specified environment for those products.

1.2 DEFINITIONS

A. Air-Conditioned: Equipped with an apparatus for washing air and controlling its humidity and temperature.

B. Controlled (Environment): Equipped with systems for heating, ventilation, cooling, humidity control, filtration, or cleaning as needed to provide the specified environmental conditions.

1.3 GENERAL ENVIRONMENTAL CONDITIONS

A. Altitude: Sea level to 500 ft

B. Ground-Water Level:

1. Assume ground-water level is 36 inches below ground surface unless a higher water table is indicated on the Drawings.

C. Soil pH and Resistivity:

1. Engage qualified geotechnical or electrical testing agency to perform soil pH and resistivity testing

1.4 OUTDOOR CONDITIONS

A. Annual Ambient Temperature Range: Minus 30 to plus 122 deg F dry bulb.

B. Temperature Variation: Allow for thermal movements from the following differential temperatures:

1. Ambient Temperature Differential: 120 deg F
2. Material Surface Temperature Differential: 180 deg F
3. Ground Surface Temperature Differential to 10 ft (3 m) Depth:

C. Relative Humidity: 20 to 90 percent relative humidity, condensing

D. Weather: Exposed to rain, winds up to 85 mile/h, and snow accumulation up to 24 inches.

1.5 INDOOR CONDITIONS

A. Indoor Controlled Mechanical/Electrical Equipment Room Environment:

1. Ambient Temperature Range: [36 to 122 deg F dry bulb.
2. Relative Humidity Range: 20 to 90 percent, noncondensing
3. Dew Point Range: 7 to 118 deg F

B. Indoor Uncontrolled Mechanical/Electrical Equipment Room Environment:

1. Ambient Temperatures Range: [0 to 104 deg F dry bulb.
2. Relative Humidity Range: 20 to 90 percent, noncondensing
3. Dew Point Range: Minus 29 to plus 100 deg F

PART 2 - PRODUCTS (Not Used)
PART 3 - EXECUTION (Not Used)

END OF SECTION 018116

SECTION 024119

SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Baltimore County Department of Public Works and Transportation Standard Specifications for Construction and Materials, Latest Edition.

1.2 SUMMARY

A. Section Includes:

1. Demolition and removal of selected site elements.
2. Salvage of existing items to be reused or recycled.

B. Related Requirements:

1. Section 011000 "Summary" for restrictions on use of the premises, Owner-occupancy requirements, and phasing requirements.
2. Section 015639 "Temporary Tree and Plant Protection" for temporary protection of existing trees and plants that are affected by selective demolition.
3. Section 017300 "Execution" for cutting and patching procedures.
4. Section 311000 "Site Clearing" for site clearing and removal of above- and below-grade improvements not part of selective demolition.

1.3 DEFINITIONS

A. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged or reinstalled.

B. Remove and Salvage: Detach items from existing construction, in a manner to prevent damage, and store.

C. Remove and Reinstall: Detach items from existing construction, in a manner to prevent damage, prepare for reuse, and reinstall where indicated.

D. Existing to Remain: Leave existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.

1.4 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition waste becomes property of Contractor.

1.5 PREINSTALLATION MEETINGS

A. Predemolition Conference: Conduct conference at Project site.

1. Inspect and discuss condition of construction to be selectively demolished.
2. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
3. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
4. Review areas where existing construction is to remain and requires protection.

1.6 CLOSEOUT SUBMITTALS

A. Inventory: Submit a list of items that have been removed and salvaged.

1.7 FIELD CONDITIONS

A. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

B. Notify Engineer of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

C. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
1. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.

D. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

1. Maintain fire-protection facilities in service during selective demolition operations.

1.8 COORDINATION

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

B. Contact Miss Utility at least 72 hours prior to beginning any demolition, utility or excavation activities.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ASSE A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

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

3.3 PROTECTION

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

1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.

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

3.4 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
5. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
6. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
7. Dispose of demolished items and materials promptly. Comply with requirements in Section 017419 "Construction Waste Management and Disposal."

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

C. Removed and Salvaged Items:

1. Clean salvaged items.
2. 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.

D. Removed and Reinstalled Items:

1. Clean and repair items to functional condition adequate for intended reuse.
2. Pack or crate items after cleaning and repairing. Identify contents of containers.
3. Protect items from damage during transport and storage.

4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

E. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition.

3.5 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

A. Concrete: Demolish in small sections. Using power-driven saw, cut concrete to a depth of at least 3/4 inch at junctures with construction to remain. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete. Neatly trim openings to dimensions indicated.

B. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals using power-driven saw, and then remove concrete between saw cuts.

C. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, and then break up and remove.

3.6 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.
3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
4. Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."

B. Burning: Do not burn demolished materials.

3.7 CLEANING

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

3.8 SELECTIVE DEMOLITION SCHEDULE

A. Remove: As Indicated on Demolition Plan Drawings.

B. Remove and Salvage: As Indicated on Demolition Plan Drawings.

C. Remove and Reinstall: As Indicated on Demolition Plan Drawings.

D. Existing to Remain: As Indicated on Demolition Plan Drawings.

END OF SECTION 024119

SECTION 031000

CONCRETE FORMING AND ACCESSORIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Formwork for cast-in-place concrete, with shoring, bracing and anchorage.

B. Openings for other work.

C. Form accessories.

D. Form stripping.

1.2 REFERENCE STANDARDS

A. ACI 117 – Standard Specifications for Tolerances for Concrete Construction and Materials; American Concrete Institute.

B. ACI 301 – Specifications for Structural Concrete for Buildings; American Concrete Institute.

C. ACI 318 – Building Code Requirements for Structural Concrete and Commentary; American Concrete Institute.

D. ACI 347 – Guide to Formwork for Concrete; American Concrete Institute.

E. ASME A17.1 – Safety Code for Elevators and Escalators; The American Society of Mechanical Engineers.

1.3 SUBMITTALS

A. See Section 01 30 00 – Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on void form materials.

C. Shop Drawings: Indicate pertinent dimensions, materials, bracing and arrangement of joints and ties.

1. Prepared by or under the supervision of a qualified professional engineer detailing fabrication, assembly, and support of formwork. Shop drawings shall be signed and sealed by an engineer registered in the local jurisdiction.
2. Indicate proposed schedule and sequence of stripping formwork, shoring removal, and installing and removing reshoring.
3. Indicate location of all slab joint types.

1.4 QUALITY ASSURANCE

A. Perform work of this section in accordance with ACI 347, ACI 301, and ACI 318.
   1. Maintain one copy of standards on project site.

PART 2 - PRODUCTS

2.1 FORMWORK – GENERAL

A. Provide concrete forms, accessories, shoring and bracing as required to accomplish cast-in-place concrete work.

B. Design and construct to provide resultant concrete that conforms to design with respect to shape, lines, and dimensions.

C. Comply with applicable State and local codes with respect to design, fabrication, erection, and removal of formwork.

D. Comply with relevant portions of ACI 347, ACI 301 and ACI 318.

2.2 WOOD FORM MATERIALS

A. Form Materials: At the discretion of the Contractor.

2.3 PREFABRICATED FORMS

A. Preformed Steel Forms: Minimum 16 gage matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished surfaces.

B. Glass Fiber Fabric Reinforced Plastic Forms: Matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished surfaces.

C. Void Forms: Moisture resistant treated paper faces, biodegradable, structurally sufficient to support weight of wet concrete mix until initial set; 2 inches thick.

2.4 FORMWORK ACCESSORIES

A. Form Ties: Snap-off type, galvanized metal, fixed length, cone type, with waterproofing washer, 1 inch back break dimension, free of defects that could leave holes larger than 1 inch in concrete surface.

B. Form Release Agent: Colorless mineral oil that will not stain concrete, absorb moisture, impair natural bonding of concrete finish coatings, or affect color characteristics of concrete finish coatings.
   1. Product must meet VOC requirements per Section 01 81 19, “Indoor Air Quality Requirements.”

C. Corners: Chamfered, rigid plastic or wood strip type, ¾ x ¾ inch size, maximum possible lengths.

D. Dovetail Anchor Slot: Galvanized steel, 22 gage thick, foam filled, release tape sealed slots, anchors for securing to concrete formwork.

E. Flashing Reglets: Galvanized steel, 22 gage thick, longest possible lengths, with alignment splines for joints, foam filled, release tape sealed slots, anchors for securing to concrete formwork.

F. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Sized as required, of sufficient strength and character to maintain formwork in place while placing concrete.

G. Waterstops: Preformed mineral colloid strips, ¾ inch thick, moisture expanding.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify lines, levels and centers before proceeding with formwork. Ensure that dimensions agree with drawings.

3.2 EARTH FORMS

A. Hand trim sides and bottom of earth forms. Remove loose soil prior to placing concrete.

3.3 ERECTION – FORMWORK

A. Erect formwork, shoring and bracing to achieve design requirements, in accordance with requirements of ACI 301.

B. Provide bracing to ensure stability of formwork. Shore or strengthen formwork subject to overstressing by construction loads.

C. Provide chamfer strips on external corners of beams, joists, and columns.

D. Install void forms in accordance with manufacturer’s recommendations. Protect forms from moisture or crushing.

E. Coordinate this section with other sections of work that require attachment of components to formwork.

F. If formwork is placed after reinforcement, resulting in insufficient concrete cover over reinforcement, request instructions from Architect before proceeding.

3.4 APPLICATION – FORM RELEASE AGENT

A. Apply form release agent on formwork in accordance with manufacturer's recommendations.

B. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.

C. Do not apply release agent where concrete surfaces will receive special finishes or applied coverings that are affected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces coated prior to placement of concrete.

3.5 INSERTS, EMBEDDED PARTS AND OPENINGS

A. Provide formed openings where required for items to be embedded or passing through concrete work.

B. Locate and set in place items that will be cast directly into concrete.

C. Coordinate with work of other sections in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other work.

D. Install accessories in accordance with manufacturer's instructions, so they are straight, level, and plumb. Ensure items are not disturbed during concrete placement.

E. Install waterstops in accordance with manufacturer's instructions, so they are continuous without displacing reinforcement.

F. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.

G. Close temporary openings with tight fitting panels, flush with inside face of forms, and neatly fitted so joints will not be apparent in exposed concrete surfaces.

3.6 FORM CLEANING

A. Clean forms as erection proceeds, to remove foreign matter within forms.

B. Clean formed cavities of debris prior to placing concrete.

1. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.
2. During cold weather, remove ice and snow from within forms. Do not use deicing salts. Do not use water to clean out forms, unless formwork and concrete construction proceed within heated enclosure. Use compressed air or other means to remove foreign matter.

3.7 FORMWORK TOLERANCES

A. Construct formwork to maintain tolerances required by ACI 117, unless more stringent tolerances are required within the contract documents.

B. Construct and align formwork for elevator hoistway in accordance with ASME A17.1.

3.8 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Division 1. Inspection services shall conform to the Statement of Special Inspections noted in the structural drawings.

B. Inspect erected formwork, shoring and bracing to ensure that work is in accordance with formwork design, and to verify that supports, fastenings, wedges, ties, and items are secure.

C. Do not reuse wood formwork more than 3 times for concrete surfaces to be exposed to view. Do not patch formwork.

3.9 FORM REMOVAL

A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads.

B. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finished concrete surfaces scheduled for exposure to view.

C. Store removed forms to prevent damage to form materials or to fresh concrete. Discard damaged forms.

END OF SECTION 031000

SECTION 032000

CONCRETE REINFORCING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Reinforcing steel for cast-in-place concrete.

B. Supports and accessories for steel reinforcement.

1.2 REFERENCE STANDARDS

A. ACI 301 – Specifications for Structural Concrete for Buildings; American Concrete Institute.

B. ACI 318 – Building Code Requirements for Structural Concrete and Commentary; American Concrete Institute.

C. ACI SP-66 – ACI Detailing Manual; American Concrete Institute.

D. ASTM A 615/A 615M – Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.

E. ASTM A 1064/A 1064M – Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain, Deformed, for Concrete.

F. CRSI (DA4) – Manual of Standard Practice; Concrete Reinforcing Steel Institute.

G. CRSI (P1) – Placing Reinforcing Bars; Concrete Reinforcing Steel Institute.

1.3 SUBMITTALS

A. See Section 01 30 00: Administrative Requirements, for submittal procedures.

B. Shop Drawings: Comply with requirements of ACI SP-66. Include bar schedules, shapes of bent bars, spacing of bars, and location of splices.

C. Manufacturer’s Certificate: Certify that reinforcing steel and accessories supplied for this project meet or exceed specified requirements.

D. Reports: Submit certified copies of mill test report of reinforcement materials analysis.

1.4 QUALITY ASSURANCE

A. Perform work of this section in accordance with CRSI (DA4), CRSI (P1), ACI 301, ACI SP-66, and ACI 318.

1. Maintain one copy of each document on the project site.

PART 2 - PRODUCTS

2.1 REINFORCEMENT

A. Reinforcing Steel: ASTM A 615/A 615M Grade 60 (420).
   1. Deformed billet-steel bars.
   2. Unfinished.

B. Steel Welded Wire Reinforcement: ASTM A 1064/A 1064M, plain type.
   1. Flat sheets.
   2. Mesh Size and Wire Gage: As indicated on drawings.

C. Reinforcement Accessories:
   1. Tie Wire: Annealed, minimum 16 gage.
   2. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for adequate support of reinforcement during concrete placement.
   3. Supports and Spacers in Contact with the Ground:
      a. Precast concrete supports with a surface area of not less than 4 in^2, a compressive strength equal to or greater than the specified compressive strength of the concrete being placed, and embedded tie wires for securing the reinforcement.
      b. Chairs with plastic components and sand plates.
      c. Spacers: Plastic.
   4. Provide stainless steel components for placement within 1½ inches of weathering surfaces.

D. Recycled Content: Provide steel with minimum 90 percent total recycled content, including at least 60 percent post-consumer content

E. Regional Materials: Provide steel manufactured and containing recycled raw materials recovered within 100 mile radius of Project Site.

F. FABRICATION

G. Fabricate concrete reinforcing in accordance with CRSI (DA4) – Manual of Standard Practice.

H. Welding of reinforcement is not permitted.

I. Locate reinforcing splices not indicated on drawings at point of minimum stress.
   1. Review location of splices with Architect.

PART 3 - EXECUTION

3.1 PLACEMENT

A. Place, support and secure reinforcement against displacement before and during concrete placement. Do not deviate from required position.

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

C. Do not displace or damage vapor barrier.

D. Accommodate placement of formed openings.

E. Conform to structural drawings for concrete cover over reinforcement.

3.2 FIELD QUALITY CONTROL

A. An independent inspection agency, as specified in Division 1, will inspect installed reinforcement for conformance to contract documents before placing concrete. Inspection services shall conform to the Statement of Special Inspections noted in the structural drawings.

END OF SECTION 032000

SECTION 033000

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Floors and slabs on grade.

B. Footings.

C. Piers.

D. Joint devices associated with concrete work.

E. Miscellaneous concrete elements, including equipment pads.

1.2 RELATED REQUIREMENTS

A. Section 03 10 00 – Concrete Forming and Accessories.

B. Section 03 20 00 – Concrete Reinforcing.

C. Section 03 35 00 – Concrete Floor Sealers

D. Section 03 39 00 – Concrete Curing.

E. Section 07 92 00 – Joint Sealants.

F. Section 31 20 00 – Earth Moving (for Drainage Fill Under Slabs-on-Ground)

G. Section 32 13 13 – Concrete Paving (for Concrete Paving and Walks)

1.3 REFERENCE STANDARDS

A. ACI 211.1 – Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete; American Concrete Institute.

B. ACI 211.2 - Standard Practice for Selecting Proportions for Structural Lightweight Concrete; American Concrete Institute.

C. ACI 301 – Specifications for Structural Concrete for Buildings; American Concrete Institute.

D. ACI 302.1R – Guide for Concrete Floor and Slab Construction; American Concrete Institute.

E. ACI 304R – Guide for Measuring, Mixing, Transporting, and Placing Concrete; American Concrete Institute.

F. ACI 305R – Hot Weather Concreting; American Concrete Institute.

G. ACI 306R – Cold Weather Concreting: American Concrete Institute.

H. ACI 318 – Building Code Requirements for Structural Concrete and Commentary; American Concrete Institute.

I. ASTM C 33 – Standard Specification for Concrete Aggregates.

J. ASTM C 39/C 39M – Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.

K. ASTM C 94/C 94M – Standard Specification for Ready-Mixed Concrete.

L. ASTM C 150 – Standard Specification for Portland Cement.

M. ASTM C 173/C 173M – Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.

N. ASTM C 260 – Standard Specification for Air-Entraining Admixtures for Concrete.

O. ASTM C 330 – Standard Specification for Lightweight Aggregates for Structural Concrete.

P. ASTM C 494/ C 494M – Standard Specification for Chemical Admixtures for Concrete.

Q. ASTM C 618 – Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.

R. ASTM C 881/C 881M – Standard Specification for Epoxy-Resin Base Bonding Systems for Concrete.

S. ASTM C 989 – Standard Specification for Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars.

T. ASTM C 1077 – Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation.

U. ASTM C 1107/C 1107M – Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Non-Shrink).

V. ASTM C 1240 – Standard Specification for Silica Fume Used in Cementitious Mixtures.

W. ASTM D 1751 – Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non-Extruding and Resilient Bituminous Types).

X. ASTM E 96 – Standard Test Methods for Water Vapor Transmission of Materials.

Y. ASTM E 329 – Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials used in Construction.

Z. IBC 2018 – International Building Code.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:

a. Contractor's superintendent.
b. Independent testing agency responsible for inspections and acceptance testing of concrete at Project site.
c. Ready-mix concrete manufacturer.
d. Concrete Subcontractor.

2. Review the following:

a. Special inspection and testing and inspecting agency procedures for field quality control.
b. Construction joints, control joints, isolation joints, and joint-filler strips.
c. Semirigid joint fillers.
d. Vapor-retarder installation.
e. Anchor rod and anchorage device installation tolerances.
f. Cold- and hot-weather concreting procedures.
g. Concrete finishes and finishing.
h. Curing procedures.
i. Forms and form-removal limitations.
j. Methods for achieving specified floor and slab flatness and levelness.
k. Floor and slab flatness and levelness measurements.
l. Concrete repair procedures.
m. Concrete protection.
n. Initial curing of standard-cured and field curing of field-cured test cylinders (ASTM C31/C31M.)
o. Protection of field cured field test cylinders.
p. Distribution of test reports.

1.5 SUBMITTALS

A. See Section 01 30 00 – Administrative Requirements for submittal procedures.

B. Product Data: Submit manufacturer’s data on manufactured products showing compliance with specified requirements.

C. Samples: Submit samples of under-slab vapor retarder to be used.

D. Design Mixtures:

1. Submit for each concrete mixture.
2. Submit alternate design mixtures when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.
3. Indicate amounts of mixing water to be withheld for later addition at project site.

E. Shop Drawings:

1. Reinforcement layout for all building elements
2. Construction/Control Joint Layout for Slabs on Ground

1.6 QUALITY ASSURANCE

A. Concrete Producer: Engage a firm with experience in producing concrete similar to that indicated for this project and within 15 percent of this project size, with a record of successful in-service performance as well as sufficient production capacity to supply concrete without delaying the work.

1. Provide documentation that concrete producer has supplied concrete for at least 3 projects within 15 percent of project size and complexity in the last six years.

B. Concrete Contractor: Engage a firm with experience in placing and finishing concrete similar to that indicated for this project and within 15 percent of this project size, with a record of successful in-service performance.

1. Provide documentation that the concrete contractor has installed concrete for at least 3 projects within 15 percent of project size and complexity in the last six years.

C. Perform work of this section in accordance with ACI 301 and ACI 318.

1. Maintain one copy of each document on site.

D. Follow recommendations of ACI 305R when concreting during hot weather.

E. Follow recommendations of ACI 306R when concreting during cold weather.

F. All form release agents and membrane curing compounds used for slabs and walls that are to be waterproofed shall be submitted to the manufacturer of hot fluid waterproofing system for compatibility review prior to application.

G. Testing Agency Qualifications: Qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1.
2. Personnel performing laboratory tests shall be an 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.

1.7 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to furnish replacement sheet vapor retarder/termite barrier material and accessories for sheet vapor retarder/ termite barrier and accessories that do not comply with requirements or that fail to resist penetration by termites within specified warranty period.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 FORMWORK

A. Comply with requirements of Section 03 10 00.

2.2 REINFORCEMENT

A. Comply with requirements of Section 03 20 00.

2.3 CONCRETE MATERIALS

A. Cement: Acquire from the same source and use same type for entire Project.
1. Portland Cement: ASTM C 150, Type 1.
2. Blended Hydraulic Cement: ASTM C 595, Type IL, Portland-limestone.

B. Fine and Coarse Aggregates: ASTM C 33.
1. Acquire all aggregates for entire project from same source.

C. Ground Granulated Blast Furnace Slag: ASTM C 989, Grade 100 or 120.

D. Fly Ash: ASTM C 618 Class F.

E. Calcined Pozzolan: ASTM C 618 Class N.

F. Silica Fume: ASTM C 1240.

G. Water: Clean and not detrimental to concrete.

2.4 CHEMICAL ADMIXTURES

A. Do not use chemicals that will result in soluble chloride ions in excess of 0.1 percent by weight of cement.

B. Air Entrainment Admixture: ASTM C 260.

C. High Range Water Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.

D. High Range Water Reducing Admixture: ASTM C 494/C 494M, Type F.

E. Water Reducing and Accelerating Admixture: ASTM C 494/C 494M, Type E.

F. Water Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.

G. Accelerating Admixture: ASTM C 494/C 494M, Type C.

H. Retarding Admixture: ASTM C 494/C 494M, Type B.

I. Water Reducing Admixture: ASTM C 494/C 494M, Type A.

2.5 ACCESSORY MATERIALS

A. Underslab Vapor Barrier / Vapor Retarder: Comply with ASTM E 1745, Class A.
   1. Maximum Permeance ASTM E 96: 0.018 perms (English).
   2. Provide standard accessories and tape for complete system.
   3. Acceptable Products:
      a. Stego Wrap (15-mil) Vapor Barrier by Stego Industries LLC.
      b. Perminator: 15 mils by W.R. Meadows, Inc.
      c. 15 Mil Green by Reef Industries, Inc.
      d. Vapor Block 15 by Raven Industries.
      e. Yellow Guard 15-mil Vapor Barrier by Poly-America.
   4. Single ply polyethylene is prohibited.

B. Non-Shrink Grout: ASTM C 1107/C 1107M; premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents.
   1. Minimum Compressive Strength at 48 Hours: 2,400 psi.
   2. Minimum Compressive Strength at 28 Days: 7,000 psi.

C. Curing Materials: Comply with requirements of Section 03 39 00.

2.6 BONDING AND JOINTING PRODUCTS

A. Bonding Agent: Epoxy bonding system complying with ASTM C 881/C 881M and of Type required for specific application.

B. Waterproofing Admixture Slurry: Slurry coat of Portland cement, sand, and crystalline waterproofing additive, mixed with water in proportions recommended by manufacturer to achieve waterproofing at cold joints in concrete.
   1. Manufacturers:
      a. Aquafin, Inc.: www.aquafin.net.
      b. Xypex Chemical Corporation: www.xypen.com.
      c. Kryton International Inc: www.kryton.com.

C. Self-Expanding Strip Waterstops: Manufactured rectangular or trapezoidal strip, sodium bentonite or other hydrophilic material for adhesive bonding to concrete.
   1. Available Products:

a. CETCO Waterstop-RX: Mineral Technologies Inc.
b. Conseal CS-231: Concrete Sealants Inc.
c. De Neef Swellseal Joint: GCP Applied Technologies
d. Hydrotite CJ: Sika Corporation.
e. Mirastop BW: Henry Corporation.
f. Adeka Ultra Seal: OCM Inc.
g. Superstop: Tremco Construction Products Group

D. Joint Filler: Non-extruding, resilient asphalt impregnated fiberboard, cork or flexible foam, complying with ASTM D 1751, thickness as indicated on drawings and full depth of slab less ½ inch; tongue and groove profile.

E. Slab Construction Joint Devices: Combination keyed joint form and screed, galvanized steel, with minimum1 inch diameter holes for conduit or rebars to pass through at 6 inches on center, ribbed steel stakes for setting.

1. Provide removable plastic cap strip that forms wedge-shaped joint for sealant installation.
2. Height: To suit slab thickness.

F. Sealant and Primer: As specified in Section 07 90 05.

2.7 CONCRETE MIX DESIGN

A. Proportioning Normal Weight Concrete: Comply with ACI 211.1 recommendations.

1. Replace no less than 30% and no more than 50% of Portland cement in structural concrete with approved pozzolanic materials.
2. Ground Granulated Blast Furnace Slag Content: Not to exceed 50% of cementitious material by weight.
   a. GGBFS is not permitted in exposed concrete slabs designated to receive a polished finish.
3. Fly Ash or Calcined Pozzolan Content: Not to exceed 25% of cementitious material by weight.
   a. Fly ash is not permitted in exposed concrete elements designated as architectural concrete.
4. Silica Fume Content: Not to exceed 10% of total cementitious material by weight.
   a. Silica fume is not permitted in exposed concrete elements designated as architectural concrete.
5. Obtain approval in advance before submitting mix containing any other pozzolanic substances.

B. Concrete Strength: Establish required average strength for each type of concrete on the basis of field experience or trial mixtures, as specified in ACI 301.

1. For trial mixtures method, employ independent testing agency acceptable to Architect for preparing and reporting proposed mix designs.

C. Admixtures: Add acceptable admixtures as recommended in ACI 211.1 and at rates recommended by manufacturer.

D. Normal Weight Concrete:

1. Compressive Strength, when tested in accordance with ASTM C 39/C 39M at 28 days: As indicated on drawings.
2. Water-Cementitious Materials Ratio: Maximum 58% by weight. Maximum 40% by weight for exterior concrete.
   a. Interior slabs shall have a maximum water-cementitious material ratio of 50% by weight.
3. Concrete to Receive a Hard-Troweled Finish:
   a. Total air content shall not exceed 3%, determined in accordance with ASTM C 173/C 173M.
   b. Air entraining admixtures are prohibited.
4. Entrained air content for footings shall not exceed 4.5%, determined in accordance with ASTM C 173/C 173M
5. Air Content for Exterior Exposed Concrete: Add air entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content as follows with a tolerance of plus 1 or minus 1.5%, unless otherwise indicated.
   a. Air Content: 6% entrained air, determined in accordance with ASTM C 173/C 173M.
6. Maximum Slump: 4 inches.
7. Maximum Aggregate Size: 1 inch.

2.8 MIXING

A. Transit Mixers: Comply with ASTM C 94/C 94M.

B. Do not add water to concrete during delivery, at the project site or during placement except as predetermined by concrete mix, unless approved by the Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify lines, levels, and dimensions before proceeding with work of this section.

3.2 PREPARATION

A. Where new concrete is to be bonded to previously placed concrete, prepare existing surface by cleaning with steel brush and applying bonding agent, as indicated on the drawings, in accordance with the manufacturer's instructions.

B. Where new concrete with integral waterproofing is to be bonded to previously placed concrete, prepare surfaces to be treated in accordance with waterproofing

manufacturer's instructions. Saturate cold joint surface with clean water, and remove excess water before application of coat of waterproofing admixture slurry. Apply slurry coat uniformly with semi-stiff bristle brush at rate recommended by waterproofing manufacturer.

C. In locations where new concrete is doweled to existing work, drill holes in existing concrete and insert steel dowels using an epoxy adhesive approved by the Architect.

D. Install vapor retarder under interior slabs on grade in accordance with manufacturer's instructions and ASTM E 1643.

E. Place concrete in accordance with ACI 304R.

F. Place concrete for floor slabs in accordance with ACI 302.1R.

G. Ensure reinforcement, inserts, waterstops, embedded parts, and formed construction joint devices will not be disturbed during concrete placement.

H. Separate slabs on grade from vertical surfaces with joint filler.

I. Place joint filler in coordination with floor slab pattern placement sequence. Set top to required elevations. Secure to resist movement by wet concrete.

J. Extend joint filler from bottom of slab to within ½ inch of finished slab surface. Conform to Section 07 90 05 for finish joint sealer requirements.

K. Install joint devices in accordance with manufacturer's instructions.

L. Install construction joint devices in coordination with floor slab pattern placement sequence. Set top to required elevations. Secure to resist movement by wet concrete.

M. Install joint device anchors for expansion joint assemblies specified in Section 07 95 13. Maintain correct position to allow joint cover to be flush with floor and wall finish.

N. Apply sealants in joint devices in accordance with Section 07 90 05.

O. Maintain records of concrete placement. Record date, location, quantity, air temperature and test samples taken.

P. Place concrete continuously between predetermined expansion, control and construction joints.

Q. Do not interrupt successive placement. Do not permit cold joints to occur.

R. Place slabs on grade with saw cut pattern indicated.

S. Saw cut joints as soon as the concrete is firm enough not to be damaged by the cutting action. Use 3/16 inch thick blade, cut into ¼ depth of slab thickness.

3.3 CONCRETE FINISHING

A. Repair surface defects, including tie holes, immediately after removing formwork.

B. Unexposed Form Finish: Rub down or chip off fins or other raised areas ¼ inch or more in height.

C. Exposed Form Finish: Rub down or chip off and smooth fins or other raised areas ¼ inch or more in height. Provide finish as follows:

1. Smooth Rubbed Finish: Wet concrete and rub with carborundum brick or other abrasive, not more than 24 hours after form removal.

D. Concrete Slabs: Finish to requirements of Section 03 35 13.

1. Do not apply a hard-troweled finish to air-entrained slabs or slabs containing a total air content greater than 3 percent.

3.4 CURING AND PROTECTION

A. Comply with requirements of Section 03 39 00.

3.5 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Division 1. Inspection services shall conform to Section 1705.3 and Table 1705.3 of the 2018 IBC Code and the Statement of Special Inspections noted in the structural drawings. The exceptions noted in Section 1705.3 shall not be allowed.

B. Provide free access to concrete operations at project site and cooperate with appointed firm; inspection to occur for:

1. Steel reinforcement placement.
2. Anchor bolts and studs.
3. Verification of use of required design mixture.
4. Concrete placement, including conveying and depositing.
5. Curing procedures and maintenance of curing temperature.
6. Verification of concrete strength before removal of shores and forms from beams and slabs.

C. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of concrete operations.

D. Tests of concrete and concrete materials may be performed at any time to ensure conformance with specified requirements.

E. Test composite samples of fresh concrete obtained according to ASTM C 172.

F. Compressive Strength Tests: ASTM C 39/C 39M.

1. Compression Test Specimens: ASTM C31/C 31M; cast and laboratory cure five 6”x12” standard cylinder specimens or seven 4”x8” standard cylinder specimens for each composite sample.
2. Test one laboratory-cured specimen at 7 days and one set of two 6”x12” or three 4”x8” specimens at 28 days. Remaining cylinders shall be held in reserve.
3. Obtain test samples for every 75 cu.yd. or less of each class of concrete placed each day.
4. A compressive-strength test shall be the average compressive strength from all specimens obtained from same composite sample and tested at age indicated.
5. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.

G. Perform one slump test, at point of discharge for each set of test cylinders taken, following procedures of ASTM C 143/C 143M.

H. Perform air content test for each set of test cylinders taken, following procedures of ASTM C 231.

I. Perform unit weight test of structural lightweight concrete for each set of test cylinders taken, following procedures of ASTM C 567.

J. Test concrete temperature each hour when air temperature is 40 degrees F and below and when 80 degrees F and above, and for each set of test cylinders taken, following procedures of ASTM C 1064/C 1064M.

3.6 DEFECTIVE CONCRETE

A. Test Results: The testing agency shall report test results in writing to the Architect and Contractor within 24 hours of test.
1. Testing and inspecting agency will make additional tests of concrete when test results indicate that slump, compressive strengths, or other requirements have not been met, as directed by the Architect.
2. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by the Architect.
3. Additional testing and inspecting, at Contractor’s expense, will be performed to determine compliance of replaced or additional work with specified requirements.
4. Correct deficiencies that test reports and inspections indicate do not comply with specified requirements.

B. Defective Concrete: Concrete not conforming to required lines, details, dimensions, tolerances or specified requirements. Repair or replace defective concrete, subject to the approval of the Architect.

C. Do not patch, fill, touch-up, repair or replace exposed concrete except upon express direction of the Architect for each individual area.

END OF SECTION 033000

SECTION 033500

CONCRETE FLOOR SEALERS/DENSIFIERS/HARDENERS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Surface treatment with concrete hardener and sealer.

1.2 REFERENCE STANDARDS

A. ACI 301 – Specifications for Structural Concrete for Buildings; American Concrete Institute.

B. ACI 302.1R – Guide for Concrete Floor and Slab Construction; American Concrete Institute.

1.3 SUBMITTALS

A. Product Data: Provide data on concrete hardener and sealer, including information on compatibility of different products and limitations.

1.4 QUALITY ASSURANCE

A. Perform work in accordance with ACI 301 and ACI 302.1R.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in manufacturer’s sealed packaging, including application instructions.

1.6 PROJECT CONDITIONS

A. Coordinate the work with concrete floor placement and concrete floor curing.

B. Maintain ambient temperature of 50 degrees F minimum.

PART 2 - PRODUCTS

2.1 COMPOUNDS, HARDENERS AND SEALERS

A. Chemical hardener: Clear, chemically reactive, waterborne solution of inorganic siliconate materials and proprietary components, odorless, colorless, that penetrates, hardens, and densifies concrete surfaces.
   1. VOC Content: Not to exceed 200 g/L.
   2. Acceptable Products:

a. Ashford Formula, Concrete Chemical Company, Inc.
b. Seal Hard, L & M Construction Chemicals, Inc.
c. Titan Hard, Burke Construction Chemicals.
d. Euco Diamond Hard, Euclid Chemical Company

PART 3 - EXECUTION

3.1 FLOOR SURFACE TREATMENT

A. Prepare surface in accordance with manufacturer's instructions.

B. Clean concrete surfaces of dirt, dust, debris, oil, grease, bond-breaker compounds, curing compounds, sealers, laitance, paint and other contaminants which could adversely affect liquid concrete floor hardener penetration.

C. Apply hardener to floor surfaces in accordance with manufacturer's instructions.

END OF SECTION 033500

SECTION 033900

CONCRETE CURING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Initial and final curing of horizontal and vertical concrete surfaces.

1.2 REFERENCE STANDARDS

A. ACI 301 – Specifications for Structural Concrete for Buildings; American Concrete Institute.

B. ACI 302.1R – Guide for Concrete Floor and Slab Construction; American Concrete Institute.

C. ACI 305R – Hot Weather Concreting; American Concrete Institute.

D. ACI 306R – Cold Weather Concreting; American Concrete Institute.

E. ACI 308R – Guide to Curing Concrete; American Concrete Institute.

F. ASTM C 171 – Standard Specification for Sheet Materials for Curing Concrete.

G. ASTM C 309 – Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

H. ASTM D 2103 – Standard Specification for Polyethylene Film and Sheeting.

1.3 SUBMITTALS

A. See Section 01 30 00 – Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on curing compounds, moisture-retaining sheet, and polyethylene film, including compatibility of different products and limitations.

C. LEED Submittal: Provide documentation of VOC content in g/L for concrete curing compound.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with ACI 301 and ACI 302.1R.

PART 2 - PRODUCTS

2.1 MATERIALS

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

B. Membrane Curing Compound: ASTM C 309 Type 1 – Clear or translucent, Class B.

1. VOC Content not to exceed 350 g/L.

C. Moisture-Retaining Sheet: ASTM C 171.

1. Curing paper, regular.
2. Polyethylene film, clear, minimum nominal thickness of 0.0040 in.
3. White-burlap-polyethylene sheet, weighing not less than 10 oz/per linear yd., 40 inches wide.

D. Polyethylene Film: ASTM D 2103, 4 mil thick, clear.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that substrate surfaces are ready to be cured.

3.2 EXECUTION – HORIZONTAL SURFACES

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306R for cold-weather protection and ACI 305R 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./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. Cure floor surfaces in accordance with ACI 308.

D. Moisture-Retaining Sheet: Lap strips not less than 3 inches and seal with waterproof tape or adhesive; secure at edges; maintain in place for not less than 4 days.

E. Absorptive Moisture-Retaining Sheet: Saturate burlap-polyethylene and place burlap side down over floor slab areas, lapping ends and sides; maintain in place for 7 days.

F. Membrane Curing Compound: Apply curing compound in accordance with manufacturer's instructions in one coat.

3.3 EXECUTION – VERTICAL SURFACES

A. Cure surfaces in accordance with ACI 308.

B. Membrane Curing Compound: Apply compound in accordance with manufacturer's instructions in one coat.

3.4 PROTECTION

A. Do not permit traffic over unprotected floor surface.

END OF SECTION 033900

SECTION 040100
MAINTENANCE OF MASONRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Water cleaning of new masonry surfaces.

1.02 RELATED REQUIREMENTS

A. Section 040511 - Masonry Mortaring and Grouting.

B. Section 042900 - Reinforced Unit Masonry - CMU Walls.

1.03 REFERENCE STANDARDS

A. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2016.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Scheduling:
   1. Perform cleaning and washing of masonry between the hours of 7 am to 11 pm only.

1.05 SUBMITTALS

A. See Section 013300 - Submittal Procedures

B. Product Data: Provide data on cleaning compounds.

1.06 QUALITY ASSURANCE

A. Comply with provisions of TMS 402/602, except where exceeded by requirements of Contract Documents.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver masonry neatly stacked and tied on pallets. Store clear of ground with adequate waterproof covering.

1.08 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 MANUFACTURERS

A. Restoration and Cleaning Chemicals:
   1. PROSOCO: www.prosoco.com/#sle.
   2. Carlisle Coatings and Waterproofing Inc; SimpleKleen; www.carlisle-ccw.com
   3. Substitutions: See Section 016000 - Product Requirements.

2.02 CLEANING MATERIALS

A. Cleaning Agent: Detergent type.

2.03 MORTAR MATERIALS

A. Comply with requirements of Section 040511.

2.04 MASONRY MATERIALS

A. CMU: Section 042900 - Reinforced Unit Masonry - CMU Walls

B. Decorative CMU: Section 042001 - Masonry Veneer (Brick and CMU Block non-load bearing).

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces to be cleaned are ready for work of this section.

3.02 PREPARATION

A. Protect surrounding elements from damage due to restoration procedures.

B. Carefully remove and store removable items located in areas to be restored, including fixtures, fittings, finish hardware, and accessories; reinstall upon completion.

C. Separate areas to be protected from restoration areas using means adequate to prevent damage.

D. Cover existing landscaping with tarpaulins or similar covers.

E. Mask immediately adjacent surfaces with material that will withstand cleaning and restoration procedures.

3.03 CLEANING NEW MASONRY

A. Verify mortar is fully set and cured.

B. Clean surfaces and remove large particles with wood scrapers, brass or nylon wire brushes.

C. Scrub walls with detergent type cleaning agent solution using stiff brush. Thoroughly rinse and wash off cleaning solution, dirt and mortar crumbs using clean, pressurized water.

3.04 CLEANING

A. Immediately remove stains, efflorescence, or other excess resulting from the work of this section.

B. Remove excess mortar, smears, and droppings as work proceeds and upon completion.

C. Clean surrounding surfaces.

END OF SECTION 040100

SECTION 040511

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 040100 - Maintenance of Masonry: Bedding and pointing mortar for masonry restoration work.

B. Section 042001 - Masonry Veneer (Brick and CMU Block non-load bearing): Installation of mortar.

C. Section 042900 - Reinforced Unit Masonry - CMU Walls: Installation of mortar and grout.

1.03 REFERENCE STANDARDS

A. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2016.

B. ASTM C5 - Standard Specification for Quicklime for Structural Purposes; 2010.

C. ASTM C91/C91M - Standard Specification for Masonry Cement; 2012.

D. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2016a.

E. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar; 2011.

F. ASTM C150/C150M - Standard Specification for Portland Cement; 2016.

G. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes; 2006 (Reapproved 2011).

H. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2014a.

I. ASTM C387/C387M - Standard Specification for Packaged, Dry, Combined Materials for Concrete and High Strength Mortar; 2015.

J. ASTM C404 - Standard Specification for Aggregates for Masonry Grout; 2011.

K. ASTM C476 - Standard Specification for Grout for Masonry; 2016.

L. ASTM C780 - Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry; 2016a.

M. ASTM C979/C979M - Standard Specification for Pigments for Integrally Colored Concrete; 2016.

N. ASTM C1019 - Standard Test Method for Sampling and Testing Grout; 2016.

O. ASTM C1072 - Standard Test Method for Measurement of Masonry Flexural Bond Strength; 2013.

P. ASTM C1142 - Standard Specification for Extended Life Mortar for Unit Masonry; 1995 (Reapproved 2013).

Q. ASTM C1148 - Standard Test Method for Measuring the Drying Shrinkage of Masonry Mortar; 1992a (Reapproved 2014).

R. ASTM C1314 - Standard Test Method for Compressive Strength of Masonry Prisms; 2016.

S. ASTM E514/E514M - Standard Test Method for Water Penetration and Leakage Through Masonry; 2014a.

T. ASTM E518/E518M - Standard Test Methods for Flexural Bond Strength of Masonry; 2015.

1.04 SUBMITTALS

A. See Section 013300 - 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.

D. Reports: Submit reports on mortar indicating compliance of mortar to property requirements of ASTM C270 and test and evaluation reports per ASTM C780.

E. Reports: Submit reports on grout indicating compliance of component grout materials to requirements of ASTM C476 and test and evaluation reports to requirements of ASTM C1019.

F. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

G. Manufacturer's Installation Instructions: Submit packaged dry mortar manufacturer's installation instructions.

1.05 QUALITY ASSURANCE

A. Comply with provisions of TMS 402/602, except where exceeded by requirements of Contract Documents.
   1. Maintain one copy of each document on project site.

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. At Contractor's option, mortar and grout may be field-mixed from packaged dry materials, made from factory premixed dry materials with addition of water only, or ready-mixed.

B. Mortar Color: As indicated on A-603 Finish Schedule.

C. Mortar Mix Designs: ASTM C270, Property Specification.
   1. Masonry below grade and in contact with earth: Type S.
   2. Exterior Masonry Veneer: Type N.
   3. Reinforced and Non-Reinforced CMU as specified in Structural Drawings: Type S.

2.02 MATERIALS

A. Packaged Dry Material for Mortar for Unit Masonry: Premixed Portland cement, hydrated lime, and sand; complying with ASTM C387/C387M and capable of producing mortar of the specified strength in accordance with ASTM C270 with the addition of water only.
   1. Type: Types as scheduled in this section. (SECTION 2.01, C)
   2. Color: Mineral pigments added as required to produce approved color sample.

B. Packaged Dry Material for Mortar for Repointing: Premixed Portland cement, hydrated lime, and graded sand; capable of producing Type O mortar in accordance with ASTM C270 with the addition of water only.
   1. Color: Mineral pigments added as required to produce approved color sample.
   2. Manufacturers:
      a. Amerimix, an Oldcastle brand; AMX 420: www.amerimix.com/#sle.
      b. Substitutions: See Section 016000 - Product Requirements.

C. Packaged Dry Material for Grout for Masonry: Premixed cementitious materials and dried aggregates; capable of producing grout of the specified strength in accordance with ASTM C476 with the addition of water only.
   1. Type: Fine.
   2. Manufacturers:
      a. Amerimix, an Oldcastle brand; AMX 600: www.amerimix.com/#sle.
      b. Substitutions: See Section 016000 - Product Requirements.

D. Portland Cement: ASTM C150/C150M.
   1. Type: Type I - Normal; ASTM C150/C150M.
   2. Color: Color as required to produce approved color sample.
   3. Manufacturers:
      a. Solomon Colors; Solomon Colors Concentrated A, H, and X Series: www.solomoncolors.com/#sle.
      b. Substitutions: See Section 016000 - Product Requirements.

E. Masonry Cement: ASTM C91/C91M.
   1. Type: Types as scheduled in this section; 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.
      b. Substitutions: See Section 016000 - Product Requirements.

F. Hydrated Lime: ASTM C207, Type S.

G. Quicklime: ASTM C5, non-hydraulic type.

H. Mortar Aggregate: ASTM C144.

I. Pigments for Colored Mortar: Pure, concentrated mineral pigments specifically intended for mixing into mortar and complying with ASTM C979/C979M.
   1. Color(s): As indicated on drawings.
   2. Manufacturers:
      a. Solomon Colors; Solomon Colors Concentrated A, H, and X Series : www.solomoncolors.com/#sle.
      b. Substitutions: See Section 016000 - Product Requirements.

J. Water: Clean and potable.

K. Bonding Agent: Latex type.

L. Integral Water Repellent Admixture: Polymeric liquid admixture added to mortar at the time of manufacture.
   1. Performance of Mortar with Integral Water Repellent:
      a. Water Permeance: When tested per ASTM E514/E514M and for a minimum of 72 hours:
         1) No water visible on back of wall above flashing at the end of 24 hours.
         2) No flow of water from flashing equal to or greater than 0.032 gallons per hour (0.05 L per hour) at the end of 24 hours.
         3) No more than 25 percent of wall area above flashing visibly damp at end of test.
      b. Flexural Bond Strength: ASTM C1072; minimum 10 percent increase.
      c. Compressive Strength: ASTM C1314; maximum 5 percent decrease.
      d. Drying Shrinkage: ASTM C1148; maximum 5 percent increase in shrinkage.
   2. Use only in combination with masonry units produced with integral water repellent admixture.

2.03 MORTAR MIXING

A. Ready Mixed Mortar: ASTM C1142, Type equivalent to that specified according to ASTM C270.

B. Thoroughly mix mortar ingredients using mechanical batch mixer, in accordance with ASTM C270 and in quantities needed for immediate use.

C. Maintain sand uniformly damp immediately before the mixing process.

D. Colored Mortar: Proportion selected pigments and other ingredients to match Architect's sample, without exceeding manufacturer's recommended pigment-to-cement ratio; mix in accordance with manufacturer's instructions, uniform in coloration.

E. Add admixtures in accordance with manufacturer's instructions; mix uniformly.

F. Do not use anti-freeze compounds to lower the freezing point of mortar.

G. 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.

C. Add admixtures in accordance with manufacturer's instructions; mix uniformly.

D. Do not use anti-freeze compounds to lower the freezing point of grout.

2.05 PRECONSTRUCTION TESTING

A. Testing will be conducted by an independent test agency, in accordance with provisions of Section 014000 - Quality Requirements.

B. Mortar Mixes: Test mortars prebatched by weight in accordance with ASTM C780 recommendations for preconstruction testing.
   1. Test results will be used to establish optimum mortar proportions and establish quality control values for construction testing.

PART 3 - EXECUTION

3.01 PREPARATION

A. Apply bonding agent to existing concrete surfaces.

B. Plug clean-out holes for grouted masonry with brick masonry units. Brace masonry to resist wet grout pressure.

3.02 INSTALLATION

A. Install mortar and grout to requirements of section(s) in which masonry is specified.

B. Work grout into masonry cores and cavities to eliminate voids.

C. Do not install grout in lifts greater than 16 inches (400 mm) without consolidating grout by rodding.

D. Do not displace reinforcement while placing grout.

E. Remove excess mortar from grout spaces.

3.03 FIELD QUALITY CONTROL

A. An independent testing agency will perform field tests, in accordance with provisions of Section 014000 - Quality Requirements.

B. Test and evaluate mortar in accordance with ASTM C780 procedures.

C. Test and evaluate grout in accordance with ASTM C1019 procedures.

END OF SECTION 040511

SECTION 040519

MASONRY ANCHORAGE AND REINFORCING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Horizontal Joint Reinforcement.
   2. Veneer Anchors and Ties.

B. Related Requirements:
   1. Section 042001 - Masonry Veneer (Brick and CMU Block non-load bearing).
   2. Section 047200 - Cast Stone Masonry

1.02 REFERENCES

A. Reference Standards:
   1. ASTM International (ASTM):
      a. ASTM A82/A82M Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
      b. ASTM A153/A153M Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

1.03 ACTION SUBMITTALS

A. General: Submit listed submittals in accordance with Contract Conditions and Section 01 33 00 - Submittal Procedures.

B. Product Data: Submit specified products as follows:
   1. Manufacturer’s installation instructions.
   2. Catalog pages illustrating products to be included in project.
   3. Material Safety Data Sheets (MSDS).

1.04 INFORMATION SUBMITTALS

A. General: Submit listed submittals in accordance with Contract Conditions and Section 01 33 00 - Submittal Procedures.

B. Source Quality Control: Submit documentation verifying that components and materials specified in this Section are from single manufacturer.

C. Qualification Statements:
   1. Submit letter of verification for Manufacturer's Qualifications.
   2. Submit letter of verification for Installer's Qualifications.

1.05 CLOSEOUT SUBMITTALS

A. General: Submit listed submittals in accordance with Contract Conditions and Section 01 33 00 - Submittal Procedures.

B. Warranty Documentation: Submit warranty documents specified.

1.06 QUALITY ASSURANCE

A. Qualifications:
   1. Installer: Acceptable to manufacturer, experienced in performing work of this section and has specialized in installation of work similar to that required for this project.

1.07 DELIVERY, STORAGE & HANDLING

A. Delivery and Acceptance Requirements:
   1. Deliver material in accordance with Section 01 60 00 - Product Requirements and in accordance with manufacturer's written instructions.
   2. Deliver materials in manufacturer's original packaging with identification labels intact and in sizes to suit project.

B. Storage and Handling Requirements:
   1. Store materials protected from exposure to harmful weather conditions and as directed by manufacturer.

C. Packaging Waste Management:
   1. Separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Construction Waste Management and Disposal.

1.08 WARRANTY

A. Warranty: Refer to Contract Conditions and Section 01 78 00 - Closeout Procedures for project warranty provisions.

B. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to, and does not limit, other rights Owner may have under other Contract Documents.

PART 2 - PRODUCTS

2.01 REINFORCEMENT AND ANCHORAGE

A. Corrugated Metal Ties: Not allowed.

B. Reinforcing Steel: ASTM A615/A615M, grade 60 (420) yield grade, deformed billet bars.

C. Horizontal Joint Reinforcement: Use ladder type joint reinforcement where vertical reinforcement is involved and truss type elsewhere, unless otherwise indicated.
   1. Ladder Type: ASTM A1064/A1064M steel wire, hot dip galvanized after fabrication to ASTM A153/A153M, Class B; 0.1483 inch side rods with 0.1483 inch cross rods; width as required to provide not more than 1 inch and not less than 1/2 inch of mortar coverage on each exposure.
      a. Manufacturers:
         1) Blok-Lok Limited; Product BL-42 Ladder Reinforcement: www.blok-lok.com.
         2) Hohmann & Barnard, Inc.; Product 270 Ladder Eye-Wire: www.h-b.com.
         3) WIRE-BOND; Product Ladder Hook & Eye: www.wirebond.com.
         4) Substitutions: In accordance with Section 01 25 00 - Substitution Procedures.
   2. Provide horizontal joint reinforcement components and materials specified in this section from a single manufacturer.

D. Self-Drilling Adjustable Veneer Anchors and Ties: Single anchor-screw-tie adjustable system that transfers horizontal loads directly to backup material or interior wythe.
   1. Metal Stud Backup Wall:
      a. Basis of Design Product: Hohmann & Barnard, Inc.: 2-Seal Thermal Wing Nut Anchor for non-seismic applications.
      b. Other Acceptable Products:
         1) Heckmann Building Products, Inc.; Pos-I-Tie ThermalClip with Self Drilling Screw.
         2) Substitutions: In accordance with Section 01 25 00 - Substitution Procedures.
         3) Anchor:
            (a) Type: Screw type.
            (b) Length: Equal to thickness of exterior grade gypsum board sheathing and/or insulation.
            (c) Barrel Finish: Stainless steel - Type 304.
         4) Hook:
            (a) Type: Compressed Leg 2X-Hook.
            (b) Thickness: 3/16 inch (4.8 mm).
            (c) Length: Sized to extend at least halfway through veneer but with at least 5/8-inch (16-mm) cover on outside face.

(d) Finish: Hot-Dipped Galvanized, to ASTM A82, with zinc coating hot-dip galvanized after fabrication to ASTM A153.
(1) Tensile Strength: Not less than 80,000 psi (552 MPa).
(2) Yield Point: Not less than 70,000 psi (483 MPa).

5) Factory-Installed Accessories:
(a) EPDM washers.
(b) Plastic wing nut

2. Concrete / CMU Backup Wall:
a. Basis of Design Product: Hohmann & Barnard, Inc.: 2-Seal Thermal Concrete Wing Nut Anchor for non-seismic applications.
b. Other Acceptable Products:
1) Heckmann Building Products, Inc.; Pos-I-Tie ThermalClip with Concrete/CMU Screw.
2) Substitutions: In accordance with Section 01 25 00 - Substitution Procedures.
3) Anchor:
(a) Type: Screw type.
(b) Length: Equal to thickness of sheathing and/or insulation.
(c) Barrel Finish: Stainless steel - Type 304.
4) Hook:
(a) Type: Compressed Leg 2X-Hook.
(b) Thickness: 3/16 inch (4.8 mm).
(c) Length: Sized to extend at least halfway through veneer but with at least 5/8-inch (16-mm) cover on outside face.
(d) Finish: Hot-Dipped Galvanized, to ASTM A82, with zinc coating hot-dip galvanized after fabrication to ASTM A153.
(1) Tensile Strength: Not less than 80,000 psi (552 MPa).
(2) Yield Point: Not less than 70,000 psi (483 MPa).
5) Factory-Installed Accessories:
(a) EPDM washers.
(b) Plastic wing nut.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verification of Conditions: Verify that conditions of substrates previously installed under other sections or contracts are acceptable for product installation in accordance with manufacturer's instructions prior to masonry anchor and tie assembly installation.

B. Verify that site conditions installed under other sections are in accordance with manufacturer's instructions prior to masonry anchor and tie assembly installation.
1. Inform Architect of unacceptable conditions immediately upon discovery.

2. Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval from Architect.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surface in accordance with manufacturer's written recommendations and coordinate with Section 01 73 00 - Execution.

3.03 INSTALLATION

A. 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.

B. Install horizontal joint reinforcement 16 inches on center.

C. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.

D. Place continuous joint reinforcement in first and second joint below top of walls.

E. Lap joint reinforcement ends minimum 6 inches.

F. Masonry Back-Up: Embed anchors to bond veneer at maximum 16 inches on center vertically and 36 inches on center horizontally. Place additional anchors at perimeter of openings and ends of panels, so maximum spacing of anchors is 8 inches on center.

G. Stud Back-Up: Secure veneer anchors to stud framed back-up and embed into masonry veneer at maximum 16 inches on center vertically and 24 inches on center horizontally. Place additional anchors at perimeter of openings and ends of panels, so maximum spacing of anchors is 8 inches on center.

H. Accurately fit, align, securely fasten and install free from distortion or defects.

I. Support and secure vertical reinforcing bars from displacement. Maintain positions within 1/2 inch of dimensioned position.

J. Place and consolidate grout fill without displacing reinforcing.

3.04 APPLICATION

A. Coordinate application of veneer masonry anchor and tie assemblies in accordance with Section 01 73 00 - Execution.

3.05 CLEANING

A. Perform cleanup in accordance with Section 01 73 00 - Execution.

B. Upon completion, remove surplus materials, rubbish, tools and equipment in accordance with Section 017800 - Closeout Procedures.

3.06 PROTECTION

A. Protect installed product from damage during construction in accordance with Section 01 73 00 - Execution.

B. Repair damage to adjacent materials caused by masonry veneer anchor and tie assembly installation.

END OF SECTION 040519

SECTION 040523
MASONRY ACCESSORIES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Embedded Flashing.

B. Miscellaneous Masonry Accessories.

1.02 RELATED REQUIREMENTS

A. Section 040511 - Masonry Mortaring and Grouting.

B. Section 040519 - Masonry Anchorage and Reinforcing.

C. Section 042001 - Masonry Veneer (Brick and CMU Block non-load bearing).

D. Section 076200 - Sheet Metal Flashing and Trim: Reglets for flashing.

1.03 REFERENCE STANDARDS

A. ASTM International (ASTM):
   1. ASTM A167 Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
   2. ASTM A240 Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip
      a. for Pressure Vessels and for General Applications.
   3. ASTM A480 Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip.
   4. ASTM G151 Standard Practice for Exposing Nonmetallic Materials in Accelerated Test Devices that Use Laboratory Light Sources.
   5. ASTM G154 Standard Practice for Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate work of this Section with work of other trades for proper time and sequence to avoid construction delays. Comply with Section 01 31 00 - Project Management and Coordination.

1.05 ACTION SUBMITTALS

A. General: Submit listed submittals in accordance with Contract Conditions and Section 01 33 00 - Submittal Procedures.

B. Product Data: Submit for each type of product indicated.
   1. Manufacturer's product data, including manufacturer's SPEC-DATA product sheet.
   2. Catalog pages illustrating products to be incorporated into project.
   3. Material Safety Data Sheets (MSDS).

C. Samples: Submit as follows:
   1. 6 inches (152 mm) in length, of each type of flashing and reglet specified.

1.06 INFORMATION SUBMITTALS

A. General: Submit listed submittals in accordance with Contract Conditions and Section 01 33 00 - Submittal Procedures.

B. Test and Evaluation Reports:
   1. Certified test reports showing compliance with specified performance characteristics and physical properties.

C. Manufacturer's Instructions: Submit manufacturer's storage and installation instructions.

D. Source Quality Control: Submit documentation verifying that components and materials specified in this Section are from single manufacturer.

1.07 QUALITY ASSURANCE

A. Qualifications:
   1. Manufacturer:
   2. Having 5 years' experience manufacturing components similar to or exceeding requirements of project.
   3. Having sufficient capacity to produce and deliver required materials without causing delay in work.
   4. Capable of providing field service representation during construction.
   5. Installer: Acceptable to the manufacturer and experienced in performing work of this section and has specialized in installation of work similar to that required for this project.

1.08 DELIVERY, STORAGE & HANDLING

A. Delivery and Acceptance Requirements:

1. Deliver material in accordance with Section 01 60 00 - Product Requirements and in accordance with manufacturer's written instructions.
2. Deliver materials in manufacturer's original packaging with identification labels intact and in sizes to suit project.

B. Storage and Handling Requirements:
1. Store materials protected from exposure to harmful weather conditions and at temperatures recommended by manufacturer.
2. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.09 MOCK-UP

A. Supply sufficient quantity of embedded flashing materials and masonry accessories for use in constructing integrated exterior mock-up panels, as specified in Section 01 40 00 - Quality Requirements.

1.10 WARRANTY

A. Warranty: Refer to Contract Conditions and Section 01 78 00 - Closeout Procedures for project warranty provisions.

B. Manufacturer's Warranty: Submit for Owner's acceptance manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to, and does not limit, other rights Owner may have under other Contract Documents.

PART 2 - PRODUCTS

2.01 EMBEDDED FLASHING MATERIALS

A. Manufacturer: Hohmann & Barnard, Inc.

B. Contact: 30 Rasons Court, Hauppauge, NY 11788-4206; Telephone: (800) 645-0616, (631) 234-0600; Fax: (631) 234- 0683; E-mail: weanchor@h-b.com; website: www.h-b.com.
1. Single Source Responsibility: Provide components and materials specified in this section from a single manufacturer.
2. Substitutions: In accordance with Section 01 25 00 - Substitution Procedures.
3. Compatibility:
a. Ensure components and materials are compatible with specified accessories and adjacent materials.

4. Mighty-Flash: A stainless steel fabric flashing consisting of a layer of polymeric fabric with a single sheet of stainless steel bonded to one side. For use at Splash Pad Office/Mech Building cavity wall assemblies.
    a. Material: 304 stainless steel.
    b. Width: 24 inch.
    c. Roll Length: 60 feet.
    d. Puncture (PSI), ASTM E154: 2,500+ psi.
    e. Tensile, ASTM D412: 100,000+ psi.
    f. Fire Resistant, ASTM E84: Pass, Class A material.
    g. Mold Resistant, ASTM D3723: Pass.
    h. UV-Resistant: 180 days.
    i. Recycled Content: 60 percent.
5. MFL-Metal Flashing:
    a. Material: 26 gauge Type 304 stainless steel to ASTM A167, ASTM A240 and ASTM A480).
6. Termination Bar:
    a. Type T-2. (integral 3/8 inch flange on top for caulking)
    b. Material: Type 304 stainless steel.
    c. Gauge: 26 Gauge.
    d. Size: 1.5 inch (38 mm) x 8 feet (2.4 m).
    e. 1/4 inch holes spaced 8 inches on center.
7. Drip Plate: Use one of the following:
    a. DP - Standard Drip Plate:
        1) Material: Type 304 stainless steel to ASTM A24D/A24DM, ASTM A666, ASTM A480/A480DM, and ASTM A167.
        2) Size: 3 inches.
    b. Flex-Flash Drip Edge:
        1) Thickness: 45 mil.
        2) Size: 3 inches wide x 8 feet long with a 3/8 inch drip.
        3) Color: Grey.
8. H&B Asphalt Mastic: Asphalt based emulsion.
9. Splice Tape:
    a. X-Seal Splice Tape.
        1) Size: 4 inches wide.
10. Textroflash Flashing: Polyethylene sheeting with laminated clear adhesive. For use at Comfort Station CMU Assemblies.
    a. Thickness: 40 mil (1 mm).
    b. Width: 24 inches (610 mm).
    c. Puncture Resistance Film, ASTM D781: 170 pounds (77 kg), minimum.
    d. Puncture Resistance Membrane, ASTM D781: 40 pounds (18 kg), minimum.
    e. Tensile Strength Membrane, ASTM D412: 1500 psi (10,342 kPa), minimum.
    f. Elongation of Rubberized Asphalt, ASTM D882: 400%, minimum.

2.02 MISCELLANEOUS MASONRY ACCESSORIES

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

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

C. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).

D. Weep/Vent Products: Use one of the following unless otherwise indicated:
   1. Cellular Plastic Weep/Vent: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, full height and width of head joint and depth 1/8 inch (3 mm) less than depth of outer wythe, in color selected from manufacturer's standard.
      a. Products: Subject to compliance with requirements, provide one of the following:
         1) Advanced Building Products Inc.; Mortar Maze Cell Vent.
         2) Blok-Lok Limited; CELLVENT.
         3) Heckmann Building Products Inc.; No. 85 Cell Vent.
         4) Hohmann & Barnard, Inc.; QV - Quadro-Vent.
         5) Mortar Net USA, Ltd.; CellVent.
         6) Wire-Bond; No. 3601 Cell Vent.
   2. Mesh Weep/Vent: Free-draining mesh; made from polyethylene strands, full height and width of head joint and depth 1/8 inch (3 mm) less than depth of outer wythe; in color selected from manufacturer's standard.
      a. Products: Subject to compliance with requirements, provide one of the following:
         1) Advanced Building Products Inc.; Mortar Break Weep Mesh.
         2) Hohmann & Barnard, Inc.; Mortar Trap Weep Vents.
         3) Mortar Net USA, Ltd.; Mortar Net Weep Vents.

E. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Advanced Building Products Inc.; Mortar Maze, Mortar Break DT.
      b. Hohmann & Barnard, Inc.; Mortar Trap.
      c. Mortar Net USA, Ltd.; Mortar Net.
      d. Wire-Bond; Cavity Net DT.
   2. Provide one of the following configurations:
      a. Strips, full-depth of cavity and 10 inches (250 mm) high, with dovetail shaped notches 7 inches (175 mm) deep that prevent clogging with mortar droppings.

b. Strips, not less than 1-1/2 inches (38 mm) thick and 10 inches (250 mm) high, with offset dimpled surface designed to catch mortar droppings and prevent weep holes from clogging with mortar.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verification of Conditions: Verify that conditions of substrates previously installed under other sections or contracts are acceptable for product installation in accordance with manufacturer's instructions prior to flashing installation.
   1. Inform Architect of unacceptable conditions immediately upon discovery.
   2. Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval from Architect.

3.02 PREPARATION

A. Surface Preparation: Prepare surface in accordance with manufacturer's written recommendations.

3.03 FLASHING, WEEP HOLES, CAVITY DRAINAGE, AND VENTS

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

B. Install flashing as follows unless otherwise indicated:
   1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
   2. At multiwythe masonry walls, including cavity walls, extend flashing through outer wythe, turned up a minimum of 8 inches (200 mm), and 1-1/2 inches (38 mm) into the inner wythe. Form 1/4 inch hook in edge of flashing embedded in inner wythe.
   3. At masonry-veneer walls, extend flashing through veneer, across air space behind veneer, and up face of sheathing at least 8 inches (200 mm); with upper edge tucked under building paper or building wrap, lapping at least 4 inches (100 mm).
   4. At lintels and shelf angles, extend flashing a minimum of 6 inches (150 mm) into masonry at each end. At heads and sills, extend flashing 6 inches (150 mm) at ends and turn up not less than 2 inches (50 mm) to form end dams.

5. Interlock end joints of ribbed sheet metal flashing by overlapping ribs not less than 1-1/2 inches (38 mm) or as recommended by flashing manufacturer, and seal lap with elastomeric sealant complying with requirements in Section 07 90 05 - Joint Sealers for application indicated.
6. Install metal drip edges and sealant stops with ribbed sheet metal flashing by interlocking hemmed edges to form hooked seam. Seal seam with elastomeric sealant complying with requirements in Section 90 05 - Joint Sealers for application indicated.
7. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch (13 mm) back from outside face of wall and adhere flexible flashing to top of metal drip edge.

C. Install single-wythe CMU flashing system in bed joints of CMU walls where indicated to comply with manufacturer's written instructions. Install CMU cell pans with upturned edges located below face shells and webs of CMUs above and with weep spouts aligned with face of wall. Install CMU web covers so that they cover upturned edges of CMU cell pans at CMU webs and extend from face shell to face shell.

D. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.

E. Install weep vents in head joints in exterior wythes of first course of masonry immediately above embedded flashing and as follows:
   1. Use specified weep/vent products to form weep holes.
   2. Space weep holes 24 inches (600 mm) o.c. unless otherwise indicated.

F. Place cavity drainage material in cavities to comply with configuration requirements for cavity drainage material in "Miscellaneous Masonry Accessories" Article.

G. Install vents in head joints in exterior wythes at spacing indicated. Use specified weep/vent products to form vents.
   1. Close cavities off vertically and horizontally with blocking in manner indicated. Install through-wall flashing and weep holes above horizontal blocking.

3.04 CLEANING

A. Perform cleanup in accordance with Section 01 74 19 - Construction Waste Management and Disposal.

B. Upon completion, remove surplus materials, rubbish, tools and equipment in accordance with Section 01 77 00 - Closeout Procedures.

END OF SECTION 040523

SECTION 042001

MASONRY VENEER (BRICK AND CMU BLOCK NON-LOAD BEARING)

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Decorative Concrete Block at Splash Pad Office/Mech Building.

1.02 RELATED REQUIREMENTS

A. Section 040100 - Maintenance of Masonry.

B. Section 040511 - Masonry Mortaring and Grouting.

C. Section 040519 - Masonry Anchorage and Reinforcing.

D. Section 040523 - Masonry Accessories: Embedded flashing and masonry accessories.

E. Section 054000 - Cold-Formed Metal Framing: Steel stud backup for masonry veneer.

F. Section 079200 - Joint Sealants: Sealing control and expansion joints.

1.03 REFERENCE STANDARDS

A. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2016.

B. ASTM C67 - Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile; 2014.

C. ASTM C90 - Standard Specification for Loadbearing Concrete Masonry Units; 2016.

D. ASTM C652 - Standard Specification for Hollow Brick (Hollow Masonry Units Made From Clay or Shale); 2015.

E. ASTM C979/C979M - Standard Specification for Pigments for Integrally Colored Concrete; 2016.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week before starting work of this section.

1.05 SUBMITTALS

A. See Section 013300 - Submittal Procedures

B. Product Data: Provide data for masonry units, fabricated wire reinforcement, and mortar.

C. Samples: Submit four samples of facing brick units to illustrate color, texture, and extremes of color range.

D. Manufacturer's Certificate: Certify that masonry units meet or exceed specified requirements.

1.06 QUALITY ASSURANCE

A. Comply with provisions of TMS 402/602, except where exceeded by requirements of Contract Documents.
   1. Maintain one copy of each document on project site.

1.07 MOCK-UP

A. Construct a masonry mock-up panel sized 8 feet (2.4 m) long by 6 feet (1.8 m) high; include mortar and accessories and structural backup in mock-up for each type of veneer brick and block - see Section 40 00 - Quality Requirements.

B. Mock-up may remain as part of the Work.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

1.09 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 CONCRETE MASONRY UNITS

A. Concrete Block: Comply with referenced standards and as follows:
   1. Size: Standard units with nominal face dimensions of 16 by 8 inches (400 by 200 mm) and nominal depths as indicated on drawings for specific locations.
   2. Special Shapes: Provide non-standard blocks configured for corners.
   3. Load-Bearing Units: ASTM C90, normal weight.
      a. Hollow block, as indicated.
      b. Exposed Faces: Manufacturer's standard color and texture where indicated.

2.02 DECORATIVE CONCRETE MASONRY UNITS

A. Manufacturers:
   1. York Building Products, M-01 Gemstone and M-04 Splitface as noted on Finish Schedule A-604

B. Product:
   1. TypeM-01 and M-04 : Decorative concrete masonry units, conforming to ASTM C90.
      a. Size: Standard units with nominal face dimensions of 16 x 8 inches and nominal depths 3-5/8" typical.
      b. Texture: Splitface and Groundface.
      c. Color: Per finish schedule.

2.03 MORTAR AND GROUT MATERIALS

A. Mortar and Grout: As specified in Section 040511.

2.04 REINFORCEMENT AND ANCHORAGE

A. Reinforcement and Anchorage: As specified in Section 040519.

2.05 FLASHINGS

A. Embedded Flashings: As specified in Section 040523 - Masonry Accessories.

2.06 ACCESSORIES

A. Masonry Accessories: As specified in Section 04 05 23 - Masonry Accessories.

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 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.
   2. Coursing: One unit and one mortar joint to equal 8 inches (200 mm).
   3. Mortar Joints: Concave.

3.03 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 as work progresses.

E. Interlock intersections and external corners, except for units laid in stack bond.

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 veneer from horizontal structural framing members or support angles with compressible joint filler.

3.04 WEEPS/CAVITY VENTS

A. Install weeps in veneer walls at 24 inches (600 mm) on center horizontally on top of through-wall flashing above shelf angles and lintels and at bottom of walls.

3.05 REINFORCEMENT AND ANCHORAGE - MASONRY VENEER

A. Install horizontal joint reinforcement 16 inches (400 mm) on center.

B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches (400 mm) 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 (150 mm).

E. Masonry Back-Up: Embed anchors to bond veneer at maximum 16 inches (400 mm) on center vertically and 36 inches (900 mm) on center horizontally. Place additional anchors at perimeter of openings and ends of panels, so maximum spacing of anchors is 8 inches (200 mm) on center.

F. Stud Back-Up: Secure veneer anchors to stud framed back-up and embed into masonry veneer at maximum 16 inches (400 mm) on center vertically and 24 inches (600 mm) on center horizontally. Place additional anchors at perimeter of openings and ends of panels, so maximum spacing of anchors is 8 inches (200 mm) on center.

G. Seismic Reinforcement: Connect veneer anchors with continuous horizontal wire reinforcement before embedding anchors in mortar.

3.06 CONTROL AND EXPANSION JOINTS

A. Do not continue horizontal joint reinforcement through control or expansion joints.

3.07 TOLERANCES

A. Maximum Variation From Unit to Adjacent Unit: 1/16 inch (1.6 mm).

B. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft (6 mm in 3 m) and 1/2 inch in 20 ft (13 mm in 6 m) or more.

C. Maximum Variation from Plumb: 1/4 inch (6 mm) per story non-cumulative; 1/2 inch (13 mm) in two stories or more.

D. Maximum Variation from Level Coursing: 1/8 inch in 3 ft (3 mm in 1 m) and 1/4 inch in 10 ft (6 mm in 3 m); 1/2 inch in 30 ft (13 mm in 9 m).

E. Maximum Variation of Mortar Joint Thickness: Head joint, minus 1/4 inch, plus 3/8 inch (minus 6.4 mm, plus 9.5 mm).

3.08 CUTTING AND FITTING

A. Cut and fit for pipes and conduit. Coordinate with other sections of work to provide correct size, shape, and location.

B. Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.09 CLEANING

A. Remove excess mortar and mortar smears as work progresses.

B. Replace defective mortar. Match adjacent work.

C. Clean soiled surfaces as specified in Section 040100 - Maintenance of Masonry.

3.10 PROTECTION

A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

END OF SECTION 042001

SECTION 042900
REINFORCED UNIT MASONRY - CMU WALLS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Concrete block at Comfort Station.

B. Reinforcement and anchorage.

C. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 040100 - Maintenance of Masonry.

B. Section 040511 - Masonry Mortaring and Grouting.

C. Section 040523 - Masonry Accessories.

1.03 REFERENCE STANDARDS

A. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2016.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.

C. ASTM A641/A641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire; 2009a (Reapproved 2014).

D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

E. ASTM A767/A767M - Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement; 2009.

F. ASTM C90 - Standard Specification for Loadbearing Concrete Masonry Units; 2016.

1.04 SUBMITTALS

A. See Section 013300 - Submittal Procedures

B. Product Data: Provide data for masonry units, fabricated wire reinforcement, and mortar and grout.

C. Shop Drawings: Indicate bar sizes, spacings, reinforcement quantities, bending and cutting schedules, reinforcement supporting and spacing devices, and accessories.

D. Design Data: Indicate required mortar strength, unit assembly strength in each plane, and supporting test data.

E. Manufacturer's Certificate: Certify that masonry units meet or exceed specified requirements.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 016000 - Product Requirements, for additional provisions.

1.05 QUALITY ASSURANCE

A. Comply with provisions of TMS 402/602, except where exceeded by requirements of Contract Documents.
   1. Maintain one copy of each document on project site.

1.06 MOCK-UP

A. Construct a masonry wall as a mock-up panel sized 8 feet (2.4 m) long by 6 feet (1.8 m) high; include mortar and accessories, structural backup, reinforcement, grout, flashings, weather barrier, and wall insulation in mock-up.

B. Mock-up may remain as part of the Work.

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.

1.08 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 CONCRETE MASONRY UNITS

A. Concrete Block: Comply with referenced standards and as follows:
   1. Size: Standard units with nominal face dimensions of 16 by 8 inches (400 by 200 mm) and nominal depths as indicated on drawings for specific locations.
   2. Special Shapes: Provide non-standard blocks configured for corners and other detailed conditions.
   3. Load-Bearing Units: ASTM C90, normal weight.
      a. Hollow block, as indicated. Reinforced per Structural Drawings.
      b. Exposed Faces: Manufacturer's standard color and texture where indicated.
   4. Manufacturer: York Building Products
      a. Products: As noted on Finish Schedule A-604. See M-01, M-02, M-03, and M-04.

2.02 MORTAR AND GROUT MATERIALS

A. Mortar and Grout: As specified in Section 040511.

2.03 FLASHINGS

A. As specified in Section 040523 - Masonry Accessories

2.04 ACCESSORIES

A. Masonry Accessories: As specified in Section 04 05 23 - Masonry Accessories.

2.05 MORTAR MIXES

A. Mortar: As specified in Section 040511.

2.06 GROUT MIXES

A. Grout: As specified in Section 040511

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 PREPARATION

A. Direct and coordinate placement of metal anchors supplied for installation under other sections.

B. Clean reinforcement of loose rust.

C. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

D. For areas where high-lift grouting will be employed, provide cleanout openings as follows:
   1. Brick Masonry: Not less than 8 inches (200 mm) on center at the bottom of one wythe, formed by omitting bricks.
   2. Hollow Masonry: Not less than 8 inches (200 mm) high at the bottom of each cell to be grouted, formed by cutting out face shell of masonry unit.

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.
   2. Coursing: One unit and one mortar joint to equal 8 inches (200 mm).
   3. Mortar Joints: Concave.

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 as work progresses.

E. Interlock intersections and external corners, except for units laid in stack bond.

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.

3.05 CONTROL AND EXPANSION JOINTS

A. Do not continue horizontal joint reinforcement through control or expansion joints.

B. Form control joint with a sheet building paper bond breaker fitted to one side of the hollow contour end of the block unit. Fill the resultant core with grout fill. Rake joint at exposed unit faces for placement of backer rod and sealant.

C. Install preformed control joint device in continuous lengths. Seal butt and corner joints in accordance with manufacturer's instructions.

D. Size control joints as indicated on drawings; if not indicated, 3/4 inch (19 mm) wide and deep.

3.06 TOLERANCES

A. Maximum Variation from Alignment of Columns: 1/4 inch (6 mm).

B. Maximum Variation From Unit to Adjacent Unit: 1/16 inch (1.6 mm).

C. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft (6 mm/3 m) and 1/2 inch in 20 ft (13 mm/6 m) or more.

D. Maximum Variation from Plumb: 1/4 inch (6 mm) per story non-cumulative; 1/2 inch (13 mm) in two stories or more.

E. Maximum Variation from Level Coursing: 1/8 inch in 3 ft (3 mm/m) and 1/4 inch in 10 ft (6 mm/3 m); 1/2 inch in 30 ft (13 mm/9 m).

F. Maximum Variation of Joint Thickness: 1/8 inch in 3 ft (3 mm/m).

G. Maximum Variation from Cross Sectional Thickness of Walls: 1/4 inch (6 mm).

3.07 CUTTING AND FITTING

A. Cut and fit for chases. Coordinate with other sections of work to provide correct size, shape, and location.

B. Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.08 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 014000 - Quality Requirements.

3.09 CLEANING

A. Remove excess mortar and mortar smears as work progresses.

B. Replace defective mortar. Match adjacent work.

3.10 PROTECTION

A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

END OF SECTION 042900

SECTION 047200
CAST STONE MASONRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Units required are indicated on drawings as "cast stone" or "precast" (PC-01) .

B. Units required are:
   1. Exterior wall units, including wall caps, lintels, and sills.
   2. Interior units, including wall caps and beams.
   3. Other items indicated on drawings.

1.02 RELATED REQUIREMENTS

A. Section 040511 - Masonry Mortaring and Grouting: Mortar for setting cast stone.

B. Section 042000 - Unit Masonry: Installation of cast stone in conjunction with masonry.

C. Section 042001 - Masonry Veneer (Brick and CMU Block non-load bearing)

D. Section 042900 - Reinforced Unit Masonry - CMU Walls: Installation of cast stone in conjunction with masonry.

E. Section 079200 - Joint Sealants: Sealing joints indicated to be left open for sealant.

1.03 REFERENCE STANDARDS

A. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2016.

B. ASTM A767/A767M - Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement; 2009.

C. ASTM A884/A884M - Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement; 2014.

D. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2015.

E. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2016, with Editorial Revision (2016).

F. ASTM C150/C150M - Standard Specification for Portland Cement; 2016.

G. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2014a.

H. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete; 2017.

I. ASTM C642 - Standard Test Method for Density, Absorption, and Voids in Hardened Concrete; 2013.

J. ASTM C1364 - Standard Specification for Architectural Cast Stone; 2017.

1.04 SUBMITTALS

A. See Section 013300 - Submittal Procedures

B. Product Data: Test results of cast stone components made previously by the manufacturer.
   1. Include one copy of ASTM C1364 for Architect's use.

C. Shop Drawings: Include elevations, dimensions, layouts, profiles, cross sections, reinforcement, exposed faces, arrangement of joints, anchoring methods, anchors, and piece numbers.

D. Mortar Color Selection Samples.

E. Verification Samples: Pieces of actual cast stone components not less than 4 inches (101.6 mm) square, illustrating range of color and texture to be anticipated in components furnished for the project.

F. Source Quality Control Test Reports.

G. Manufacturer's Qualification Data: Documentation showing compliance with specified requirements.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications:
   1. Current producer member of the Cast Stone Institute or the Architectural Precast Association.
   2. Manufacturer's production facility currently holds a Plant Certification from the Cast Stone Institute or the Architectural Precast Association.

3. Adequate plant capacity to furnish quality, sizes, and quantity of cast stone required without delaying progress of the work.

1.06 MOCK-UP

A. Provide full size cast stone components for installation in mock-up of exterior wall.

B. See Section 014000 - Quality Requirements for additional requirements.
   1. Approved mock-up will become standard for appearance and workmanship.
   2. Mock-up may remain as part of the completed work.
   3. Remove mock-up not incorporated into the work and dispose of debris.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver cast stone components secured to shipping pallets and protected from damage and discoloration. Protect corners from damage.

B. Number each piece individually to match shop drawings and schedule.

C. Store cast stone components and installation materials in accordance with manufacturer's instructions.

D. Store cast stone components on pallets with nonstaining, waterproof covers. Ventilate under covers to prevent condensation. Prevent contact with dirt.

E. Protect cast stone components during handling and installation to prevent chipping, cracking, or other damage.

F. Store mortar materials where contamination can be avoided.

G. Schedule and coordinate production and delivery of cast stone components with unit masonry work to optimize on-site inventory and to avoid delaying the work.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Architectural Cast Stone:
   1. Any current producer member of the Cast Stone Institute.
   2. Substitutions: See Section 016000 - Product Requirements.

2.02 MATERIALS

A. Portland Cement: ASTM C150/C150M.
   1. For Mortar: Type I or II, except Type III may be used in cold weather.

B. Coarse Aggregate: ASTM C33/C33M, except for gradation; granite, quartz, or limestone.

C. Fine Aggregate: ASTM C33/C33M, except for gradation; natural or manufactured sands.

D. Admixtures: ASTM C494/C494M.

E. Water: Potable.

F. Reinforcing Bars: ASTM A615/A615M deformed bars, galvanized.
   1. Galvanized in accordance with ASTM A767/A767M, Class I.

G. Steel Welded Wire Reinforcement: ASTM A1064/A1064M, galvanized or ASTM A884/A884M, epoxy coated.

H. Embedded Anchors, Dowels, and Inserts: Type 304 stainless steel, of type and size as required for conditions.

I. Mortar: Portland cement-lime, as specified in Section 040511 ; do not use masonry cement.

J. Cleaner: General-purpose cleaner designed for removing mortar and grout stains, efflorescence, and other construction stains from new masonry surfaces without discoloring or damaging masonry surfaces; approved for intended use by cast stone manufacturer and by cleaner manufacturer for use on cast stone and adjacent masonry materials.

2.03 SOURCE QUALITY CONTROL

A. Test compressive strength and absorption of specimens selected at random from plant production.
   1. Test in accordance with ASTM C642.
   2. Select specimens at rate of 3 per 500 cubic feet (3 per 14 cubic m), with a minimum of 3 per production week.
   3. Submit reports of tests by independent testing agency, showing compliance with requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine construction to receive cast stone components. Notify Architect if construction is not acceptable.

B. Do not begin installation until unacceptable conditions have been corrected.

3.02 INSTALLATION

A. Install cast stone components in conjunction with masonry, complying with requirements of Section 042000.

B. Mechanically anchor cast stone units indicated; set remainder in mortar.

C. Setting:
   1. Drench cast stone components with clear, running water immediately before installation.
   2. Set units in a full bed of mortar unless otherwise indicated.
   3. Fill vertical joints with mortar.
   4. Fill dowel holes and anchor slots completely with mortar or non-shrink grout.

3.03 TOLERANCES

A. Joints: Make all joints 3/8 inch (9.5 mm), except as otherwise detailed.
   1. Rake mortar joints 3/4 inch (19 mm) for pointing.
   2. Remove excess mortar from face of stone before pointing joints.
   3. Point joints with mortar in layers 3/8 inch (9.5 mm) thick and tool to a slight concave profile.
   4. Leave the following joints open for sealant:
      a. Head joints in top courses, including copings, parapets, cornices, sills, and steps.
      b. Joints in projecting units.
      c. Joints between rigidly anchored units, including soffits, panels, and column covers.
      d. Joints below lugged sills and stair treads.
      e. Joints below ledge and relieving angles.
      f. Joints labeled "expansion joint".

B. Installation Tolerances:
   1. Variation from Plumb: Not more than 1/8 inch in 10 feet (3 mm in 3 m) or 1/4 inch in 20 feet (6 mm in 6 m) or more.

2. Variation from Level: Not more than 1/8 inch in 10 feet (3 mm in 3 m) or 1/4 inch in 20 feet (6 mm in 6 m), or 3/8 inch (9 mm) maximum.
3. Variation in Joint Width: Not more than 1/8 inch in 36 inches (3 mm in 900 mm) or 1/4 of nominal joint width, whichever is less.
4. Variation in Plane Between Adjacent Surfaces (Lipping): Not more than 1/16 inch (1.5 mm) difference between planes of adjacent units or adjacent surfaces indicated to be flush with units.

3.04 REPAIR

A. Repair chips and other surface damage noticeable when viewed in direct daylight at 20 feet (6 m).
   1. Repair with matching touch-up material provided by the manufacturer and in accordance with manufacturer's instructions.
   2. Repair methods and results subject to Architect 's approval.

3.05 CLEANING

A. Clean completed exposed cast stone after mortar is thoroughly set and cured.
   1. Wet surfaces with water before applying cleaner.
   2. Apply cleaner to cast stone in accordance with manufacturer's instructions.
   3. Remove cleaner promptly by rinsing thoroughly with clear water.
   4. Do not use acidic cleaners.

3.06 PROTECTION

A. Protect completed work from damage.

B. Clean, repair, or restore damaged or mortar-splashed work to condition of new work.

END OF SECTION 047200

SECTION 051200

STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Structural steel framing members, support members and struts.

B. Base plates and embedded plates

C. Grouting under base plates.

1.2 REFERENCE STANDARDS

A. AISC (MANUAL) – Steel Construction Manual; American Institute of Steel Construction, Inc.

B. AISC S303 – Code of Standard Practice for Steel Buildings and Bridges; American Institute of Steel Construction, Inc.

C. AISC S348 – Specification for Structural Joints Using Grade A325 or A490 Bolts.

D. ASTM A 36/A 36M – Standard Specification for Carbon Structural Steel.

E. ASTM A 53/A 53M – Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded and Seamless.

F. ASTM A 108 – Standard Specification for Steel Bar, Carbon and Alloy, Cold Finished.

G. ASTM A 123/A 123M – Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

H. ASTM A 153/A 153M – Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

I. ASTM A 307 – Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

J. ASTM A 500 – Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.

K. ASTM A 563 – Standard Specification for Carbon and Alloy Steel Nuts.

L. ASTM A 992/A 992M – Standard Specification for Structural Steel Shapes.

M. ASTM C 1107/C 1107M – Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Non-Shrink).

N. ASTM E 94 – Standard Guide for Radiographic Examination.

O. ASTM E164 – Standard Practice for Ultrasonic Contact Examination of Weldments.

P. ASTM E 165 – Standard Test Method for Liquid Penetrant Examination.

Q. ASTM E 709 – Standard Guide for Magnetic Particle Examination.

R. ASTM F 436 – Standard Specification for Hardened Steel Washers.

S. ASTM F 959 – Standard Specification for Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners.

T. ASTM F 1554 – Standard Specification for Anchor Bolts, Steel, 36, 55 and 105 ksi Yield Strength.

U. ASTM F 3125 – Standard Specification for High Strength Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength

V. AWS A2.4 – Standard Symbols for Welding, Brazing, and Non-Destructive Examination.
   1. American Welding Society.

W. AWS D1.1/D1.1M – Structural Welding Code – Steel; American Welding Society.

X. IBC 2018 – International Building Code.

1.3 SUBMITTALS

A. See Section 01 30 00 – Administrative Requirements, for submittal procedures.

B. Shop Drawings:
   1. Indicate profiles, sizes, spacing, and locations of structural members.
   2. Include details of cuts, openings, attachments, fasteners, splices and camber.
   3. Detail all connections.
      a. Indicate pre-tensioned and slip-critical high-strength bolted connections.
      b. Indicate welded connections with AWS welding symbols. Include type, size and length.
      c. Indicate all AWS weld designations for pre-qualified full and partial penetration welds and detail all joint preparations.
   4. Provide erection details for all field welded connections.
   5. For structural-steel connections indicated to comply with design loads, connections and structural analysis data shall be signed and sealed by the

qualified professional engineer registered in the State of Maryland responsible for their preparation.

C. AISC certification for fabricator and erector or required additional documentation for non-AISC certified fabricator and erector.

D. Mill Test Reports: Signed by manufacturer certifying that the product complies with specified requirements. Indicate structural strength, destructive test analysis and non-destructive test analysis.

E. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within the previous 12 months.

F. Quality control test reports for shop and field including ultrasonic test results.

1. Submit certification by a Professional Engineer registered in the State of Maryland that all joint preparation for complete joint penetration welds meet AISC requirements and that all welding procedure specification requirements have been met.

1.4 QUALITY ASSURANCE

A. Structural steel shall be domestic origin, produced and supplied from the United States of America only. Refer to the federal “Buy American Act” and applicable local regulations.

B. Fabricate structural steel members in accordance with AISC “Steel Construction Manual” and AISC “Code of Standard Practice for Steel Buildings and Bridges”.

C. Comply with Section 10 of AISC “Code of Standard Practice for Steel Buildings and Bridges” for architecturally exposed structural steel.

D. Welding: Comply with AWS D1.1, “Structural Welding Code-Steel” for procedures, tolerances, appearance and quality.

E. Fabricator: Engage a firm experienced in fabricating structural steel similar to that indicated for this project and within 15 percent this project size, with a record of successful in-service performance, as well as sufficient production capacity to fabricate structural steel without delaying the Work.

1. Provide documentation that fabricator has provided material for and erected at least 3 projects within 15 percent of project size and complexity, in the last six years.
2. Allow the Owner’s representative to visit the fabrication plant as required to inspect in place quality control procedures and structural steel fabrication.

F. Erector: Engage a firm experienced in erecting structural steel similar to that indicated for the project and within 15 percent of this project size, with a record of successful in-service performance.

1. Provide documentation that the erector has erected at least 3 projects within 15 percent of project size and complexity in the last six years.

G. Design connections not detailed on the drawings under direct supervision of a Professional Engineer experienced in design of this work and licensed in the State of Maryland.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification. Keep steel members off the ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from erosion and deterioration.

1. Store fasteners in a protected place. Clean and re-lubricate bolts and nuts that become dry or rusty before use.
2. Do not store materials on structure in a manner that might cause deterioration, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

1.6 COORDINATION

A. Furnish 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

2.1 MATERIALS

A. Steel angles, Channels and Plates: ASTM A 36/A 36M. ASTM A 572 where plate is noted on plans to have a yield strength of 50 ksi.

B. Steel W Shapes and Tees: ASTM A 992/A 992M.

C. Cold-Formed Structural Tubing: ASTM A 500, Grade C.

D. Pipe: ASTM A 53/A 53M, Grade B, Finish black.

E. Shear Stud Connectors: Made from ASTM A 108 Grade 1015 bars. Headed stud type.

F. Rods: ASTM A 36/A 36M.

G. Structural Bolts and Nuts: Carbon steel, ASTM A 307, Grade A.

H. High-Strength Structural Bolts, Nuts, and Washers: Grade A 325, with matching ASTM A 563 nuts and ASTM F 436 washers; Type 1, medium carbon, plain. Bolts and nuts shall be heavy hex.

I. High Strength Structural Bolts: Grade A 490, with matching ASTM A 563 nuts and ASTM F 436 washers; Type 1 alloy steel. Bolts and nuts shall be heavy hex.

J. Anchor Rods: ASTM F 1554, Grade 36, plain, with matching ASTM A 563 nuts and ASTM F 436 washers.

K. Load Indicator Washers: Provide washers complying with ASTM F 959 at all connections requiring pre-tensioned high-strength bolts.

L. Welding Materials: AWS D1.1; type required for materials being welded.

M. Grout: Non-shrink, non-metallic aggregate type, complying with ASTM C 1107/C 1107M and capable of developing a minimum compressive strength of 7,000 psi at 28 days.

N. Shop and Touch-Up Primer: Type specified in Section 09 91 20, complying with VOC limitations of authorities having jurisdiction.

O. Touch-Up Primer for Galvanized Surfaces: Fabricator's standard, complying with VOC limitations of authorities having jurisdiction.

P. Recycled Content:
   1. Wide-flange shapes, tees, channels and angles: Minimum 90 percent total recycled content including at least 60 percent post-consumer recycled content.
   2. Plate and Bars: Minimum 30 percent total recycled content.
   3. Cold-Formed Hollow Structural Sections: Minimum 30 percent total recycled content.
   4. Pipe: Minimum 30 percent total recycled content.
   5. All Other Steel Materials: Minimum 30 percent total recycled content.

Q. Regional Materials: Provide steel manufactured and containing recycled raw materials recovered within 100 mile radius of Project Site.

2.2 FABRICATION

A. Shop fabricate to the greatest extent possible.

B. Develop required camber for members.

C. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
   1. Plane thermally cut edges to be welded to comply with requirements of AWS D1.1.

D. Bolt Holes: Drill or punch standard bolt holes perpendicular to metal surfaces.

E. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.

2.3 FINISH

A. Galvanize structural steel members to comply with ASTM A 123/A 123M. Provide minimum 1.7 oz/sq ft. galvanized coating. Galvanize all structural steel members. Coordinate with architectural drawings for galvanized steel that shall receive a painted finish coat.

B. Shop prime structural steel members. Do not prime surfaces that will be fireproofed, field welded, in contact with concrete, or high strength bolted with slip-critical connections.

C. Surface preparation: SSPC-SP2: “Hand Tool Cleaning” or SSPC-SP3, “Power Tool Cleaning”.

1. Refer to Division 9 for preparation of surfaces that are to receive coatings other than shop primer.

D. Provide a dry film thickness of not less than 1.5 mil.

2.4 SOURCE QUALITY CONTROL

A. An independent testing agency will perform source quality control tests, as specified in Division 1. Inspection services shall conform to Section 1705.2 of the 2018 IBC Code, the quality assurance inspection requirements of AISC 360 and the Statement of Special inspections noted in the structural drawings.

B. High-Strength Bolts: Provide testing and verification of all shop-bolted connections in accordance with AISC “Specification for Structural Joints Using Grade A 325 or A 490 Bolts”.

1. Pre-tensioned and slip-critical bolts shall be installed using direct-tension-indicator washer method or twist-off type tension control bolt method.

C. Welded Connections: Visually inspect all shop-welded connections and test all full penetration welds using ultrasonic testing performed in accordance with ASTM E 164.

1. Inspect all joint preparations for complete joint penetration welds and verify compliance with welding procedure specification requirements.

PART 3 - EXECUTION

3.1 ERECTION

A. Erect structural steel in compliance with AISC “Code of Standard Practice for Steel Buildings and Bridges”.

B. Allow for erection loads, and provide sufficient temporary bracing to maintain structure in safe condition, plumb, and in true alignment until completion of erection and installation of permanent bracing.

C. Field weld components indicated on shop drawings.

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

E. Use carbon steel bolts only for temporary bracing during construction, unless otherwise specifically permitted on drawings. Install high-strength bolts in accordance with AISC "Specification for Structural Joints Using Grade A 325 or A 490 Bolts".

F. Do not field cut or alter structural members without the approval of the Architect.

G. After erection, prime welds, abrasions, and surfaces not shop primed or galvanized, except surfaces to be in contact with concrete and surfaces that will be fireproofed. Repair damaged galvanized coatings with galvanized repair paint.

H. Grout solidly between column plates and bearing surfaces, complying with manufacturer's instructions for non-shrink grout. Trowel grouted surfaces smooth, splaying neatly to 45 degrees.

3.2 TOLERANCES

A. Maintain erection tolerances of structural steel and architecturally exposed structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges".

3.3 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Division 1. Inspection services shall conform to Section 1705.2 of the 2018 IBC Code, the quality assurance inspection requirements of AISC 360 and the Statement of Special Inspections noted in the structural drawings.

B. High-Strength Bolts: Provide testing and verification of all field-bolted connections in accordance with AISC "Specification for Structural Joints Using Grade A 325 or A 490 Bolts".

1. Pre-tensioned and slip-critical bolts shall be installed using direct-tension-indicator washer method or twist-off type tension control bolt method.

C. Welded Connections: Visually inspect all field-welded connections and test all full penetration welds using ultrasonic testing performed in accordance with ASTM E 164.

1. Inspect all joint preparations for complete joint penetration welds and verify compliance with welding procedure specification requirements.

D. In addition to visual inspection, field-welded shear connectors shall be tested and inspected according to the requirements of AWS D1.1 for stud welding.

E. Correct deficiencies in work that inspections indicate does not comply with the specified requirements.

END OF SECTION 051200

SECTION 054000

COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Formed steel stud exterior wall framing.

B. Formed steel joist framing and bridging.

1.2 REFERENCE STANDARDS

A. AISI SG02-1 – North American Specification for the Design of Cold-Formed Steel Structural Members; American Iron and Steel Institute (replaced SG-971).

B. ASTM A 153/A 153M – Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

C. ASTM A 653/A 653M – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

D. ASTM A 1008/A 1008M – Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low Alloy, and High-Strength Low Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.

E. ASTM C 955 – Standard Specification for Load-Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging for Screw Application of Gypsum Panel Products and Metal Plaster Bases.

F. AWS D1.1/D1.1M – Structural Welding Code – Steel; American Welding Society.

G. SSPC-Paint 20 – Zinc-Rich Primers (Type I, “Inorganic”, and Type II, “Organic”); Society for Protective Coatings.

H. IBC 2018 – International Building Code.

1.3 DESIGN REQUIREMENTS

A. Axial and lateral load bearing elements shall be designed to the following conditions unless more stringent requirements are imposed by governing code; these requirements take precedent when more stringent than governing code.

1. Gravity Loads: Per ASCE 7-2016.
2. Wind and Seismic Loads: Per ASCE 7-2016.

B. Maximum Allowable Deflection:

1. Backing of Masonry Veneer and Stone: 1:600 of span.
2. Other Systems: 1:240 of span.

C. Wall and General System:
1. Design to AISI SG-973 Cold-Formed Steel Design Manual.
2. Design to provide for movement of components without damage, failure of joint seals, undue stress on fasteners, or other detrimental effects when subject to seasonal or cyclic day/night temperature ranges.
3. Design system to accommodate construction tolerances, deflection of building structural members and clearances of intended openings.
4. Design to meet loading and anchorage requirements for window systems and curtainwall system based on calculations provided by the respective subcontractors.
5. Design cold-formed metal truss framing for exterior soffits to meet applicable wind uplift requirements.
6. Seismic Loads: Design and size components to withstand seismic loads and sway displacement as in accordance with IBC code.

1.4 SUBMITTALS

A. See Section 01 30 00 – Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on standard framing members; describe materials and finish, product criteria, limitations.

C. Product Data: Provide manufacturer’s data on factory-made framing connectors, showing compliance with requirements.

D. Shop Drawings: Indicate component details, framed openings, bearing, anchorage, loading, welds, type and location of fasteners, and accessories or items required of related work.
1. Indicate stud, joist and truss layouts.
2. Provide details, shop drawings and calculations stamped by a Professional Structural Engineer licensed in the State of Maryland.
a. Regionally sourced steel: Documentation indicating locations of recovery, manufacture, purchase or recycled raw materials.

1.5 QUALITY ASSURANCE

A. Calculate structural properties of framing members in accordance with the requirements of AISI North American Specification for the Design of Cold-Formed Steel Structural Members.
1. Maintain one copy of document on project site.

B. Design structural elements under the direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed in the State of Maryland.

1.6 PROJECT CONDITIONS

A. Verify that field measurements are as indicated on the drawings.

PART 2 - PRODUCTS

2.1 FRAMING SYSTEM

A. Provide primary and secondary framing members, bridging, bracing, plates, gussets, clips, fittings, reinforcement, and fastenings as required to provide a complete framing system.

2.2 FRAMING MATERIALS

A. Studs and Track: ASTM C 955; studs formed to channel with punched web; U-shaped track in matching nominal width and compatible height.
   1. Galvanized Steel Sheet: ASTM A 653/A 653M Structural Steel (SS) with G90/Z275 hot-dipped galvanized coating.
   2. Gage and depth: As indicated on the drawings and as required to meet specified performance levels.
   3. Grade: As indicated on drawings.

B. Joists and Purlins: ASTM C 955.
   1. Galvanized Steel Sheet: ASTM A 653/A 653M Structural Steel (SS) with G90/Z275 hot-dipped galvanized coating.
   2. Gage and depth: As indicated on the drawings and as required to meet specified performance levels.
   3. Grade: As indicated on drawings.

C. Framing Connectors: Factory-made formed steel sheet, ASTM A 653/A 653M SS Grade 50, with G90/Z275 hot-dipped galvanized coating and factory punched holes.
   1. Structural Performance: Maintain load and movement capacity required by applicable code, when evaluated in accordance with AISI North American Specification for the Design of Cold-Formed Steel Structural Members; minimum 16 gage, 0.06 inch thickness.
   2. Movement Connections: Provide mechanical anchorage devices that accommodate movement using slotted holes, screws and anti-friction bushings, while maintaining structural performance of framing. Provide movement connections where indicated on drawings.
      a. Connect stud to structure in manner allowing vertical movement of structure without affecting studs; allow for minimum movement of ½ inch.

b. Provide top track preassembled with connection devices spaced to fit stud spacing indicated on drawings; minimum track length of 12 feet.

2.3 ACCESSORIES

A. Bracing, Furring, Bridging: Formed sheet steel, thickness determined for conditions encountered; finish to match framing components.

B. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I – Inorganic, complying with VOC limitations of authorities having jurisdiction.

2.4 FASTENERS

A. Self-Drilling, Self-Tapping Screws, Bolts, Nuts and Washers: Hot-dip galvanized per ASTM A 153/A 153M.

B. Anchorage Devices: Power actuated.

C. Welding: In conformance with AWS D1.1.

2.5 SHOP FABRICATED ASSEMBLIES

A. Shop fabricate metal framing to the greatest extent possible.

B. Fabricate assemblies of framed sections of sizes and profiles required; with framing members fitted, reinforced, and braced to suit design requirements.

C. Fit and assemble in largest practical sections for delivery to site, ready for installation.

2.6 Recycled Content: Provide steel with minimum 25 percent post-consumer recycled content.

2.7 Regional Materials: Provide steel manufactured and containing recycled raw materials recovered within 100 mile radius of Project Site.

PART 3 - EXECUTION

3.1 INSTALLATION OF STUDS

A. Install components in accordance with manufacturer’s instructions and ASTM C 1007 requirements.

B. Align floor and ceiling tracks; locate to wall layout. Secure in place with fasteners at maximum 24 inches on center. Coordinate installation of sealant with floor and ceiling tracks.

C. Construct corners using minimum of three studs. Install double studs, as a minimum, at wall openings, door and window jambs.

D. Install load bearing studs full length in one piece. Splicing of studs is not permitted.

E. Install load bearing studs, braced and reinforced to develop full strength and achieve design requirements.

F. Coordinate placement of insulation in multiple stud spaces made inaccessible after erection.

G. Install intermediate studs above and below openings to align with wall stud spacing.

H. Provide deflection allowance in stud track, directly below horizontal building framing at non-load bearing framing.

I. Attach cross studs to studs for attachment of fixtures anchored to walls.

J. Install framing between studs for attachment of mechanical and electrical items, and to prevent stud rotation.

K. Touch-up field welds and damaged galvanized surfaces with primer.

3.2 INSTALLATION OF JOISTS AND TRUSSES

A. Install framing components in accordance with manufacturer's instructions.

B. Make provisions for erection stresses. Provide temporary alignment and bracing.

C. Set floor joists, ceiling joists, and trusses, parallel and level, with lateral bracing and bridging.

D. Locate joist and truss end bearing directly over load bearing studs or provide load distributing member to top of stud track.

E. Provide web stiffeners at reaction points.

F. Touch-up field welds and damaged galvanized surfaces with primer.

3.3 TOLERANCES

A. Maximum Variation from True Position: 1/8 inch.

B. Maximum Variation of any Member from Plane: 1/8 inch.

3.4 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Division 1. Inspection services shall conform to the Statement of Special Inspections noted in the structural drawings.

B. Inspections:

1. Perform inspections in order to assure strict conformance to the shop drawings at all phases of construction.
2. Check members for proper size, gage, plumbness, alignment, bearing, completeness of attachments, reinforcement, connection to structural frame, etc.
3. Check attachments for conformance with the shop drawings; all welds shall be touched up as specified.
4. Complete general inspection of structure prior to applying loads to those members.

END OF SECTION 054000

SECTION 055213

PIPE AND TUBE RAILINGS - SITE

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. Stainless-steel pipe railings at site stairs with base plate

B. Related Requirements:
   1. Section 057300 "Decorative Metal Railings" for ornamental railings fabricated from pipes and tubes.

1.3 COORDINATION

A. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

B. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

1.4 ACTION SUBMITTALS

A. Product Data: For the following:

   1. Manufacturer's product lines of mechanically connected railings.
   2. Railing brackets.
   3. Grout, anchoring cement, and paint products.

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

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

1. Sections of each distinctly different linear railing member, including handrails, top rails and posts.
2. Fittings and brackets.
3. Assembled Sample of railing system, made from full-size components, including top rail, post, handrail, and infill. Sample need not be full height.

a. Show method of connecting and finishing members at intersections.

D. Delegated-Design Submittal: For railings, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Welding certificates.

C. Mill Certificates: Signed by manufacturers of stainless-steel products certifying that products furnished comply with requirements.

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

E. Evaluation Reports: For post-installed anchors, from ICC-ES.

1.6 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
3. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

1.8 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Stainless-Steel Pipe Railings

B. Source Limitations: Obtain each type of railing from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design railings, including attachment to building construction.

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

1. Handrails and Top Rails of Guards:

a. Uniform load of 50 lbf/ ft. applied in any direction.
b. Concentrated load of 200 lbf applied in any direction.
c. Uniform and concentrated loads need not be assumed to act concurrently.

2. Infill of Guards:

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

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change : 120 deg F ambient ; 180 deg F

2.3 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.

1. Provide type of bracket with flange tapped for concealed anchorage to threaded hanger bolt and that provides 1-1/2-inch clearance from inside face of handrail to finished wall surface.

2.4 STAINLESS STEEL

A. Tubing: ASTM A 554, Grade MT 304.

B. Pipe: ASTM A 312/A 312M, Grade TP 304.

C. Castings: ASTM A 743/A 743M, Grade CF 8 or CF 20.

D. Plate and Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304.

2.5 FASTENERS

A. General: Provide the following:
   1. Stainless-Steel Railings: Type 304 stainless-steel fasteners.
   2. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.

B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.

C. Fasteners for Interconnecting Railing Components:

   1. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless otherwise indicated.
   2. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless exposed fasteners are unavoidable or are the standard fastening method for railings indicated.
   3. Provide tamper-resistant flat-head machine screws for exposed fasteners unless otherwise indicated.

D. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors capable of sustaining, without failure, a load equal to 6 times the load imposed when installed in unit masonry and 4 times the load imposed when installed in concrete, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.
   1. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 (A1) stainless-steel bolts, ASTM F 593 (ASTM F 738M), and nuts, ASTM F 594 (ASTM F 836M).

2.6 MISCELLANEOUS MATERIALS

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

1. For stainless-steel railings, provide type and alloy as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.

B. Low-Emitting Materials: Paints and coatings shall comply with the testing and product requirements of the California Department of Public Health's (formerly, the California Department of Health Services') "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

C. Non-shrink, Nonmetallic Grout: Factory-packaged, non-staining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

D. Anchoring Cement: Factory-packaged, non-shrink, non-staining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.

1. Water-Resistant Product: At exterior locations and where indicated provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior use.

2.7 FABRICATION

A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.

B. Shop assemble railings to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.

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

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

E. Fabricate connections that are exposed to weather in a manner that excludes water. Provide weep holes where water may accumulate.

F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.

G. Connections: Fabricate railings with welded connections unless otherwise indicated.

H. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove flux immediately.
4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.

I. Non-welded Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.

1. Fabricate splice joints for field connection using an epoxy structural adhesive if this is manufacturer's standard splicing method.

J. Form Changes in Direction as Follows:

1. As detailed.

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

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

M. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch or less.

N. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.

1. At brackets and fittings fastened to plaster or gypsum board partitions, provide crush-resistant fillers or other means to transfer loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.

O. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.

P. For railing posts set in concrete, provide stainless-steel sleeves not less than 6 inches long with inside dimensions not less than 1/2 inch greater than outside dimensions of post, with metal plate forming bottom closure.

2.8 STAINLESS-STEEL FINISHES

A. Remove tool and die marks and stretch lines, or blend into finish.

B. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.

C. Dull Satin Finish: No. 6

D. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine plaster and gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements are clearly marked for Installer. Locate reinforcements and mark locations if not already done.

B. Verify that all railing meets local, ADA and building codes prior to fabrication. Notify landscape architect of any discrepancy immediately and prior to fabrication and installation.

3.2 INSTALLATION, GENERAL

A. Fit exposed connections together to form tight, hairline joints.

B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.

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

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

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

D. Adjust railings before anchoring to ensure matching alignment at abutting joints.

E. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.3 RAILING CONNECTIONS

A. Non-welded Connections: Use mechanical or adhesive joints for permanently connecting railing components. Seal recessed holes of exposed locking screws using plastic cement filler colored to match finish of railings.

B. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article whether welding is performed in the shop or in the field.

C. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending 2 inches beyond joint on either side, fasten internal sleeve securely to one side, and locate joint within 6 inches of post.

3.4 ANCHORING POSTS

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

B. Form or core-drill holes not less than 5 inches deep and 3/4 inch larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with non-shrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions.

C. Cover anchorage joint with flange of same metal as post, welded to post after placing anchoring material.

D. Leave anchorage joint exposed with 1/8-inch buildup, sloped away from post.

E. Anchor posts to metal surfaces with oval flanges, angle type, or floor type as required by conditions, connected to posts and to metal supporting members as follows:
   1. For stainless-steel pipe railings, weld flanges to post and bolt to supporting surfaces.

3.5 ATTACHING RAILINGS

A. Anchor railing ends at walls with round flanges anchored to wall construction and welded to railing ends.

B. Anchor railing ends to metal surfaces with flanges bolted to metal surfaces and welded to railing ends.

C. Attach railings to wall with wall brackets, except where end flanges are used. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.

D. Secure wall brackets and railing end flanges to building construction as follows:

1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
2. For hollow masonry anchorage, use toggle bolts.

3.6 ADJUSTING AND CLEANING

A. Clean stainless steel by washing thoroughly with clean water and soap and rinsing with clean water.

3.7 PROTECTION

A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

END OF SECTION 055213

SECTION 061000
ROUGH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Sheathing.

B. Roofing nailers.

C. Fire retardant treated wood materials.

D. Communications and electrical room mounting boards.

E. Concealed wood blocking, nailers, and supports.

1.02 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete: Setting anchors in concrete.

B. Section 072500 - Weather Barriers: Air barrier over sheathing.

C. Section 076200 - Sheet Metal Flashing and Trim: Sill flashings.

1.03 REFERENCE STANDARDS

A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.

B. ASTM D2898 - Standard Test Methods for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing; 2010 (Reapproved 2017).

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2017.

D. AWPA U1 - Use Category System: User Specification for Treated Wood; 2017.

E. PS 1 - Structural Plywood; 2023.

F. PS 2 - Performance Standard for Wood-Based Structural-Use Panels; 2010.

G. PS 20 - American Softwood Lumber Standard; 2025.

H. SPIB (GR) - Grading Rules; 2014.

1.04 SUBMITTALS

A. See Section 013300 - Submittal Procedures

B. Product Data: Provide technical data on insulated sheathing, wood preservative materials, and application instructions.

C. Manufacturer's Certificate: Certify that wood products supplied for rough carpentry meet or exceed specified requirements.

D. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05 DELIVERY, STORAGE, AND HANDLING

A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.

B. Fire Retardant Treated Wood: Prevent exposure to precipitation during shipping, storage, or installation.

1.06 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
   1. If no species is specified, provide any species graded by the agency specified; if no grading agency is specified, provide lumber graded by any grading agency meeting the specified requirements.
   2. Grading Agency: Any grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee (www.alsc.org) and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.

B. Lumber fabricated from old growth timber is not permitted.

2.02 DIMENSION LUMBER FOR CONCEALED APPLICATIONS

A. Grading Agency: Southern Pine Inspection Bureau, Inc; SPIB (GR).

B. Sizes: Nominal sizes as indicated on drawings, S4S.

C. Moisture Content: S-dry or MC19.

D. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
   1. Lumber: S4S, No. 2 or Standard Grade.
   2. Boards: Standard or No. 3.

2.03 CONSTRUCTION PANELS

A. Roof Sheathing: PS1 type, rated Structural I Sheathing.
   1. Bond Classification: Exterior.
   2. Span Rating: 40/20.
   3. Performance Category: 3/4 PERF CAT.

B. Wall Sheathing: PS 2 type.
   1. Bond Classification: Exterior.
   2. Grade: Structural I Sheathing.
   3. Span Rating: 24.
   4. Performance Category: 5/8 PERF CAT.
   5. Edge Profile: Square edge.

C. Plywood Backed Panels: For mounting electrical or telephone equipment, provide fire retardant-treated plywood panels with grade designation, APA C-D PLUGGED EXPOSURE 1, in thickness indicated, or, if not other indicated, not less than 15/32".
   1. OIT backer panel indicated on drawings.

D. Other Applications:
   1. Plywood Concealed From View But Located Within Exterior Enclosure: PS 1, C-C Plugged or better, Exterior grade.
   2. Plywood Exposed to View But Not Exposed to Weather: PS 1, A-D, or better.
   3. Other Locations: PS 1, C-D Plugged or better.

2.04 METAL FRAMING ANCHORS

A. General: Provide metal framing anchors of type, size, metal, and finish indicated that comply with requirements specified including the following:
   1. Current Evaluation/Research Reports: Provide products for which model code evaluation/research reports exist that are acceptable to authorities having jurisdiction and that evidence compliance of metal framing anchors for application indicated with the building code in effect for this project.

2. Allowable Design Loads: Provide products for which manufacturer publishes allowable design loads that are determined from empirical data or by rational engineering analysis and that are demonstrated by comprehensive testing performed by a qualified independent testing laboratory.
3. Products:
   a. Simpson.
   b. USP.

2.05 ACCESSORIES

A. Fasteners and Anchors:
   1. Metal and Finish: Hot-dipped galvanized steel complying with ASTM A153/A153M for high humidity and preservative-treated wood locations, unfinished steel elsewhere.
   2. Drywall Screws: Bugle head, hardened steel, power driven type, length three times thickness of sheathing.
   3. Anchors: Toggle bolt type for anchorage to hollow masonry.

B. Sill Flashing: As specified in Section 076200.

2.06 FACTORY WOOD TREATMENT

A. Treated Lumber and Plywood: Comply with requirements of AWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.
   1. Fire-Retardant Treated Wood: Mark each piece of wood with producer's stamp indicating compliance with specified requirements.
   2. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWPA standards.

B. Fire Retardant Treatment:
   1. Manufacturers:
      a. Lonza Group; ____: www.wolmanizedwood.com/#sle.
      b. Hoover Treated Wood Products, Inc; ____: www.frtw.com/#sle.
      c. Koppers, Inc; ____: www.koppersperformancechemicals.com/#sle.
      d. Viance, LLC; D-Blaze: www.treatedwood.com/#sle.
      e. Substitutions: See Section 016000 - Product Requirements.
   2. Exterior Type: AWPA U1, Category UCFB, Commodity Specification H, chemically treated and pressure impregnated; capable of providing a maximum flame spread index of 25 when tested in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes both before and after accelerated weathering test performed in accordance with ASTM D2898.

a. Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.
b. Do not use treated wood in direct contact with the ground.

3. Interior Type A: AWPA U1, Use Category UCFA, Commodity Specification H, low temperature (low hygroscopic) type, chemically treated and pressure impregnated; capable of providing a maximum flame spread index of 25 when tested in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes.
   a. Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.
   b. Treat rough carpentry items as indicated .
   c. Do not use treated wood in applications exposed to weather or where the wood may become wet.

C. Preservative Treatment:
   1. Preservative Pressure Treatment of Lumber Above Grade: AWPA U1, Use Category UC3B, Commodity Specification A using waterborne preservative.
      a. Kiln dry lumber after treatment to maximum moisture content of 19 percent.
      b. Treat lumber exposed to weather.
      c. Treat lumber in contact with roofing, flashing, or waterproofing.
      d. Treat lumber in contact with masonry or concrete.
      e. Treat lumber less than 18 inches (450 mm) above grade.
      f. Treat lumber in other locations as indicated.
   2. Preservative Pressure Treatment of Plywood Above Grade: AWPA U1, Use Category UC2 and UC3B, Commodity Specification F using waterborne preservative.
      a. Kiln dry plywood after treatment to maximum moisture content of 19 percent.
      b. Treat plywood in contact with roofing, flashing, or waterproofing.
      c. Treat plywood in contact with masonry or concrete.
      d. Treat plywood less than 18 inches (450 mm) above grade.
      e. Treat plywood in other locations as indicated.

PART 3 EXECUTION

3.01 INSTALLATION - GENERAL

A. Select material sizes to minimize waste.

B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.

C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

3.02 BLOCKING, NAILERS, AND SUPPORTS

A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.

B. In framed assemblies that have concealed spaces, provide solid wood fireblocking as required by applicable local code, to close concealed draft openings between floors and between top story and roof/attic space; other material acceptable to code authorities may be used in lieu of solid wood blocking.

C. In metal stud walls, provide continuous blocking around door and window openings for anchorage of frames, securely attached to stud framing.

D. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.

E. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.

3.03 ROOF-RELATED CARPENTRY

A. Coordinate installation of roofing carpentry with deck construction, framing of roof openings, and roofing assembly installation.

3.04 INSTALLATION OF CONSTRUCTION PANELS

A. Roof Sheathing: Secure panels with long dimension perpendicular to framing members, with ends staggered and over firm bearing.
   1. Nail panels to framing; staples are not permitted.

B. Wall Sheathing: Secure with long dimension perpendicular to wall studs, with ends over firm bearing and staggered, using nails, screws, or staples.

3.05 TOLERANCES

A. Framing Members: 1/4 inch (6 mm) from true position, maximum.

B. Variation from Plane (Other than Floors): 1/4 inch in 10 feet (2 mm/m) maximum, and 1/4 inch in 30 feet (7 mm in 10 m) maximum.

3.06 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

3.07 CLEANING

A. Waste Disposal: Comply with the requirements of Section 017419 - Construction Waste Management and Disposal.
   1. Comply with applicable regulations.
   2. Do not burn scrap on project site.
   3. Do not burn scraps that have been pressure treated.
   4. Do not send materials treated with pentachlorophenol, CCA, or ACA to co-generation facilities or “waste-to-energy” facilities.

B. Do not leave any wood, shavings, sawdust, etc. on the ground or buried in fill.

C. Prevent sawdust and wood shavings from entering the storm drainage system.

END OF SECTION 061000

SECTION 072100
THERMAL INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Insulation at Splash Pad Mech/Office Buiding.
   1. Board insulation at cavity wall construction, perimeter foundation wall, and exterior wall behind Rain Screen wall finish.
   2. Batt insulation in exterior wall construction.
   3. Batt insulation for filling perimeter window and door shim spaces and crevices in exterior wall and roof.

1.02 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete: Field-applied termiticide for concrete slabs and foundations.

B. Section 042723 - Cavity Wall Unit Masonry: Masonry walls enclosing insulation.

C. Section 054000 - Cold-Formed Metal Framing: Board insulation as wall sheathing.

D. Section 072400 - Exterior Insulation and Finish Systems: Board insulation on exterior side of walls, finished with weatherproof coating.

E. Section 072500 - Weather Barriers: Separate air barrier and vapor retarder materials.

F. Section 075400 - Thermoplastic Membrane Roofing: Insulation specified as part of roofing system.

1.03 REFERENCE STANDARDS

A. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2017a.

B. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2014.

C. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2017.

D. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2017.

E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2017.

F. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2016.

G. ASTM E136 - Standard Test Method for Behavior of Materials in a Vertical Tube Furnace At 750 Degrees C; 2016a.

H. ASTM E2357 - Standard Test Method for Determining Air Leakage of Air Barrier Assemblies; 2017.

I. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components; 2012.

1.04 SUBMITTALS

A. See Section 013300 - Submittal Procedures

B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.

C. ABAA Field Quality Control Submittals: Submit third-party reports of testing and inspection required by ABAA QAP.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Manufacturer's Installation Instructions: Include information on special environmental conditions required for installation and installation techniques.

F. ABAA Manufacturer Qualification: Submit documentation of current evaluation of proposed manufacturer and materials.

G. ABAA Installer Qualification: Submit documentation of current contractor accreditation and current installer certification. Keep copies of contractor accreditation and installer certification on site during and after installation. Present on-site documentation upon request.

1.05 QUALITY ASSURANCE

A. Air Barrier Association of America (ABAA) Quality Assurance Program (QAP); www.airbarrier.org/#sle:
   1. Installer Qualification: Use accredited contractor, certified installers, evaluated materials, and third-party field quality control audit.
   2. Manufacturer Qualification: Use evaluated materials from a single manufacturer regularly engaged in air barrier material manufacture. Use secondary materials approved in writing by primary material manufacturer.

1.06 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 at Perimeter of Foundation: Extruded polystyrene (XPS) board.

B. Insulation Over Metal Stud Framed Walls, Continuous: Composite Polyisocyanurate (ISO) Board Insulation Faced with Plywood board.

C. Insulation in Metal Framed Walls: Batt insulation with no vapor retarder.

2.02 FOAM BOARD INSULATION MATERIALS

A. Extruded Polystyrene (XPS) Board Insulation: Complies with ASTM C578 with either natural skin or cut cell surfaces.
   1. Flame Spread Index (FSI): Class A - 0 to 25, when tested in accordance with ASTM E84.
   2. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
   3. Type and Thermal Resistance, R-value (RSI-value): Type IV, 5.0 (0.88) per 1 inch (25.4 mm) thickness at 75 degrees F (24 degrees C) mean temperature.
   4. Manufacturers:
      a. Dow Chemical Company; STYROFOAM HIGHLOAD 40: www.dowbuildingsolutions.com/#sle.
      b. Owens Corning Corporation; FOAMULAR Extruded Polystyrene (XPS) Insulation: www.ocbuildingspec.com/#sle.
      c. Substitutions: See Section 016000 - Product Requirements.

B. Composite Polyisocyanurate (ISO) Board Insulation Faced with Plywood: Rigid cellular foam, complying with ASTM C1289.
   1. Classifications:
      a. Type V: Faced with plywood on one major surface of core foam and glass fiber reinforced cellulosic felt or uncoated or coated polymer-bonded glass fiber mat facer on other major surface of core foam.
         1) Compressive Strength: 16 psi (110 kPa), minimum.
         2) Thermal Resistance, R-value (RSI-value): At 2.1 inch (38.1 mm) thick; 9.8 (1.09) at 75 degrees F (24 degrees C).
   2. Flame Spread Index (FSI): Class A - 0 to 25, when tested in accordance with ASTM E84.
   3. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
   4. Complies with fire resistance requirements indicated on drawings as part of an exterior non-load-bearing exterior wall assembly when tested in accordance with NFPA 285.
   5. Board Size: 48 inch by 96 inch (1220 mm by 2440 mm).
   6. Plywood Thickness: 5/8 inch (16 mm).
   7. Board Edges: Square.
   8. Manufacturers:
      a. Hunter Panels; Xci Ply: www.hunterpanels.com/#sle.
      b. Substitutions: See Section 016000 - Product Requirements.

2.03 BATT INSULATION MATERIALS

A. Glass Fiber Batt Insulation: Flexible preformed batt or blanket, complying with ASTM C665; friction fit.
   1. Combustibility: Non-combustible, when tested in accordance with ASTM E136.
   2. Formaldehyde Content: Zero.
   3. Thermal Resistance: R-value (RSI-value) of R-13 (Walls) (____).
   4. Facing: Unfaced.
   5. Manufacturers:
      a. CertainTeed Corporation; _____: www.certainteed.com/#sle.
      b. Johns Manville; _____: www.jm.com/#sle.
      c. Owens Corning Corporation; EcoTouch PINK FIBERGLAS Insulation: www.ocbuildingspec.com/#sle.
      d. Substitutions: See Section 016000 - Product Requirements.

2.04 ACCESSORIES

A. Tape: Reinforced polyethylene film with acrylic pressure sensitive adhesive.
   1. Application: Sealing of interior circular penetrations, such as pipes or cables.
   2. Width: Are required for application.

B. Tape joints of rigid insulation in accordance with roofing and insulation manufacturers' instructions.

C. Insulation Fasteners: Lengths of unfinished, 13 gage, 0.072 inch (1.83 mm) high carbon spring steel with chisel or mitered tips, held in place by tension, length to suit insulation thickness and substrate, capable of securely supporting insulation in place.

D. Insulation Fasteners: Appropriate for purpose intended and approved by roofing manufacturer.
   1. Length as required for thickness of insulation material and penetration of deck substrate.

E. Nails or Staples: Steel wire; electroplated or galvanized; type and size to suit application.

F. 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 BOARD INSTALLATION AT FOUNDATION PERIMETER

A. Adhere a 6 inch (150 mm) wide strip of polyethylene sheet over construction, control, and expansion joints with double beads of adhesive each side of joint.

B. Apply adhesive to back of boards:
   1. Full bed 1/8 inch (3 mm) thick.

C. Install boards horizontally on foundation perimeter.
   1. Place boards to maximize adhesive contact.
   2. Install in running bond pattern.
   3. Butt edges and ends tightly to adjacent boards and to protrusions.

D. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

3.03 BOARD INSTALLATION AT EXTERIOR WALLS

A. Adhere a 6 inch (150 mm) wide strip of polyethylene sheet over expansion joints with double beads of adhesive each side of joint.

B. Install rigid insulation directly to steel studs or exterior grade sheathing at 16 inches (406 mm) on center with manufacturer recommended mechanical fasteners, and tape joints with manufacturer's minimum 4 inch (102 mm) wide sealant tape; comply with ASTM E2357.

C. Install boards horizontally on walls.

D. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

3.04 BOARD INSTALLATION AT CAVITY WALLS

A. Install boards to fit snugly between wall ties.
   1. Place membrane surface facing out, and tape seal board joints.

B. Install boards horizontally on walls.
   1. Install in running bond pattern.
   2. Butt edges and ends tightly to adjacent boards and to protrusions.

C. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

3.05 BATT INSTALLATION

A. Install insulation and vapor retarder 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.

END OF SECTION 072100

SECTION 072500
WEATHER BARRIERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Air Barriers: Materials that form a system to stop passage of air through exterior walls, joints between exterior walls and roof, and joints around frames of openings in exterior walls.

1.02 RELATED REQUIREMENTS

A. Section 054000 - Cold-Formed Metal Framing: Water-resistive barrier under exterior cladding.

B. Section 061000 - Rough Carpentry: Water-resistive barrier under exterior cladding.

C. Section 072400 - Exterior Insulation and Finish Systems: Water-resistive barrier under exterior insulation.

D. Section 075400 - Thermoplastic Membrane Roofing: Vapor retarder installed as part of roofing system.

E. Section 079200 - Joint Sealants: Sealing building expansion joints.

1.03 DEFINITIONS

A. Weather Barrier: Assemblies that form either water-resistive barriers, air barriers, or vapor retarders.

B. Air Barrier: Air tight barrier made of material that is relatively air impermeable but water vapor permeable, both to the degree specified, with sealed seams and with sealed joints to adjacent surfaces. Note: For the purposes of this specification, vapor impermeable air barriers are classified as vapor retarders.

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. AATCC Test Method 127 - Water Resistance: Hydrostatic Pressure Test; 2014.

C. ASTM D226/D226M - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing; 2009.

D. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension; 2016.

E. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection; 2017.

F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2017.

G. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2016.

H. ASTM E2178 - Standard Test Method for Air Permeance of Building Materials; 2013.

I. ICC-ES AC148 - Acceptance Criteria for Flexible Flashing Materials; 2017.

J. ICC-ES AC212 - Acceptance Criteria for Water-Resistive Coatings Used as Water-Resistive Barriers over Exterior Sheathing; 2015.

K. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components; 2012.

1.05 SUBMITTALS

A. See Section 013300 - Submittal Procedures

B. Product Data: Provide data on material characteristics and performance criteria.

C. Shop Drawings: Provide drawings of special joint conditions.

D. ABAA Field Quality Control Submittals: Submit third-party reports of testing and inspection required by ABAA QAP.

E. Manufacturer's Installation Instructions: Indicate preparation, installation methods, and storage and handling criteria.

F. ABAA Manufacturer Qualification: Submit documentation of current evaluation of proposed manufacturer and materials.

G. ABAA Installer Qualification: Submit documentation of current contractor accreditation and current installer certification; keep copies of each contractor accreditation and installer certification on site during and after installation, and present on-site documentation upon request.

H. Testing Agency Qualification Statement.

1.06 QUALITY ASSURANCE

A. Air Barrier Association of America (ABAA) Quality Assurance Program (QAP); www.airbarrier.org/#sle:
   1. Installer Qualification: Use accredited contractor, certified installers, evaluated materials, and third-party field quality control audit.
   2. Manufacturer Qualification: Use evaluated materials from a single manufacturer regularly engaged in air barrier material manufacture, and use secondary materials approved in writing by primary material manufacturer.

1.07 FIELD CONDITIONS

A. Maintain temperature and humidity recommended by the materials manufacturers before, during and after installation.

PART 2 PRODUCTS

2.01 WEATHER BARRIER ASSEMBLIES

A. Air Barrier:
   1. On outside surface of sheathing of exterior walls and soffit use air barrier sheet, mechanically fastened type.

2.02 AIR BARRIER MATERIALS (WATER VAPOR PERMEABLE AND WATER-RESISTIVE)

A. Air Barrier Sheet, Mechanically Fastened:
   1. Water Penetration Resistance: Withstand a water head of 21 inches (55 cm), minimum, for minimum of 5 hours, when tested in accordance with AATCC Test Method 127.
   2. Complies with NFPA 285 wall assembly requirements.
   3. Water Resistance: Comply with applicable water-resistive requirements of ICC-ES AC38.
   4. Manufacturers:
      a. Basis of Design: DuPont de Nemours, Inc; Tyvek Commercial Wrap with Tyvek Fluid Applied Flashing - Brush Formulation, Tyvek Fluid Applied

Flashing and Joint Compound, FlexWrap NF, StraightFlash, StraightFlash VF, Tyvek Wrap Caps, and Tyvek Tape: www.dupont.com/#sle.

b. Substitutions: See Section 016000 - Product Requirements.

2.03 ACCESSORIES

A. Sealants, Tapes, and Accessories for Sealing Weather Barrier and Sealing Weather Barrier to Adjacent Substrates: As specified or as recommended by weather barrier manufacturer.

B. Flexible Flashing: Self-adhesive sheet flashing complying with ASTM D1970/D1970M, except slip resistance requirement is waived if not installed on a roof.
   1. Composition: Butyl rubber sheet laminated to elasticized polyethylene sheet.
   2. Manufacturers:
      a. DuPont de Nemours, Inc; DuPont FlexWrap: building.dupont.com/#sle.
      b. DuPont de Nemours, Inc; DuPont StraightFlash: building.dupont.com/#sle.
      c. Substitutions: See Section 016000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces and conditions are ready to accept the work of this section.

3.02 PREPARATION

A. Remove projections, protruding fasteners, and loose or foreign matter that might interfere with proper installation.

3.03 INSTALLATION

A. Install materials in accordance with manufacturer's instructions.

B. Air Barriers: Install continuous air tight barrier over surfaces indicated, with sealed seams and with sealed joints to adjacent surfaces.

C. Mechanically Fastened Sheets - On Exterior:
   1. Install sheets shingle-fashion to shed water, with seams generally horizontal.
   2. Overlap seams as recommended by manufacturer but at least 6 inches.
   3. Overlap at outside and inside corners as recommended by manufacturer but at least 12 inches (305 mm).

4. Attach to framed construction with fasteners extending through sheathing into framing. Space fasteners at 12 to 18 inches (305 to 460 mm) on center along each framing member supporting sheathing.
5. Attach to masonry construction using mechanical fasteners spaced at 12 to 18 inches (305 to 460 mm) on center vertically and maximum 24 inches (610 mm) on center horizontally.
6. For applications specified to be air tight, seal seams, laps, penetrations, tears, and cuts with self-adhesive tape; use only large-headed, gasketed fasteners recommended by the manufacturer.
7. Where stud framing rests on concrete or masonry, extend lower edge of sheet at least 4 inches (100 mm) below bottom of framing and seal to foundation with sealant.
8. Install water-resistive barrier over jamb flashings.
9. Install air barrier and vapor retarder underneath the jamb flashings.
10. Install head flashings under weather barrier.
11. At openings to be filled with frames having nailing flanges, wrap excess sheet into opening; at head, seal sheet over flange and flashing.

D. Openings and Penetrations in Exterior Weather Barriers:
1. Install flashing over sills, covering entire sill frame member, extending at least 5 inches (125 mm) onto weather barrier and at least 6 inches (150 mm) up jambs; mechanically fasten stretched edges.
2. At openings to be filled with frames having nailing flanges, seal head and jamb flanges using a continuous bead of sealant compressed by flange and cover flanges with sealing tape at least 4 inches (100 mm) wide; do not seal sill flange.
3. At openings to be filled with non-flanged frames, seal weather barrier to each side of opening framing, using flashing at least 9 inches (230 mm) wide, covering entire depth of framing.
4. At head of openings, install flashing under weather barrier extending at least 2 inches (50 mm) beyond face of jambs; seal weather barrier to flashing.
5. At interior face of openings, seal gap between window/door frame and rough framing, using joint sealant over backer rod.
6. Service and Other Penetrations: Form flashing around penetrating item and seal to weather barrier surface.

3.04 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Coordination of ABAA Tests and Inspections:
1. Provide testing and inspection required by ABAA QAP.
2. Notify ABAA in writing of schedule for air barrier work, and allow adequate time for testing and inspection.
3. Cooperate with ABAA testing agency.
4. Allow access to air barrier work areas and staging.
5. Do not cover air barrier work until tested, inspected, and accepted.

3.05 PROTECTION

A. Do not leave materials exposed to weather longer than recommended by manufacturer.

END OF SECTION 072500

SECTION 074113
METAL ROOF PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Architectural roofing system of preformed steel panels. Indicated in drawings as (MTL-03).

1.02 RELATED REQUIREMENTS

1.03 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; 2015.

1.04 SUBMITTALS

A. See Section 013000 - 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.
   3. Specimen warranty.

C. Shop Drawings: Include layouts of roof panels, soffit 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 (305 mm) square, representing actual roofing metal, thickness, profile, color, and texture.

E. Manufacturer Qualification Statement: Provide documentation showing metal roof panel fabricator is accredited under IAS AC472.

F. Test Reports: Indicate compliance of metal roofing system to specified requirements.

G. Warranty: Submit specified manufacturer's warranty and ensure that forms have been completed in Owner's name and are registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five 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.

C. Panels shall be factory produced only.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Provide strippable plastic protection on prefinished roofing panels for removal after installation.

B. Store roofing panels on project site as recommended by manufacturer to minimize damage to panels prior to installation.

1.07 WARRANTY

A. Finish Warranty: Provide manufacturer's special warranty covering failure of factory-applied exterior finish on metal roof panels and agreeing to repair or replace panels that show evidence of finish degradation, including significant fading, chalking, cracking, or peeling within specified warranty period of twenty years from Date of Substantial Completion.

B. Provide a 20 year parts and labor warranty to include compatible flashing and trim.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design:
   1. Architectural Metal Roof Panels: Tite-Loc Panels manufactured by Peterson Aluminum Corp, Pac-Clad.

B. Architectural Metal Roof Panels:
   1. ATAS International, Inc: www.atas.com/#sle.
   2. Berridge Manufacturing Company: www.berridge.com/#sle.
   3. Englert, Inc: www.englertinc.com/#sle.

4. Fabral: www.fabral.com/#sle.
5. Firestone Building Products LLC: www.firestonebpco.com/#sle.
6. Metal Roofing Systems, Inc; _____: www.metalroofingsystems.biz/#sle.
7. Petersen Aluminum Corporation; Tite-Loc Panel: www.pac-clad.com/#sle.
8. Sheffield Metals International: www.sheffieldmetals.com/#sle.
9. Substitutions: See Section 016000 - Product Requirements.

2.02 ARCHITECTURAL METAL ROOF PANELS

A. Architectural Metal Roof Panels: 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. Architectural Metal Panels: Factory-formed panels with factory-applied finish.
   1. Steel Panels:
      a. Zinc-coated steel complying with ASTM A653/A653M; minimum G60 (Z180) galvanizing.
      b. Steel Thickness: Minimum 24 gauge (0.024 inch) (0.61 mm).
   2. Profile: Standing seam, with minimum 2.0 inch (51 mm) seam height; concealed fastener system for field seaming with special tool.
   3. Texture: Smooth.
   4. Length: Full length of roof slope, without lapped horizontal joints.
   5. Width: Maximum panel coverage of 12 inches (305 mm).
   6. Color: As noted in schedule on A-603.
   7. Mill-Finish Steel Panels: Treat with passivating chemical prior to shipment, to inhibit formation of corrosion.

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 fabricated panels with applied finish and accessory items, using manufacturer's standard processes as required to achieve specified appearance and performance requirements.

B. Joints: Provide captive gaskets, sealants, or separator strips at panel joints to ensure weathertight seals, eliminate metal-to-metal contact, and minimize noise from panel movements.

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 (0.023 mm); color and gloss as indicated on drawings.

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.
   1. Gutters and Downspouts:
      a. Gutters: SMACNA rectangular style profile.
      b. Downspouts: Open face, rectangular profile.
      c. Anchors and supports: Profiled to suit gutters and downspouts.
      d. Fasteners: Galvanized steel, with soft neoprene washers.

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.
   3. Seam Sealant: Factory-applied, non-skinning, non-drying type.

D. Thermal Insulation: Polyisocyanurate (ISO) Board Insulation with Facers Both Sides: Rigid cellular foam, complying with ASTM C1289. At R-02 Assembly only.
   1. Classifcations:
      a. Type II:
         1) Class 1 - Faced with glass fiber reinforced cellulosic felt facers on both major surfaces of core foam.
         2) Compressive Strength: Classes 1-2-3, Grade 3 - 25 psi (172 kPa), minimum.
         3) Thermal Resistance, R-value (RSI-value): At 1-1/2 inch (38.1 mm) thick; Class 1, Grades 1-2-3 - 8.4 (1.48) at 75 degrees F (24 degrees C).
   2. Flame Spread Index (FSI): Class B - 26 to 75, when tested in accordance with ASTM E84.
   3. Smoke Developed Index (SDI): 450 or less, when tesetd in accordance with ASTM E84.
   4. Board Size: 48 inch by 96 inch (1220 mm by 2440 mm).
   5. Thermal Resistance: R-value (RSI-value) of 30.
   6. Board edges: Square.

7. Manufacturers:
   a. Basis of Design: Peterson, Pac-Clad, PAC-Shield.

E. Underlayment: Self-adhering rubber-modified asphalt sheet complying with ASTM D1970/D1970M; 40 mil (1.02 mm) total thickness; with strippable release film and woven polyolefin top surface.
   1. Sheet Thickness: 40 mil, 0.040 inch (1.02 mm) minimum total thickness.
   2. Self Sealability: Passing nail sealability test specified in ASTM D1970/D1970M.
   3. Low Temperature Flexibility: Passing test specified in ASTM D1970/D1970M.
   4. Water Vapor Permeance: 0.1 perm (5.72 ng/Pa s sq m), maximum, when tested in accordance with ASTM E96/E96M Procedure A (desiccant method).
   5. Manufacturers:
      a. Basis of Design: Petersen, Pac-Clad HT Self-Adhering Roofing Underlayment.
      b. Other acceptable manufacturers include:
         1) W.R Grace "Ice & water Shield"
         2) Interwrap Titanium PSU-30
         3) Carlisle CCW WIP 300HT
         4) Interwrap Titanium PSU
         5) Tamko TW Tile and Metal Underlayment
      c. Substitutions: See Section 016000 - Product Requirements.

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. Coordinate installation of waterproof membrane over roof sheathing with 061000.

D. Remove protective film from surface of roof panels immediately prior to installation. Strip film carefully, to avoid damage to prefinished surfaces.

E. Separate dissimilar metals by applying a bituminous coating, self-adhering rubberized asphalt sheet, or other permanent method approved by roof panel manufacturer.

F. 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.

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. Roofing Underlayment:

D. Underlayment shall be laid in horizontal layers with joints lapped toward the eaves a minimum of 6”, and well secured along laps and at ends as necessary to properly hold the felt in place. All underlayment shall be preserved unbroken and whole.
   1. Peel and Stick Underlayment shall lap all hips and ridges at least 12” to form double thickness and shall be lapped 6” over the metal of any valley or built-in gutters and shall be installed as required by the Standing Seam Panel Manufacturer to attain the desired 20 Year Weathertightness Warranty.

E. Roof Panels: Install panels in strict accordance with manufacturer's instructions, minimizing transverse joints except at junction with penetrations.
   1. Form weathertight standing seams incorporating concealed clips, using an automatic mechanical seaming device approved by the panel manufacturer.
   2. Provide sealant tape or other approved joint sealer at lapped panel joints.
   3. 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 074113

SECTION 074213
METAL WALL PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Manufactured metal panels for exterior wall panels and soffit panels, with accessory components. Indicated as (MTL-01) Wall and (MTL-04) Soffit in drawings.

1.02 RELATED REQUIREMENTS

A. Section 054000 - Cold-Formed Metal Framing: Wall panel substrate.

B. Section 061000 - Rough Carpentry: Wall panel substrate.

C. Section 072500 - Weather Barriers: Weather barrier under wall panels.

D. Section 079200 - Joint Sealants: Sealing joints between metal wall panel system and adjacent construction.

1.03 REFERENCE STANDARDS

A. AAMA 609 & 610 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum (Combined Document); 2015.

B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

1.04 SUBMITTALS

A. See Section 013300 - Submittal Procedures

B. Shop Drawings: Indicate dimensions, layout, joints, construction details, _____, and methods of anchorage.

C. Samples: Submit two samples of wall panel and soffit panel, 12 inch by 12 inch (305 mm by 305 mm) in size illustrating finish color, sheen, and texture.

D. Manufacturer's Qualification Statement.

E. Installer's Qualification Statement.

F. Warranty Documentation for Installation of Building Rainscreen Assembly: Submit installer warranty and ensure that forms have been completed in Owner's name and registered with installer.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

B. Installer Qualifications: Company specializing in installing products of the type specified in this section with minimum three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect panels from accelerated weathering by removing or venting sheet plastic shipping wrap.

B. Store prefinished material off the ground and protected from weather; prevent twisting, bending, or abrasion; provide ventilation; slope metal sheets to ensure proper drainage.

C. Prevent contact with materials that may cause discoloration or staining of products.

1.07 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective work within a five year period after Date of Substantial Completion for degradation of panel finish, including color fading caused by exposure to weather.

C. Correct defective work within a five year period after Date of Substantial Completion, including defects in water tightness and integrity of seals for metal wall panels.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design:
   1. Metal Wall Panels - Concealed Fasteners: Flush Wall Panels, 11" manufactured by Petersen Aluminum Corporation, Pac-Clad.

2. Metal Soffit Panels - Concealed Fasteners: Flush Soffit Panels, 7" manufactured by Petersen Aluminum Corporation, Pac-Clad.

B. Other Acceptable Manufacturers - Metal Wall Panels - Concealed Fasteners:
1. ATAS International, Inc: www.atas.com/#sle.
2. Berridge Manufacturing Company: www.berridge.com/#sle.
3. Englert, Inc: www.englertinc.com/#sle.
4. Fabral: www.fabral.com/#sle.
5. McElroy Metal: www.mcelroymetal.com/#sle.
6. Metal Roofing Systems, Inc: www.metalroofingsystems.biz/#sle.
7. Sheffield Metals International: www.sheffieldmetals/#sle.
8. Substitutions: See Section 016000 - Product Requirements.

C. Metal Soffit Panels:
1. ATAS International, Inc: www.atas.com/#sle.
2. Berridge Manufacturing Company: www.berridge.com/#sle.
3. Englert, Inc: www.englertinc.com/#sle.
4. Fabral: www.fabral.com/#sle.
5. McElroy Metal: www.mcelroymetal.com/#sle.
6. Metal Roofing Systems, Inc: www.metalroofingsystems.biz/#sle.
7. Sheffield Metals International: www.sheffieldmetals/#sle.
8. Substitutions: See Section 016000 - Product Requirements.

2.02 MANUFACTURED METAL PANELS

A. Wall Panel System: Factory fabricated prefinished metal panel system, site assembled.
1. Provide exterior wall panels and soffit panels.
2. Design and size components to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of wall.
3. Design Pressure: In accordance with applicable codes.
4. Maximum Allowable Deflection of Panel: L/180 for length(L) of span.
5. Movement: Accommodate movement within system without damage to components or deterioration of seals, movement between system and perimeter components when subject to seasonal temperature cycling; dynamic loading and release of loads; and deflection of structural support framing.
6. Drainage: Provide positive drainage to exterior for moisture entering or condensation occurring within panel system.
7. Fabrication: Formed true to shape, accurate in size, square, and free from distortion or defects; pieces of longest practical lengths.
8. Corners: Factory-fabricated in one continuous piece with minimum 2 inch (51 mm) returns.

B. Exterior Wall Panels:

1. Profile: Vertical; Flush Wall Panel.
2. Side Seams: Double-interlocked, tight-fitting, sealed with continuous gaskets.
3. Material: Precoated steel sheet, 24 gage, .024 inch (0.61 mm) minimum thickness.
4. Panel Width: 11" inches (279 mm).
5. Color: As indicated on drawings.

C. Soffit Panels:
1. Profile: Flush Soffit Panel, with venting not provided.
2. Material: Precoated steel sheet, 24 gauge, .024 inch (0.61 mm) minimum thickness.
3. Panel Width: 7" inches.
4. Color: As indicated on drawings. Wood grain look.

D. Internal and External Corners: Same material, thickness, and finish as exterior sheets; profile to suit system; shop cut and factory mitered to required angles.

E. Trim, Closure Pieces, and Flashings: Same material, thickness and finish as exterior sheets; brake formed to required profiles.

F. Anchors: Galvanized steel.

2.03 MATERIALS

A. Precoated Steel Sheet: Hot-dipped galvanized steel sheet, ASTM A653/A653M, Structural Steel (SS) or Forming Steel (FS), with G90/Z275 coating; continuous coil-coated on exposed surfaces with specified finish coating and on panel back with specified panel back coating.

2.04 FINISHES

A. Exposed Surface Finish: Panel manufacturer's standard polyvinylidene fluoride (PVDF) coating, top coat over epoxy primer.

B. Panel Backside Finish: Panel manufacturer's standard siliconized polyester wash coat.

C. 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 (0.023 mm); color and gloss to match sample.

2.05 ACCESSORIES

A. Gaskets: Manufacturer's standard type suitable for use with system, permanently resilient; ultraviolet and ozone resistant.

B. Concealed Sealants: Non-curing butyl sealant or tape sealant.

C. Exposed Sealant: Elastomeric; silicone, polyurethane, or silyl-terminated polyether/polyurethane.

D. Fasteners: Manufacturer's standard type to suit application; with soft neoprene washers, steel, hot dip galvanized. Fastener cap same color as exterior panel.

E. Field Touch-up Paint: As recommended by panel manufacturer.

F. Bituminous Paint: Asphalt base.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that building framing members are ready to receive panels.

B. Verify that weather barrier has been installed over substrate completely and correctly.

3.02 INSTALLATION

A. Install panels on walls and soffits in accordance with manufacturer's instructions.

B. Protect surfaces in contact with cementitious materials and dissimilar metals with bituminous paint. Allow to dry prior to installation.

C. Use concealed fasteners unless otherwise approved by Architect.

D. Seal and place gaskets to prevent weather penetration. Maintain neat appearance.

3.03 TOLERANCES

A. Maximum Offset From True Alignment Between Adjacent Members Butting or In Line: 1/16 inch (1.6 mm).

B. Maximum Variation from Plane or Location Indicated on Drawings: 1/4 inch (6.4 mm).

3.04 CLEANING

A. Remove site cuttings from finish surfaces.

B. Remove protective material from wall panel surfaces.

C. See Section 017419 - Construction Waste Management and Disposal, for additional requirements.

D. Clean and wash prefinished surfaces with mild soap and water; rinse with clean water.

E. Upon completion of installation, thoroughly clean prefinished aluminum surfaces in accordance with AAMA 609 & 610.

END OF SECTION 074213

SECTION 074213.13

GORDON CUSTOM ENGINEERED SCREEN WALL SYSTEM

PART 1 – GENERAL

1.01 SECTION INCLUDES:

A. This section includes Custom Engineered Screen Wall System as shown on the Architectural Drawings. Indicated as (MTL-02) on the drawings.

1.02 RELATED DOCUMENTS/SECTIONS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions.

B. Division 1 Specification sections apply to work of this Section.

C. Finish Schedule or Finish Legend apply to work of this Section.

1.03 REFERENCES:

A. GENERAL

1. Comply with applicable requirements of the following, except where more stringent requirements are indicated by building codes.

B. ASTM (American Society for Testing and Materials)

1. ASTM B209, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

C. Aluminum Standards and Data provided by The Aluminum Association, Inc.

1.04 REFERENCE STANDARDS

D. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2013.

E. ASTM (American Society for Testing and Materials)

1. ASTM B209, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

F. Aluminum Standards and Data provided by The Aluminum Association, Inc.

1.05 DESIGN/PERFORMANCE REQUIREMENTS:

A. All components of the Custom Engineered Screen Wall System shall be provided by one (1) Manufacturer to ensure single source responsibility and quality control.

B. The Custom Engineered Screen Wall System consists of a Suspension System made of extruded aluminum 2”x2” tubes and aluminum Panels to form a continuous Screen Wall surface.

C. All fasteners are concealed.

D. PE Stamped Calculations: PE Stamped Calculations from manufacturer for wind loads will be included as part of the Submittal Drawing Package.

1.06 SUBMITTALS:

A. Submission must be made within ten (10) working days of the General Contract Award to avoid project delay.

B. Product Data: Submit Manufacturer’s Custom Engineered Screen Wall System product specifications, detail drawings, and Installation Instructions for each component required.

C. Shop Drawings shall show location of Custom Engineered Screen Wall System as well as specified finish, tolerance, Panel thickness, perforation pattern, and Panel size.

D. Samples: Submit three (3) samples of each of the following:

1. Panels for Custom Engineered Screen Wall System

2. Q-panel Sample of Specified Finish

E. Certification: Submit certification from Manufacturer of Wall Panels attesting that products comply with specified requirements including finish as specified.

F. Qualification Data:

1. Firms specified in “Quality Assurance” Article must demonstrate their capabilities and experience by including lists of completed projects with project names and addresses, names and addresses of Architects and owners, and other information specified.

G. Warranty:

1. Provide sample of product warranty.

H. Cleaning and Maintenance Instructions

1.07 MOCKUP

I. Construct mock-up, include panel and framing system, attachements to builidng, insect screening, drainage system, sealants and seals.

J. Locate as directed by architect.

K. Mock-up may remain as part of the Work if approved.

1.08 QUALITY ASSURANCE:

A. Manufacturer: Furnish components from one (1) Manufacturer with a minimum of ten (10) years of experience in the fabrication of metal wall specialties, utilizing systems, materials, and techniques as herein specified.

B. Installer: Firm with not less than three (3) years of successful experience in the installation of systems like those required by this project and acceptable to Manufacturer of the system.

1.09 PRODUCT DELIVERY, STORAGE AND HANDLING:

A. All materials shall be protected during fabrication, shipment, site storage, and erection to prevent damage from other trades. Store Custom Engineered Screen Wall System and components inside a well-ventilated area, away from uncured concrete and masonry, and protected from the weather, moisture, soiling, abrasion, extreme temperatures, and humidity.

1.10 WARRANTY:

A. Furnish Manufacturer's:

1. Warranty that materials furnished will perform as specified for a period of not less than five (5) years from date of material shipment when installed in accordance with Manufacturer’s recommendations. Extended warranty available upon request.

PART 2 – PRODUCTS

2.01 MANUFACTURERS:

A. Acceptable System: Custom Engineered Screen Wall System shall be manufactured by Gordon, Inc. For all inquiries contact, Gordon, Inc., 5023 Hazel Jones Road, Bossier City, LA 71111, (800) 747-8954.

B. The products specified herein are standard manufactured products of the listed Manufacturer.

C. System must be manufactured in the U.S.A.

2.02 PRODUCT CONSTRUCTION:

A. Suspension Component (Aluminum Tube) shall be extruded aluminum of standard 6063 T-5 or T-6 aluminum alloy.

B. Materials:

1. Panels shall be aluminum 3003-H14 and mechanically connect to the Suspension System with concealed screws. Panels are 0.090” minimum thickness. Panels are perforated.

2. Perforation Pattern: R18-316SG40

3. Panels have double return legs for connection to the Suspension System.

C. Optional Accessories:

1. Corner and Perimeter Trims as required.

2.03 FINISHES:

A. All Panels shall receive 5-stage pretreatment with dried-in-place conversion coating prior to receiving an electrostatically applied AAMA 2605 compliant powder coating finish, depending on final application.

1. Color: Custom to match color indicated in schedule on A-604.

2.04 FABRICATION:

A. Provide Suspension Tubes in stock lengths for field cutting.

B. Panels to be factory formed to specific sizes..

PART 3 - EXECUTION

3.01 EXAMINATION:

A. Examination of Surfaces: Installer must examine conditions under which work is to be performed and must notify Contractor in writing of unsatisfactory conditions.

B. Verify that field measurements and block-out dimensions are as shown on Shop Drawings.

3.02 PREPARATION:

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the Manufacturer to achieve the best result for the project conditions.

3.03 INSTALLATION:

A. General: Comply with Manufacturer’s printed instructions and any special instructions provided.

B. Space Enclosure: For Interior Installations, do not install any work until space is enclosed and weatherproofed, wet-work in space is completed and nominally dry, work above ceilings is complete, and temperature and humidity shall be continuously maintained at values near those of final occupancy.

3.04 CLEANING:

A. Follow Manufacturer’s cleaning instructions for specified finish.

3.05 PROTECTION:

A. Procedures: Protection of Custom Engineered Screen Wall System from damage by other trades after installation to be provided by General Contractor.

B. Damage to Finished Work: Finished units shall be without damage. Damage shall be repaired by the Contractor at the expense of the party damaging the material, as in accordance with the contract requirements.

END OF SECTION 074213.13

SECTION 076200
SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fabricated sheet metal items, including flashings, counterflashings, and reglets.

B. Sealants for joints within sheet metal fabrications.

1.02 RELATED REQUIREMENTS

A. Section 042000 - Unit Masonry: Metal flashings embedded in masonry.

B. Section 061000 - Rough Carpentry: Wood nailers for sheet metal work.

C. Section 077200 - Roof Accessories: Snow Guards.

1.03 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); 2013.

C. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2013.

D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

E. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.

F. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.

G. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric); 2014.

H. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2014a.

I. ASTM D226/D226M - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing; 2009.

J. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free; 2007 (Reapproved 2012).

K. CDA A4050 - Copper in Architecture - Handbook; current edition.

L. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

1.04 SUBMITTALS

A. See Section 013300 - Submittal Procedures

B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.

C. Samples: Submit two samples 4 by 4 inch (101.6 by 101.6 mm) in size illustrating metal finish color.

1.05 QUALITY ASSURANCE

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

1.06 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. Galvanized Steel: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 24 gauge, (0.0239 inch) (0.61 mm) thick base metal.

1. Typ. Exterior concealed conditions.

B. Pre-Finished Galvanized Steel: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 24 gauge, (0.0239) inch (0.61 mm) thick base metal, shop pre-coated with PVDF coating.
   1. PVDF (Polyvinylidene Fluoride) Coating: Superior Performance Organic Finish, AAMA 2605; multiple coat, thermally cured fluoropolymer finish system.
   2. Color: As indicated on drawings.
   3. Typ. Roof flashings/trim and Metal siding flashings/trim.

C. Stainless Steel: ASTM A666, Type 304 alloy, soft temper, 28 gage, (0.0156 inch) (0.40 mm) 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 (13 mm); miter and seam corners.

D. Form material with flat lock seams, except where otherwise indicated; at moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.

E. Fabricate corners from one piece with minimum 18 inch (450 mm) long legs; seam for rigidity, seal with sealant.

F. Fabricate flashings to allow toe to extend 2 inches (50 mm) over roofing gravel. Return and brake edges.

2.03 EXTERIOR PENETRATION FLASHING PANELS

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.

2.04 ACCESSORIES

A. Fasteners: Galvanized 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.

F. Reglets: Surface mounted type, galvanized steel; face and ends covered with plastic tape.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.

B. Verify roofing termination and base flashings are in place, sealed, and secure.

3.02 PREPARATION

A. Install starter and edge strips, and cleats before starting installation.

B. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil (0.4 mm).

3.03 INSTALLATION

A. Comply with drawing details.

B. Insert flashings into reglets to form tight fit; secure in place with lead wedges; pack remaining spaces with lead wool; seal flashings into reglets with sealant.

C. Secure flashings in place using concealed fasteners, and use exposed fasteners only where permitted..

D. Apply plastic cement compound between metal flashings and felt flashings.

E. Fit flashings tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.

F. Seal metal joints watertight.

3.04 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for field inspection requirements.

B. Inspection will involve surveillance of work during installation to ascertain compliance with specified requirements.

3.05 SCHEDULE

A. Through-Wall Flashing in Masonry:
   1. See Section 04 0523

B. Material Transitions, Flashing, Sills (MTL-01, MTL-04): See Acceptable Sheet Materials Section 2.02.

C. Break Metal (MTL-06): See Acceptable Sheet Materials Section Section 2.02.

D. Roof flashings and trim (MTL-03): See Acceptable Sheet Materials Section Section 2.02.

END OF SECTION 076200

SECTION 077200
ROOF ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Snow guards.

1.02 RELATED REQUIREMENTS

A. Section 074113 - Metal Roof Panels.

B. Section 076200 - Sheet Metal Flashing and Trim: Roof accessory items fabricated from sheet metal.

1.03 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; 2015.

1.04 SUBMITTALS

A. See Section 013300 - Submittal Procedures

B. Product Data: Manufacturer's data sheets on each product to be used.
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.
   4. Maintenance requirements.

C. Shop Drawings: Submit detailed layout developed for this project and provide dimensioned location and number for each type of roof accessory.
   1. Snow Guards: Submit design calculations for loadings and spacings based on manufacturer testing.

D. Certificate: For smoke hatches, provide certificate of approval from authority having jurisdiction.

E. Warranty Documentation:
   1. Submit manufacturer warranty.

2. Ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05 DELIVERY, STORAGE, AND HANDLING

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

B. Store products under cover and elevated above grade.

1.06 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 SNOW GUARDS

A. Fence Type Snow Guard: Continuous snow guard; manufacturer's standard single pipe, bar, channel, or solid rod, set in brackets or posts, with optional plates and metal trim to match roof.
   1. Mechanically fastened to seams (not the panle area between seams).
   2. Manufacturers:
      a. Basis of Design: Petersen ColorGard Snow Retention System.
      b. Substitutions: See Section 016000 - Product Requirements.

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.

B. Prepare surfaces using methods recommended by manufacturer for achieving acceptable results for applicable substrate under project conditions.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions, in manner that maintains roofing system weather-tight integrity.

3.04 CLEANING

A. Clean installed work to like-new condition.

3.05 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 077200

SECTION 079200
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.

1.02 RELATED REQUIREMENTS

A. Section 072500 - Weather Barriers: Sealants required in conjunction with air barriers and vapor retarders.

B. Section 078413 - Penetration Firestopping : Firestopping sealants.

C. Section 079513 - Expansion Joint Cover Assemblies: Sealants forming part of expansion joint cover assemblies.

D. Section 087100 - Door Hardware: Setting exterior door thresholds in sealant.

E. Section 088000 - Glazing: Glazing sealants and accessories.

F. Section 092116 - Gypsum Board Assemblies: Sealing acoustical and sound-rated walls and ceilings.

G. Section 093000 - 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; 2015a.

C. ASTM C834 - Standard Specification for Latex Sealants; 2014.

D. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications; 2012.

E. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2014a.

F. ASTM C1087 - Standard Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems; 2016.

G. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016.

H. ASTM C1248 - Standard Test Method for Staining of Porous Substrate by Joint Sealants; 2008 (Reapproved 2012).

I. ASTM C1311 - Standard Specification for Solvent Release Sealants; 2014.

J. ASTM C1330 - Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants; 2002 (Reapproved 2013).

1.04 SUBMITTALS

A. See Section 013300 - 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.

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.

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. 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.

1.06 WARRANTY

A. See Section 017800 - 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 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. Type S-E - Exterior Joints: Use non-sag non-staining silicone sealant, unless otherwise indicated.
   1. Type S-E1 - Lap Joints in Sheet Metal Fabrications: Butyl rubber, non-curing.
   2. Type S-E1 - Lap Joints between Manufactured Metal Panels: Butyl rubber, non-curing.
   3. Type S-E2 - Control and Expansion Joints in Concrete Paving: Self-leveling polyurethane "traffic-grade" sealant.

C. Type S-I - Interior Joints: Use non-sag Acrylic Emulsion Latex sealant, unless otherwise indicated.
   1. Type S-I1 - Wall and Ceiling Joints in Wet Areas: Non-sag polyurethane sealant for continuous liquid immersion.
   2. Type S-I2 - Floor Joints in Wet Areas: Non-sag polyurethane "traffic-grade" sealant suitable for continuous liquid immersion.
   3. Type S-I3 - Joints between Fixtures in Wet Areas and Floors, Walls, and Ceilings: Mildew-resistant silicone sealant; Color to be selected by Architect.

D. Interior Wet Areas: Bathrooms, restrooms, kitchens, food service areas, and food processing areas; fixtures in wet areas include plumbing fixtures, food service equipment, countertops, cabinets, and other similar items.

2.02 NONSAG JOINT SEALANTS

A. Type S-E - Non-Staining Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.
   1. Movement Capability: 50, 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 35, Shore A, when tested in accordance with ASTM C661.
   5. Color: To be selected by Architect from manufacturer's standard range.
   6. Cure Type: Single-component, neutral moisture curing.
   7. Service Temperature Range: Minus 20 to 180 degrees F (Minus 29 to 82 degrees C).
   8. Manufacturers:
      a. Dow Chemical Company; DOWSIL 790 Silicone Building Sealant: consumer.dow.com/en-us/industry/ind-building-construction.html/#sle.
      b. Pecora Corporation; 864 NST: www.pecora.com/#sle.
      c. Sika Corporation; Sikasil WS-290: www.usa-sika.com/#sle.
      d. Tremco Commercial Sealants & Waterproofing; Spectrem 3: www.tremcosealants.com/#sle.
      e. Substitutions: See Section 016000 - Product Requirements.

B. Type S-I3 - 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.
   2. Manufacturers:
      a. Pecora Corporation; 898 NST: www.pecora.com/#sle.
      b. Sika Corporation; Sikasil GP: www.usa-sika.com/#sle.
      c. Substitutions: See Section 016000 - Product Requirements.

C. Type S-I1 - Polyurethane Sealant for Continuous Water Immersion: ASTM C920, Grade NS, Uses M and A; single or multi-component; explicitly approved by manufacturer for continuous water immersion; suitable for traffic exposure when recessed below traffic surface .
   1. Movement Capability: Plus and minus 35 percent, minimum.
   2. Color: To be selected by Architect from manufacturer's standard range.
   3. Service Temperature Range: Minus 40 to 180 degrees F (Minus 40 to 82 degrees C).
   4. Manufacturers:
      a. Sika Corporation; Sikaflex-1a: www.usa-sika.com/#sle.
      b. Sika Corporation; Sikaflex-2c NS: www.usa-sika.com/#sle.
      c. Substitutions: See Section 016000 - Product Requirements.

D. Type S-I2 - Non-Sag "Traffic-Grade" Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; single or multi-component; explicitly approved by manufacturer for continuous water immersion and traffic without the necessity to recess sealant below traffic surface.
   1. Movement Capability: Plus and minus 25 percent, minimum.
   2. Hardness Range: 40 to 50, 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 (Minus 40 to 82 degrees C).
   5. Manufacturers:
      a. Pecora Corporation; DynaTred.
      b. Substitutions: See Section 016000 - Product Requirements.

E. Type S-E1 - Non-Curing Butyl Sealant: Solvent-based; ASTM C1311; single component, non-sag, non-skinning, non-hardening, non-bleeding; vapor-impermeable; intended for fully concealed applications.
   1. Manufacturers:
      a. Tremco Cormmercial Sealants and Waterproofing; Butyl Sealant.
      b. Substitutions: See Section 016000 - Product Requirements.

2.03 SELF-LEVELING SEALANTS

A. Type S-E2 - Self-Leveling Polyurethane Sealant: ASTM C920, Grade P, Uses M and A; single or multi-component; explicitly approved by manufacturer for traffic exposure; not expected to withstand continuous water immersion .
   1. Movement Capability: Plus and minus 25 percent, minimum.
   2. Color: To be selected by Architect from manufacturer's standard range.
   3. Service Temperature Range: Minus 40 to 180 degrees F (Minus 40 to 82 degrees C).
   4. Manufacturers:
      a. Pecora Corporation; NR-201: www.pecora.com/#sle.
      b. The QUIKRETE Companies; QUIKRETE® Polyurethane Self-Leveling Sealant: www.quikrete.com/#sle.
      c. Sika Corporation; Sikaflex-1c SL: www.usa-sika.com/#sle.

2.04 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.
   5. Manufacturers:
      a. Nomaco, Inc; HBR: www.nomaco.com/#sle.
      b. Substitutions: See Section 016000 - Product Requirements.

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.

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.

E. Concrete Floor Joints That Will Be Exposed in Completed Work: Test joint filler in inconspicuous area to verify that it does not stain or discolor slab.

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. Perform acoustical sealant application work in accordance with ASTM C919.

D. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer, except where specific dimensions are indicated.

E. Install bond breaker backing tape where backer rod cannot be used.

F. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.

G. 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.

H. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.

3.04 FIELD QUALITY CONTROL

A. Perform field quality control inspection/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.

3.05 POST-OCCUPANCY

A. Post-Occupancy Inspection: Perform visual inspection of entire length of project sealant joints at a time that joints have opened to their greatest width; i.e. at low temperature in thermal cycle. Report failures immediately and repair.

END OF SECTION 079200

SECTION 081113
HOLLOW METAL DOORS AND FRAMES

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. Standard and custom hollow metal doors and frames.
   2. Steel sidelight, borrowed lite and transom frames.
   3. Louvers installed in hollow metal doors.

B. Related Sections:
   1. Section 04 27 31 - Reinforced Unit Masonry for embedding anchors for hollow metal work into masonry construction.
   2. Section 08 71 00 - Door Hardware.
   3. Section 09 91 13 - Exterior Painting

C. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.
   1. ANSI/SDI A250.8 - Recommended Specifications for Standard Steel Doors and Frames.
   2. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames, Frames Anchors and Hardware Reinforcing.
   3. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames.
   4. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.
   5. ANSI/SDI A250.11 - Recommended Erection Instructions for Steel Frames.
   6. ASTM A1008 - Standard Specification for Steel Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
   7. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
   8. ASTM A924 - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.

9. ASTM C 1363 - Standard Test Method for Thermal Performance of Building Assemblies by Means of a Hot Box Apparatus.
10. ANSI/BHMA A156.115 - Hardware Preparation in Steel Doors and Frames.
11. ANSI/SDI 122 - Installation and Troubleshooting Guide for Standard Steel Doors and Frames.
12. ANSI/NFPA 80 - Standard for Fire Doors and Fire Windows; National Fire Protection Association.
13. ANSI/NFPA 105: Standard for the Installation of Smoke Door Assemblies.
14. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; National Fire Protection Association.
15. UL 10C - Positive Pressure Fire Tests of Door Assemblies.
16. UL 1784 - Standard for Air Leakage Tests of Door Assemblies.

1.03 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, hardware reinforcements, profiles, anchors, fire-resistance rating, and finishes.

B. Door hardware supplier is to furnish templates, template reference number and/or physical hardware to the steel door and frame supplier in order to prepare the doors and frames to receive the finish hardware items.

C. Shop Drawings: Include the following:
   1. Elevations of each door design.
   2. Details of doors, including vertical and horizontal edge details and metal thicknesses.
   3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
   4. Locations of reinforcement and preparations for hardware.
   5. Details of anchorages, joints, field splices, and connections.
   6. Details of accessories.
   7. Details of moldings, removable stops, and glazing.
   8. Details of conduit and preparations for power, signal, and control systems.

D. Samples for Verification:
   1. Samples are only required for manufacturers that are not current members of the Steel Door Institute.

1.04 QUALITY ASSURANCE

A. Source Limitations: Obtain hollow metal doors and frames through one source from a single manufacturer wherever possible.

B. Quality Standard: In addition to requirements specified, comply with ANSI/SDI A250.8, latest edition, "Recommended Specifications for Standard Steel Doors and Frames".

C. Energy Efficient Exterior Openings: Comply with minimum thermal ratings, based on ASTM C1363. Openings to be fabricated and tested as fully operable, thermal insulating door and frame assemblies.
   1. Thermal Performance (Exterior Openings): Independent testing laboratory certification for exterior door assemblies being tested in accordance with ASTM C1363 and meet or exceed the following requirements:
      a. Door Assembly Operable U-Factor and R-Value Ratings: U-Factor 0.37 Max, R-Value 2.7, including insulated door, thermal-break frame and threshold.
   2. Air Infiltration (Exterior Openings): Independent testing laboratory certification for exterior door assemblies being tested in accordance with ASTM E283 to meet or exceed the following requirements:
      a. Rate of leakage of the door assembly shall not exceed 0.25 cfm per square foot of static differential air pressure of 1.567 psf (equivalent to 25 mph wind velocity).

D. Pre-Submittal Conference: Conduct conference in compliance with requirements in Section 01 31 00 - Project Management and Coordination with attendance by representatives of Supplier, Installer, and Contractor to review proper methods and procedures for installing hollow metal doors and frames and to verify installation of electrical knockout boxes and conduit at frames with electrified or access control hardware.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project site storage. Do not use non-vented plastic.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch high wood blocking. Do not store in a manner that traps excess humidity.
   1. Provide minimum 1/4-inch space between each stacked door to permit air circulation. Door and frames to be stacked in a vertical upright position.

1.06 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.07 COORDINATION

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

1.08 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.

B. Warranty includes installation and finishing that may be required due to repair or replacement of defective doors.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. County Standard is Republic Doors and Frames, no substituions without approval.

2.02 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

C. Frame Anchors: ASTM A 653/A 653M, Commercial Steel (CS), Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

2.03 STANDARD HOLLOW METAL DOORS - INTERIOR

A. General: Provide 1-3/4 inch doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8.

B. Interior Doors: Face sheets fabricated of commercial quality cold rolled steel that complies with ASTM A 1008/A 1008M. Provide doors complying with requirements

indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:

1. Design: Flush panel.
2. Core Construction: Manufacturer's standard kraft-paper honeycomb, or one-piece polystyrene core, securely bonded to both faces.
    a. Fire Door Core: As required to provide fire-protection and temperature-rise ratings indicated.
3. Level/Model: Level 2 and Physical Performance Level B (Heavy Duty), Minimum 18 gauge (0.042-inch - 1.0-mm) thick steel, Model 2.
4. Vertical Edges: Vertical edges to have the face sheets spot welded and filled full height with an epoxy filler. Welds are to be ground, filled and dressed smooth. Beveled Lock Edge, 1/8 inch in 2 inches (3 mm in 50 mm).
5. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gauge, extending the full width of the door and welded to the face sheet.
6. Hinge Reinforcement: Minimum 7 gauge (3/16") plate 1-1/4" x 9" or minimum 14 gauge continuous channel with pierced holes, drilled and tapped.
7. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.

C. Manufacturers Basis of Design:
    1. Republic DL Series Flush Doors, standard honeycomb core as required for thermal performance.

2.04 STANDARD HOLLOW METAL DOORS - EXTERIOR

A. General: Provide 1-3/4 inch doors of design specified, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8 and ANSI/NAAMM HMMA 867.

B. Exterior Doors: Face sheets fabricated of commercial quality hot-dipped zinc coated steel that complies with ASTM A 653/A 653M, Coating Designation A60. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model, ANSI/SDI A250.4 for physical performance level, and HMMA 867 for door construction.
    1. Design: Flush panel.
    2. Core Construction: Standard honeycomb core.
        a. No minimum "U-Factor" is required at the comfort station. Building is an unconditioned space.
        b. U Factor as specified in Section 1.04.C.1. is required at the Splash Pad Office/Mech Building.
    3. Level/Model: Level 2 and Physical Performance Level B (Heavy Duty), Minimum 18 gauge (0.042-inch - 1.0-mm) thick steel, Model 2.

4. Vertical Edges: Lock edge is non beveled with a continous 16 gauge channgel welded to both face sheets with a maximum of 5' on center. Cylindercal and mortise lock preps are extruded to 14 guage as specified in ANSI A250.8.
5. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gauge, extending the full width of the door and welded to the face sheet. Doors with an inverted top channel to include a steel closure channel, screw attached, with the web of the channel flush with the face sheets of the door. Plastic or composite channel fillers are not acceptable.
6. Hinge Reinforcement: Full height 16 gauge channel with additional 9 gauge reinforcing at hinge locations projection welded to both face sheets with a maximum of 5" on center.
7. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.

C. Manufacturers Basis of Design:
   1. Republic DL Series Flush Doors.

2.05 STANDARD HOLLOW METAL FRAMES

A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.

B. Exterior Frames: Fabricated of hot-dipped zinc coated steel that complies with ASTM A 653/A 653M, Coating Designation A60.
   1. Fabricate frames, with the exception of knock down types, with "closed and tight" miter seams continuously welded on face, finished smooth with no visible seam unless otherwise indicated.
   2. Frames for Level 3 Steel Doors: Minimum 14 gauge (0.053-inch -1.3-mm) thick steel sheet.
   3. Manufacturers Basis of Design:
      a. Republic ME Series Mitered Frames, Welded Corners.
      b. Republic MH Series Drywall Frames, Welded Corners.

C. Interior Frames: Fabricated from cold-rolled steel sheet that complies with ASTM A 1008/A 1008M.
   1. Fabricate frames with mitered or coped corners.
   2. Fabricate frames, with the exception of slip-on drywall types, with "closed and tight" miter seams continuously welded on face, finished smooth with no visible seam unless otherwise indicated.
   3. Frames for Steel Doors: Minimum 16 gauge (0.052-inch -1.32-mm) thick steel sheet.
   4. Manufacturers Basis of Design:
      a. Republic MH Series Drywall Frames, Welded Corners.

D. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 Table 4 with reinforcement plates from same material as frames.

2.06 FRAME ANCHORS

A. Jamb Anchors:
   1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, formed from A60 metallic coated material, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.

B. Floor Anchors: Floor anchors to be provided at each jamb, formed from A60 metallic coated material, not less than 0.042 inches thick.

C. Mortar Guards: Formed from same material as frames, not less than 0.016 inches thick.

2.07 ACCESSORIES

A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.

B. Grout Guards: Formed from same material as frames, not less than 0.016 inches thick.

2.08 FABRICATION

A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. When shipping limitations so dictate, frames for large openings are to be fabricated in sections for splicing or splining in the field by others.

B. Tolerances: Fabricate hollow metal work to tolerances indicated in ANSI/SDI A250.8.

C. Hollow Metal Doors:
   1. Exterior Doors: Provide optional weep-hole openings in bottom of exterior doors to permit moisture to escape where specified.
   2. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge strap for continuous hinges specified in hardware sets in Section "08 71 00 - Door Hardware.

D. Hollow Metal Frames:
   1. Shipping Limitations: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
   2. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
      a. Welded frames are to be provided with two steel spreaders temporarily attached to the bottom of both jambs to serve as a brace during shipping and

handling. Spreader bars are for bracing only and are not to be used to size the frame opening.

3. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
4. High Frequency Hinge Reinforcement: Provide high frequency hinge reinforcements at door openings 48-inches and wider with mortise butt type hinges at top hinge locations.
5. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge straps for continuous hinges specified in hardware sets in Section 08 71 00 - Door Hardware.
6. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated for removable stops, provide security screws at exterior locations.
7. Mortar Guards: Provide guard boxes at back of hardware mortises in frames at all hinges and strike preps regardless of grouting requirements.
8. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
9. Jamb Anchors: Provide number and spacing of anchors as follows:
   a. Masonry Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
      1) Two anchors per jamb up to 60 inches high.
      2) Three anchors per jamb from 60 to 90 inches high.
      3) Four anchors per jamb from 90 to 120 inches high.
      4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.
10. Door Silencers: Except on weather stripped or gasketed doors, drill stops to receive door silencers. Silencers to be supplied by frame manufacturer regardless if specified in Section 08 71 00 - Door Hardware.

E. Hardware Preparation: Factory prepare hollow metal work to receive template mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Section 08 71 00 - Door Hardware.
   1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
   2. Reinforce doors and frames to receive non-template, mortised and surface mounted door hardware.
   3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
   4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 Sections.

2.09 STEEL FINISHES

A. Prime Finishes: Doors and frames to be cleaned, and chemically treated to insure maximum finish paint adhesion. Surfaces of the door and frame exposed to view to receive a factory applied coat of rust inhibiting shop primer.
   1. Shop Primer: Manufacturer's standard, fast-curing, lead and chromate free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; and compatible with substrate and field-applied coatings.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. General Contractor to verify the accuracy of dimensions given to the steel door and frame manufacturer for existing openings or existing frames (strike height, hinge spacing, hinge back set, etc.).

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

3.02 PREPARATION

A. Remove welded in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

B. Prior to installation, adjust and securely brace welded hollow metal frames for squareness, alignment, twist, and plumbness.

C. Tolerances shall comply with SDI-117 "Manufacturing Tolerances Standard Steel Doors and Frames."

D. Drill and tap doors and frames to receive non-template, mortised, and surface-mounted door hardware.

3.03 INSTALLATION

A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.

B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11 and NFPA 80 at fire rated openings.
   1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete and frames properly set and secured, remove temporary braces, leaving surfaces smooth and undamaged. Shim as necessary to comply with installation tolerances.
   2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with post-installed expansion anchors.
   3. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with mortar.
   4. Grout Requirements: Do not grout head of frames unless reinforcing has been installed in head of frame. Do not grout vertical or horizontal closed mullion members.

C. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.
   1. Non-Fire-Rated Standard Steel Doors:
      a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
      b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
      c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
      d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.

3.04 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.

B. Remove grout and other bonding material from hollow metal work immediately after installation.

C. Prime-Coat and Painted Finish Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat, or painted finishes, and apply touchup of compatible air drying, rust-inhibitive primer, zinc rich primer (exterior and galvanized openings) or finish paint.

END OF SECTION 081113

SECTION 084313
ALUMINUM-FRAMED STOREFRONTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Aluminum-framed entrance doors, with vision glass. Door 201 Splash Pad Building.

B. Weatherstripping.

C. Products furnished but not installed under this Section:
   1. Anchoring devices with are built into masonry
   2. Anchoring devices which are cast in concrete.
   3. Glazing Accessories with are part of aluminum framing system.

1.02 RELATED REQUIREMENTS

A. Section 072500 - Weather Barriers: Sealing framing to weather barrier installed on adjacent construction.

B. Section 079200 - Joint Sealants: Sealing joints between frames and adjacent construction.

C. Section 088000 - Glazing: Glass and glazing accessories.

1.03 REFERENCE STANDARDS

A. AAMA CW-10 - Care and Handling of Architectural Aluminum From Shop to Site; 2015.

B. AAMA 501.2 - Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls, and Sloped Glazing Systems; 2015.

C. AAMA 503 - Voluntary Specification for Field Testing of Newly Installed Storefronts, Curtain Walls and Sloped Glazing Systems; 2014.

D. AAMA 609 & 610 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum (Combined Document); 2015.

E. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2014 (2015 Errata).

F. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; 2016.

G. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.

H. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

I. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.

J. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.

K. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2004 (Reapproved 2012).

L. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014.

M. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2016).

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

O. ASTM E1996 - Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Windborne Debris in Hurricanes; 2017.

P. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); 2002 (Ed. 2004).

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate with installation of other components that comprise the exterior enclosure.

B. Preinstallation Meeting: Conduct a preinstallation meeting one week before starting work of this section; require attendance by all affected installers.

1.05 SYSTEM REQUIREMENTS

A. Design Requirements: Manufacturer: Responsible for designing system, including anchorage to structural system and necessary modifications to meet specified requirements and maintain visual design concepts.
   1. Architectural Drawings: Are diagrammatic and do not purport to identify nor solve problems of thermal or structural movement, glazing, anchorage, or moisture disposal of the storefront systems.
   2. Employ registered professional engineer, licensed to practice structural engineering in jurisdiction where Project is located, to engineer each component of storefront system.
   3. Requirements Shown by Details: Establish basic dimension of units, sight lines and profiles of members.
   4. Provide entrance and storefront systems, including necessary modifications, to meet specified requirements and maintaining visual design concepts.
   5. Assemblies: Free from rattles, wind whistles and noise due to thermal and structural movement and wind pressure.
      a. Provide for expansion and contraction due to structural movement without detriment to appearance or performance.
      b. Attachments: Account for site peculiarities and expansion and contraction movements so there is no possibility of loosening, weakening and fracturing connection between units and building structure or between units themselves.
      c. Anchors, Fasteners and Braces: Structurally stressed not more than 50 percent of allowable stress when maximum loads are applied.
      d. Provide concealed fastening wherever possible.
   6. Drainage System: Drain water entering joints and condensation occurring within strorefront system by drain holes and gutters of adequate size to evacuate water to exterior without infiltration to interior.
      a. Provide baffles at weep hole locations.
      b. Provide continuous interior gutter system at sill including sill plate with back and side dams which drains to exterior through weep holes.
   7. Anticipated Live Load Interior Beam Deflections: 1/360 of beam length.

B. Thermal Requirements: Framing Systems: Accommodate expansion and contraction movement due to surface temperature differentials of 180 F without causing buckling, stress on glass, failure of joint seals, excessive stress on structural elements, reduction of performance, or other detrimental effects.
   1. Ensure doors function normally within limits of specified temperature range.
   2. Deflection Under Uniform Loading: When tested in accordance with ASTM E330 at design pressure, maximum deflection of exterior member shall not exceed L/175 or 3/4 inch maximum for spans under 13 feet - 6 inches and L/240 plus 1/4 inch for spans 13 feet - 6 inches or greater. Maximum deflections of members supporting plaster surfaces shall not exceed 1/360 of its span.

C. Thermal Transmittance (U-factor): When tested to AAMA Specification 1503, the thermal transmittance (U-Factor) shall not be more than 0.36 fixed or 0.45 operable. (with clear glass). Entrance doors U-Factor shall not be more than 0.63.

D. Testing Requirements: Provide components that have been previously tested by independent testing laboratory.

1.06 SUBMITTALS

A. See Section 013300 - Submittal Procedures

B. Submit Section 079200 - Joint Sealants simultaneously with submittals from this section.

C. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, door hardware, and internal drainage details.
   1. Include color charts for finish indicating manufacturer's standard colors available for selection.

D. Shop Drawings: Indicate fabrication, installation, and finish of specified systems.
   1. Provide fully dimensioned plans and elevations with detail coordination keys, and locations of exposed fasteners and joints.
   2. Provide Detailed Drawings of:
      a. Composite members.
      b. Joint connections for framing systems and for entrance doors.
      c. Anchorage.
      d. Flashing.
      e. System reinforcements.
      f. Expansion and contraction provisions.
      g. Hardware, including locations, mounting heights, reinforcements and special installation provisions.
      h. Glazing methods and accessories.
      i. Internal sealant requirements and recommended types.
   3. Include design engineer's stamp or seal on shop drawings.

E. Samples: Submit two samples 4 by 4 inches (101.6 by 101.6 mm) in size illustrating finished aluminum surface, glass, infill panels, glazing materials.

F. Manufacturer's Certificate: Certify that the products supplied meet or exceed the specified requirements.

G. Design Data: Provide framing member structural and physical characteristics, engineering calculations, and dimensional limitations.

H. Hardware Schedule: Complete itemization of each item of hardware to be provided for each door, cross-referenced to door identification numbers in Contract Documents.

I. Field Quality Control Submittals: Report of field testing for water penetration and air leakage.

J. Designer's Qualification Statement.

K. Manufacturer's Qualification Statement.

L. Installer's Qualification Statement.

M. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.07 QUALITY ASSURANCE

A. Designer Qualifications: Design structural support framing components under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed in the State in which the Project is located.

B. Manufacturer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.

C. Installer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.

D. Single Source Responsibility: To ensure quailty of appearance and performance, obtain materials for systems from either single manufacturer or from manufacturer approved by systems manufacturer,

1.08 DELIVERY, STORAGE, AND HANDLING

A. Handle products of this section in accordance with AAMA CW-10.

B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

1.09 FIELD CONDITIONS

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

1.10 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Special Warranties: Prepare and submit in accordance with Section 01 77 00 - Closeout Procedures.

1. Warranty jointly signed by manufacturer, Installer and Contractor agreeing to repair or replace assemblies which fail in material or workmanship during warranty period of two years.
   a. If joint warranty not available, issue separate warranties by manufacturer, Installer, and Contractor
2. Warranty stating organic coating finish will be free from fading more than 10 percent, chalking, yellowing, peeling, cracking, pitting, corroding or non-uniformity of color, or gloss deterioration beyond manufacturer's descriptive standards for 20 years.
3. Warranty stating insulated glass units to be free from condensation, fogging and obstruction of vision due to film on internal surfaces for 10 years.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design: YKK AP America.

2.02 BASIS OF DESIGN -- SWINGING DOORS

A. Wide Stile, Insulating Glazing, Thermally-Broken:
   1. Basis of Design: YKK AP Series, MegaTherm 50T Wide Stile Entrance..
      a. Description: 2" (50.8 mm) thick by 5" (127.0 mm) Door Stile.

2.03 STOREFRONT

A. Aluminum-Framed Storefront: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
   1. Glazing Position: Centered (front to back).
   2. Fabrication: Provide each unit of framework continuous
      a. Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors and hardware; fasteners and attachments concealed from view.
      b. Disassemble only to extent necessary for shipment and installation.
      c. Reinforce work as necessary for performance requirements, and for support to structure.
      d. Form enddams at flashings to prevent water infiltration.
      e. Separate dissimilar metals and aluminum in contact with concrete utilizing protective coating or preformed separators which will prevent contact and corrosion.
      f. Glass and Glazing: Comply with Section 088000 - Glazing

3. Reinforcement: Reinforce to develop full strength and maximum rigidity in framework. Reinforce components at anchorage and support points, at joints, and at attachment points for interfacing work.
    a. Internal Reinforcment: Provide within framing members where required to maintain rigidity and accomodate design loads.
4. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
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.
    a. Head and sill extrusions, with sill or sill plate, act as gutters to weep water to exterior; do not penetrate sections with fasteners.
    b. Sill Plate: Cover bottom of sill framing member with vertical dams at jambs for full height of sill framing member. Provide at interior side of jambs to prevent weeping or drainage of water from inside of window system to adjacent wall construction or to interior of building. Extend plate and weep beyond exterior face of sill extrusion.
6. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F (95 degrees C) over a 12 hour period without causing detrimental effect to system components, anchorages, and other building elements.
7. Movement: Allow for movement between storefront and adjacent construction, without damage to components or deterioration of seals.
8. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.

B. Performance Requirements:
    1. Wind Loads: Design and size components to withstand the specified load requirements without damage or permanent set, when tested in accordance with ASTM E330/E330M, using loads 1.5 times the design wind loads and 10 second duration of maximum load.
        a. Member Deflection: Limit member deflection to flexure limit of glass in any direction, with full recovery of glazing materials.
    2. Water Penetration Resistance on Manufactured Assembly: No uncontrolled water on interior face, when tested in accordance with ASTM E331 at pressure differential of 8 psf (390 Pa).
    3. Air Leakage Laboratory Test: Maximum of 0.06 cu ft/min sq ft (0.3 L/sec sq m) of wall area, when tested in accordance with ASTM E283 at 6.27 psf (300 Pa) pressure differential across assembly.

2.04 COMPONENTS

A. Aluminum Framing Members: Tubular aluminum sections, thermally broken with interior section insulated from exterior, drainage holes and internal weep drainage system.
    1. Glazing Stops: Flush.

B. Glazing: As specified in Section 088000.

C. Swing Doors: Glazed aluminum.
   1. Thickness: 2 inches (50 mm).
   2. Top Rail: 5 inches (127 mm) wide.
   3. Bottom Rail: 10 inches (254 mm) wide.
   4. Glazing Stops: Beveled.
   5. Finish: Clear anodized.

2.05 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M).

B. Structural Steel Sections: ASTM A36/A36M; galvanized in accordance with requirements of ASTM A123/A123M.

C. Anchorage Devices: Manufacturer's standard formed or fabricated steel or aluminum assemblies of shapes, plates, bars or tubes.

D. Expansion Anchorage Devices: Drilled in, expansion bolt anchors.

E. Fasteners: Aluminum, non-magnetic stainless steel or other non-corrosive materials compatible with items being fastened.
   1. Provide concealed fasteners wherever possible.
   2. Exposed locations: Phillips flathead screws with fainish matching item fastened.
   3. Concealed locations: Manufacturer's standard.
   4. At locations where securing dissimilar metals, provide dual alloy fasteners.

F. Exposed Flashings: Aluminum sheet, 20 gage, 0.032 inch (0.81 mm) minimum thickness; finish to match framing members.

G. Concealed Flashings: Sheet aluminum, 26 gage, 0.017 inch (0.43 mm) minimum thickness.

H. Flashings used externally or internally to be corrosive resistant, non-staining, non-bleeding, and compatible with adjoining materials.

I. Sill Flashing Sealant: Elastomeric, silicone or polyurethane, compatible with flashing material.

J. Sealant for Setting Thresholds: Non-curing butyl type.

K. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.

L. Protective Coatings and Barriers:

1. Cold-applied asphalt mastic, alkyd-type, bituminous mastic capable of preventing galvanic action between dissimilar metals, free of lead, chromates, or sulfur and containing no asbestos fibers, compounded for 30 mil dry film thickness per coat.
2. Shims: Molded or extruded plastic, establishing sufficient space between dissimilar metals to prevent galvanic action or arcing of current.

M. Shop and Touch-Up Primer for Steel Components: Zinc oxide, alkyd, linseed oil primer appropriate for use over hand cleaned steel.

N. Touch-Up Primer for Galvanized Steel Surfaces: SSPC-Paint 20 zinc rich.

2.06 FINISHES

A. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils (0.018 mm) thick.

2.07 HARDWARE

A. For each door, include weatherstripping, sill sweep strip, and threshold.

B. Other Door Hardware: As listed in the Hardware sets on A-603.

C. Weatherstripping: Wool pile, continuous and replaceable; provide on all doors.

D. Sill Sweep Strips: Resilient seal type, retracting, of neoprene; provide on all doors.

E. Threshold: Extruded aluminum, one piece per door opening, ribbed surface; provide on all doors.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify dimensions, tolerances, and method of attachment with other work.

B. Verify that wall openings and adjoining air and vapor seal materials are ready to receive work of this section.

3.02 INSTALLATION

A. Install wall system in accordance with manufacturer's instructions.

B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.

C. Provide alignment attachments and shims to permanently fasten system to building structure.

D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.

E. Provide thermal isolation where components penetrate or disrupt building insulation.

F. Install sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.

G. Set sill members in bed of sealant. Set other members with internal sealants and baffles to provide weathertight construction.

H. Where fasteners penetrate sill flashings, make watertight by seating and sealing fastener heads to sill flashing.

I. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

J. Protective Coating: Separate dissimilar materials at contact points, including metal in contact with masonry or concrete surfaces, with protective coating or preformed separators to prevent contact and corrosion.

K. Set thresholds in bed of sealant and secure.

L. Install hardware using templates provided.

M. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.03 TOLERANCES

A. Maximum Variation from Plumb: 0.06 inch per 3 feet (1.5 mm per m) non-cumulative or 0.06 inch per 10 feet (1.5 mm per 3 m), whichever is less.

B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch (0.8 mm).

3.04 FIELD QUALITY CONTROL

A. Provide services of storefront manufacturer's field representative to observe for proper installation of system and submit report.

B. See Section 014000 - Quality Requirements, for general testing and inspection requirements.

C. Water-Spray Test: Provide water spray quality test of installed storefront components in accordance with AAMA 501.2 during construction process and before installation of interior finishes.
   1. Perform a minimum of two tests in each designated area as indicated on drawings.
   2. Conduct tests in each area prior to 10 percent and 50 percent completion of this work.

D. Repair or replace storefront components that have failed designated field testing, and retest to verify performance complies with specified requirements.

3.05 ADJUSTING

A. Adjust operating hardware and sash for smooth operation.

3.06 CLEANING

A. Remove protective material from pre-finished aluminum surfaces.

B. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths, and take care to remove dirt from corners and to wipe surfaces clean.

C. Upon completion of installation, thoroughly clean aluminum surfaces in accordance with AAMA 609 & 610.

3.07 PROTECTION

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

END OF SECTION 084313

SECTION 085213
METAL CLAD WOOD WINDOWS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Factory-fabricated aluminum clad wood windows at Splash Pad Building.

B. Glazing.

C. Operating hardware.

D. Insect screens.

1.02 RELATED REQUIREMENTS

A. Section 061000 - Rough Carpentry: Wood perimeter shims.

B. Section 072500 - Weather Barriers: Sealing frames to water-resistive barrier installed on adjacent construction.

C. Section 079200 - Joint Sealants: Sealing joints between 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 611 - Voluntary Specification for Anodized Architectural Aluminum; 2014 (2015 Errata).

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Show component dimensions, anchorage and fasteners, glass, and internal drainage details.

C. Shop Drawings: Indicate opening dimensions, framed opening tolerances, affected related work, and installation requirements.

1.05 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Manufacturer Warranty: Provide 20 year manufacturer warranty for insulated glass units against seal failure, interpane dusting or misting, and replacement of same. Complete forms in Owner's name and register with manufacturer.

C. Manufacturer Warranty: Provide 10 year manufacturer warranty against defects listed. Complete forms in Owner's name and register with manufacturer or warrantor.
   1. Non glass parts.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Aluminum Clad Wood Windows:
   1. Basis of Design (County Standard): Andersen Windows, Inc; E-Series Gliding Windows: www.andersenwindows.com/#sle.

2.02 WOOD WINDOWS

A. Wood Windows: Wood frame and sash, factory fabricated and assembled.
   1. Exterior Finish: Metal clad, anodized.
   2. Interior Finish: Painted: Factory applied before assembly.
   3. Color: As indicated.
      a. Exterior: Clear anodized.
      b. Interior: White.
   4. Configuration: Horizontal sliding.
   5. Factory glazed; dry glazing method.
   6. Wood Species: Clear pine, preservative treated using treatment type suitable for required finish.
   7. Metal Cladding: Formed aluminum, factory finished, factory fit to profile of wood members.
   8. Weather Stop Flange: Continuous at perimeter of unit.
   9. Clearances and Shim Spacing: Minimum required for installation and dynamic movement of perimeter seal.
   10. Fasteners: Concealed from view.
   11. Internal Drainage of Glazing Spaces to Exterior: Weep holes.
   12. Operable Units: Double weatherstripped.

2.03 COMPONENTS

A. Glazing: Double glazed, clear, Low-E coated, argon filled, with glass thicknesses as recommended by manufacturer for specified wind conditions.

B. Frames: Manufacturer's standard profile; flush solid wood glass stops of screw fastened type, sloped for positive drainage.

C. Insect Screens: Extruded aluminum frame with mitered and reinforced corners; screen mesh taut and secure to frame; secured to window with adjustable supports allowing screen removal without use of tools.
   1. Supports: Spring-loaded steel pins; four per screen unit.
   2. Screen Mesh: Vinyl-coated fiberglass, window manufacturer's standard mesh.
   3. Frame Finish: Baked enamel, color to match window interior color.

D. Operable Sash Weatherstripping: three fins and pile, polypropylene; permanently resilient, profiled to effect weather seal.

E. Fasteners: Stainless steel.

F. Sealant and Backing Materials: See Section 079200 of types as indicated.

G. Flashing: Provide related flashings, with necessary anchors and attachment devices.

H. Sealant for Setting Sills, Stools, Aprons, and Sill Flashing: Non-curing butyl type.

2.04 PERFORMANCE REQUIREMENTS

A. Comply with AAMA/WDMA/CSA 101/I.S.2/A440 requirements for the specific window type in accordance with the following:
   1. Performance Class (PC): CW.
   2. Performance Grade (PG): 30, with minimum design pressure (DP) of 30.08 psf (1440 Pa).

B. Overall Thermal Transmittance (U-value): 0.45, maximum, including glazing, measured on window sizes required for this project.

C. Solar Heat Gain Coefficient (SHGC) of Glass: 0.33, maximum

2.05 HARDWARE

A. Horizontal Sliding Sash: surface mounted die-cast zinc, limit stops in head and sill track.

B. Sash lock: Manufacturer's standard..

2.06 ALUMINUM FINISHES

A. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41, clear anodic coating not less than 0.7 mils (0.018 mm) thick.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify wall openings and adjoining water-resistive barrier materials are ready to receive wood windows; see Section 072500.

3.02 INSTALLATION

A. Attach window frame and shims to perimeter opening to accommodate construction tolerances and other irregularities.

B. Align window plumb and level, free of warp or twist. Maintain dimensional tolerances and alignment with adjacent work.

C. Set sill members and sill flashing in continuous bead of sealant.

D. 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.

3.03 TOLERANCES

A. Maximum Variation from Level or Plumb: 1/16 inch per 3 ft (1.6 mm per m) non-cumulative or 1/8 inch per 10 ft (3.2 mm per 3 m), whichever is less.

3.04 ADJUSTING

A. Adjust hardware for smooth operation and secure weathertight closure.

3.05 CLEANING

A. Remove protective material from factory finished surfaces.

B. Wash surfaces by method recommended and acceptable to window manufacturer; rinse and wipe surfaces clean.

END OF SECTION 085213

SECTION 088000
GLAZING

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 glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:
   1. Glazed entrances. Door 201 Splash Pad Building**.**

B. Related Sections:
   1. Section 08 43 13 - Aluminum-Framed Storefronts.

1.03 DEFINITIONS

A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.

C. Interspace: Space between lites of an insulating-glass unit.

1.04 PERFORMANCE REQUIREMENTS

A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 - Quality Requirements, to design glazing.

C. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined according to ASTM E 1300.
   1. Design Wind Pressures: As indicated on Drawings.
   2. Differential Shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites.

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
   1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

1.05 PRECONSTRUCTION TESTING

A. Preconstruction Adhesion and Compatibility Testing: Test each glazing material type, tape sealant, gasket, glazing accessory, and glass-framing member for adhesion to and compatibility with elastomeric glazing sealants.
   1. Testing will not be required if data are submitted based on previous testing of current sealant products and glazing materials matching those submitted.
   2. Use ASTM C 1087 to determine whether priming and other specific joint-preparation techniques are required to obtain rapid, optimum adhesion of glazing sealants to glass, tape sealants, gaskets, and glazing channel substrates.
   3. Test no fewer than eight Samples of each type of material, including joint substrates, shims, sealant backings, secondary seals, and miscellaneous materials.
   4. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
   5. For materials failing tests, submit sealant manufacturer's written instructions for corrective measures including the use of specially formulated primers.

1.06 SUBMITTALS

A. Product Data: For each glass product and glazing material indicated.

B. Glass Samples: For each type of glass product other than clear monolithic vision glass; 12 inches (300 mm) square.

C. Glazing Accessory Samples: For gaskets, sealants, and colored spacers, in 12-inch (300-mm) lengths.

D. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

E. Qualification Data: For installers.

F. Product Certificates: For glass and glazing products, from manufacturer.

G. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for tinted glass, coated glass, insulating glass, glazing sealants, and glazing gaskets.
   1. For glazing sealants, provide test reports based on testing current sealant formulations within previous 36-month period.

H. Preconstruction adhesion and compatibility test report.

I. Warranties: Sample of special warranties.

1.07 QUALITY ASSURANCE

A. Manufacturer Qualifications for Insulating-Glass Units with Sputter-Coated, Low-E Coatings: A qualified insulating-glass manufacturer who is approved and certified by coated-glass manufacturer.

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

C. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.

D. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.

E. Source Limitations for Glass: Obtain ultraclear float glass, tinted float glass, coated float glass, and insulating glass from single source from single manufacturer for each glass type.

F. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.

G. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
   1. GANA Publications: GANA's "Laminated Glazing Reference Manual" and GANA's "Glazing Manual."
   2. AAMA Publications: AAMA GDSG-1, "Glass Design for Sloped Glazing," and AAMA TIR-A7, "Sloped Glazing Guidelines."
   3. IGMA Publication for Sloped Glazing: IGMA TB-3001, "Guidelines for Sloped Glazing."
   4. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."

H. Safety Glazing Labeling: Where safety glazing labeling is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

I. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.

J. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Install glazing in mockups specified in Division 01 Section 01 40 00 - Quality Requirements to match glazing systems required for Project, including glazing methods.
   2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. Comply with insulating-glass manufacturer's written recommendations for venting and sealing units to avoid hermetic seal ruptures due to altitude change.
   1.

1.09 PROJECT CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
   1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or below 40 deg F (4.4 deg C).

1.10 WARRANTY

A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer's standard form in which coated-glass manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.

1. Warranty Period: 10 years from date of Substantial Completion.

B. Manufacturer's Special Warranty on Laminated Glass: Manufacturer's standard form in which laminated-glass manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.
   1. Warranty Period: 10 years from date of Substantial Completion.

C. Manufacturer's Special Warranty on Insulating Glass: Manufacturer's standard form in which insulating-glass manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.
   1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 GLASS PRODUCTS, GENERAL

A. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass lites in thicknesses as needed to comply with requirements indicated.

B. Strength: Where float glass is indicated, provide annealed float glass, Kind HS heat-treated float glass, or Kind FT heat-treated float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened glass is indicated, provide Kind HS heat-treated float glass or Kind FT heat-treated float glass as needed to comply with "Performance Requirements" Article. Where fully tempered glass is indicated, provide Kind FT heat-treated float glass.

C. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:
   1. For monolithic-glass lites, properties are based on units with lites 6.0 mm thick.
   2. For laminated-glass lites, properties are based on products of construction indicated.
   3. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.

4. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F (W/sq. m x K).
5. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
6. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

2.02 GLASS PRODUCTS

A. Float Glass: ASTM C 1036, Type I, Quality-Q3, Class I (clear) unless otherwise indicated.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide Vitro Architectural Glass (Formerly PPG Industries, Inc.); Clear or comparable product by one of the following:
      a. AFG Industries, Inc.
      b. Cardinal Glass Industries.
      c. Pilkington North America.
      d. Accepted substitute in accordance with Section 01 25 00 - Substitution Procedures.

B. Ultraclear Float Glass: ASTM C 1036, Type I, Quality-Q3, Class I, complying with other requirements specified and with visible light transmission not less than 91 percent and solar heat gain coefficient not less than 0.87.
   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. AFG Industries, Inc.; Krystal Klear.
      b. Guardian Industries Corp.; Ultrawhite.
      c. Pilkington North America; Optiwhite.
      d. Vitro Architectural Glass (Formerly PPG Industries, Inc.); Starphire.
      e. Accepted substitute in accordance with Section 01 25 00 - Substitution Procedures.

C. Heat-Treated Float Glass: ASTM C 1048; Type I; Quality-Q3; Class I (clear) unless otherwise indicated; of kind and condition indicated.
   1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
   2. For uncoated glass, comply with requirements for Condition A.
   3. For coated vision glass, comply with requirements for Condition C (other coated glass).

2.03 INSULATING GLASS

A. Manufacturers: Subject to compliance with requirements, provide products by Vitro Architectural Glass (Formerly PPG Industries, Inc.) or comparable products by one of the following manufacturers:

1. AFG Industries, Inc.
2. Cardinal Glass Industries.
3. Pilkington North America.
4. Accepted substitute in accordance with Section 01 2500 - Substitution Procedures.

B. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190, and complying with other requirements specified.
   1. Sealing System: Dual seal, with manufacturer's standard primary and secondary.
   2. Spacer: Manufacturer's standard spacer material and construction.
   3. Desiccant: Molecular sieve or silica gel, or blend of both.

C. Glass: Comply with applicable requirements in "Glass Products" Article and in "Laminated Glass" Article as indicated by designations in "Insulating-Glass Types" Article and in "Insulating-Laminated-Glass Types" Article.

2.04 GLAZING GASKETS

A. Dense Compression Gaskets: Molded or extruded gaskets of profile and hardness required to maintain watertight seal, made from one of the following:
   1. Neoprene complying with ASTM C 864.
   2. EPDM complying with ASTM C 864.
   3. Silicone complying with ASTM C 1115.
   4. Thermoplastic polyolefin rubber complying with ASTM C 1115.

B. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned EPDM, silicone, or thermoplastic polyolefin rubber gaskets complying with ASTM C 509, Type II, black; of profile and hardness required to maintain watertight seal.
   1. Application: Use where soft compression gaskets will be compressed by inserting dense compression gaskets on opposite side of glazing or pressure applied by means of pressure-glazing stops on opposite side of glazing.

C. Lock-Strip Gaskets: Neoprene extrusions in size and shape indicated, fabricated into frames with molded corner units and zipper lock-strips, complying with ASTM C 542, black.

2.05 GLAZING SEALANTS

A. General:
   1. Compatibility: Provide glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.

2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
3. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.

B. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 25, Use NT.
1. Products: Subject to compliance with requirements, [provide the following] [provide one of the following] [available products that may be incorporated into the Work include, but are not limited to, the following]:
a. Dow Corning Corporation; 799.
b. GE Advanced Materials - Silicones; UltraGlaze SSG4000.
c. May National Associates, Inc.; Bondaflex Sil 200 GPN.
d. Polymeric Systems, Inc.; PSI-631.
e. Schnee-Morehead, Inc., an ITW company; SM5731 Poly-Glaze Plus.
f. Tremco Incorporated; Tremsil 600.

2.06 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C 1281 and AAMA 800 for products indicated below:
1. AAMA 804.3 tape, where indicated.
2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:
1. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.
2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.07 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

D. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

F. Perimeter Insulation for Fire-Resistive Glazing: Product that is approved by testing agency that listed and labeled fire-resistant glazing product with which it is used for application and fire-protection rating indicated.

2.08 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.

C. Grind smooth and polish exposed glass edges and corners.

2.09 INSULATING-GLASS TYPES

A. Glass Type GL-01 (Storefront Door - Tempered): Low-e-coated, tinted insulating glass, tempered.
   1. Basis of Design: Vitro Architectural Glass (formerly PPG Industries, Inc.); Solarban 65 (2) Clear + Clear.
   2. Overall Unit Thickness: 1 inch (25 mm).
   3. Thickness of Each Glass Lite: 6.0 mm.
   4. Outdoor Lite: Tinted fully tempered float glass.
   5. Interspace Content: Air.
   6. Indoor Lite: Clear fully tempered float glass.
   7. Low-E Coating: Sputtered on second surface.
   8. Visible Light Transmittance: 70 percent minimum.
   9. U-Factor: Entrance Doors: 0.63 maximum.
   10. Solar Heat Gain Coefficient: 0.36 maximum
   11. Provide safety glazing labeling.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:
   1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
   2. Presence and functioning of weep systems.
   3. Minimum required face and edge clearances.
   4. Effective sealing between joints of glass-framing members.

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

3.02 PREPARATION

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

B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that will leave visible marks in the completed work.

3.03 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Adjust glazing channel dimensions as required by Project conditions during installation to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

G. Provide spacers for glass lites where length plus width is larger than 50 inches (1270 mm).
   1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
   2. Provide 1/8-inch (3-mm) minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

J. Set glass lites with proper orientation so that coatings face exterior or interior as specified.

K. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

L. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.04 GASKET GLAZING (DRY)

A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

E. Install gaskets so they protrude past face of glazing stops.

3.05 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.06 LOCK-STRIP GASKET GLAZING

A. Comply with ASTM C 716 and gasket manufacturer's written instructions. Provide supplementary wet seal and weep system unless otherwise indicated.

3.07 CLEANING AND PROTECTION

A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer.

C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.

D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.

E. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

END OF SECTION 088000

SECTION 092216
NON-STRUCTURAL METAL FRAMING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal partition, ceiling, and soffit framing.

1.02 RELATED REQUIREMENTS

A. Section 054000 - Cold-Formed Metal Framing: Requirements for structural, load-bearing, metal stud framing and exterior wall stud framing.

B. Section 054000 - Cold-Formed Metal Framing: Execution requirements for anchors for attaching work of this section.

C. Section 061000 - Rough Carpentry: Wall sheathing.

D. Section 072100 - Thermal Insulation: Insulation.

E. Section 072500 - Weather Barriers.

F. Section 076200 - Sheet Metal Flashing and Trim: Head and sill flashings

G. Section 079200 - Joint Sealants: Sealing acoustical gaps in construction other than gypsum board or plaster work.

1.03 REFERENCE STANDARDS

A. AISI S100-12 - North American Specification for the Design of Cold-Formed Steel Structural Members; American Iron and Steel Institute; 2012.

B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

C. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members; 2014, with Editorial Revision (2015).

D. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2017.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. See Section 013300 - Submittal Procedures

C. Shop Drawings:
   1. Indicate prefabricated work, component details, stud layout, framed openings, anchorage to structure, acoustic details, type and location of fasteners, accessories, and items of other related work.
   2. Describe method for securing studs to tracks, splicing, and for blocking and reinforcement of framing connections.

D. Product Data: Provide data describing framing member materials and finish, product criteria, load charts, and limitations.

E. Product Data: Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.

F. Sustainable Design Submittal: Documentation of recycled content and location of manufacture.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the work of this section with minimum five years documented experience and approved by manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Metal Framing, Connectors, and Accessories:
   1. CEMCO: www.cemcosteel.com/#sle.
   2. ClarkDietrich: www.clarkdietrich.com/#sle.
   3. Jaimes Industries: www.jaimesind.com/#sle.
   4. Marino: www.marinoware.com/#sle.
   5. R-stud, LLC: www.rstud.com/#sle.
   6. SCAFCO Corporation: www.scafco.com/#sle.
   7. Simpson Strong Tie: www.strongtie.com/#sle.
   8. Steel Construction Systems: www.steelconsystems.com/#sle.
   9. The Steel Network, Inc: www.SteelNetwork.com/#sle.
   10. Substitutions: See Section 016000 - Product Requirements.

2.02 FRAMING MATERIALS

A. Non-Loadbearing 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/240 at 5 psf (L/240 at 240 Pa).
   1. Studs: C shaped with knurled or embossed faces.
   2. Runners: U shaped, sized to match studs.

B. 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, with G60/Z180 hot dipped galvanized coating.

C. Non-Loadbearing Framing Accessories:
   1. Ceiling Hangers: Type and size as specified in ASTM C754 for spacing required.
   2. Framing Connectors: ASTM A653/A653M G90 galvanized steel clips; secures cold rolled channel to wall studs for lateral bracing.
      a. Products:
         1) ClarkDietrich; FastBridge Clip (FB33): www.clarkdietrich.com/#sle.
         2) Substitutions: See Section 016000 - Product Requirements.

2.03 FABRICATION

A. Fabricate assemblies of framed sections to sizes and profiles required.

B. Fit, reinforce, and brace framing members to suit design requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that rough-in utilities are in proper location.

3.02 INSTALLATION OF STUD FRAMING

A. Comply with requirements of ASTM C754.

B. Extend partition framing to structure where indicated and to ceiling in other locations.

C. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer's instructions.

D. 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.

E. Align and secure top and bottom runners at 24 inches (600 mm) on center.

F. Fit runners under and above openings; secure intermediate studs to same spacing as wall studs.

G. Align stud web openings horizontally.

H. Secure studs to tracks using crimping method. Do not weld.

I. Fabricate corners using a minimum of three studs.

J. Double stud at wall openings, door and window jambs, not more than 2 inches (50 mm) from each side of openings.

K. Coordinate installation of bucks, anchors, and blocking with electrical, mechanical, and other work to be placed within or behind stud framing.

L. Furring: Install at spacing and locations shown on drawings. Lap splices a minimum of 6 inches (150 mm).

3.03 CEILING AND SOFFIT FRAMING

A. Install furring after work above ceiling or soffit is complete. Coordinate the location of hangers with other work.

B. Install furring independent of walls, columns, and above-ceiling work.

C. Securely anchor hangers to structural members or embed in structural slab. Space hangers as required to limit deflection to criteria indicated. Use rigid hangers at exterior soffits.

D. Space main carrying channels at maximum 72 inch (1 800 mm) on center, and not more than 6 inches (150 mm) from wall surfaces. Lap splice securely.

E. Securely fix carrying channels to hangers to prevent turning or twisting and to transmit full load to hangers.

F. Place furring channels perpendicular to carrying channels, not more than 2 inches (50 mm) from perimeter walls, and rigidly secure. Lap splices securely.

3.04 TOLERANCES

A. Maximum Variation From True Position: 1/8 inch in 10 feet (3 mm in 3 m).

B. Maximum Variation From Plumb: 1/8 inch in 10 feet (3 mm in 3 m).

END OF SECTION 092216

SECTION 092900
GYPSUM BOARD

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Performance criteria for gypsum board assemblies. At Splash Pad Office/Mech Building.

B. Gypsum wallboard.

C. Joint treatment and accessories.

1.02 RELATED REQUIREMENTS

A. Section 054000 - Cold-Formed Metal Framing: Structural steel stud framing.

B. Section 061000 - Rough Carpentry: Building framing and sheathing.

C. Section 061000 - Rough Carpentry: Wood blocking product and execution requirements.

D. Section 072100 - Thermal Insulation

E. Section 072500 - Weather Barriers: Water-resistive barrier over sheathing.

F. Section 079200 - Joint Sealants: Sealing acoustical gaps in construction other than gypsum board or plaster work.

G. Section 092216 - Non-Structural Metal Framing.

1.03 REFERENCE STANDARDS

A. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2015.

B. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2018a.

C. ASTM C1047 - Standard Specification for Accessories For Gypsum Wallboard and Gypsum Veneer Base; 2014a.

D. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2017.

E. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2016.

F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2017.

G. GA-216 - Application and Finishing of Gypsum Panel Products; 2016.

H. GA-224 - Installation of Predecorated Gypsum Board; Gypsum Association; 2008.

I. GA-600 - Fire Resistance Design Manual; 2015.

J. UL (FRD) - Fire Resistance Directory; current edition.

K. UL (FRD) - Fire Resistance Directory; current edition.

1.04 SUBMITTALS

A. See Section 013300 - 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.

PART 2 PRODUCTS

2.01 GYPSUM BOARD ASSEMBLIES

A. Provide completed assemblies complying with ASTM C840 and GA-216.

B. Interior Partitions: Provide comleted assemblies as noted on Building Assemblies A-601 and Interior Partitions A-602 sheets in the Contract Documents.

C. Fire Rated Assemblies: Provide completed assemblies as noted in Building Assemblies and Interior Partitions sheets in the Contract Drawings.
   1. UL Assembly Numbers: Provide construction equivalent to that listed for the particular assembly in the current UL (FRD).

2.02 METAL FRAMING MATERIALS

A. Non-structural Steel Framing for Application of Gypsum Board: As specified in Section 092216.

B. Structural Steel Framing for Application of Gypsum Board: As specified in Section 054000.

2.03 BOARD MATERIALS

A. Manufacturers - Gypsum-Based Board:
   1. American Gypsum Company: www.americangypsum.com/#sle.
   2. CertainTeed Corporation: www.certainteed.com/#sle.
   3. Continental Building Products: www.continental-bp.com/#sle.
   4. Georgia-Pacific Gypsum: www.gpgypsum.com/#sle.
   5. National Gypsum Company: www.nationalgypsum.com/#sle.
   6. PABCO Gypsum: www.pabcogypsum.com/#sle.
   7. USG Corporation: www.usg.com/#sle.
   8. Substitutions: See Section 016000 - 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. See drawings for location of each type of gypsum product. Typically, Type 'X' at rated walls, and Type 'C' at rated ceilings. See Wall/ Floor/ Roof Assembly and Interior Partition sheets in the Contract Drawings.
   2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
      a. Mold-resistant board is required whenever board is being installed before the building is enclosed and conditioned.
      b. Mold resistant board is required at Splash Pad Mechanical Room #202.
   3. Thickness:
      a. Vertical Surfaces: 5/8 inch (16 mm).
      b. Ceilings: 1/2 inch (13 mm).
      c. Multi-Layer Assemblies: Thicknesses as indicated on drawings.
   4. Paper-Faced Products:
      a. American Gypsum Company; LightRoc Gypsum Wallboard.
      b. American Gypsum Company; FireBloc Type X Gypsum Wallboard.
      c. CertainTeed Corporation; Type X Drywall.
      d. Continental Building Products; Firecheck Type X.
      e. Georgia-Pacific Gypsum; ToughRock.
      f. Georgia-Pacific Gypsum; ToughRock Fireguard X.
      g. National Gypsum Company; Gold Bond BRAND Fire-Shield Gypsum Board.
   5. Mold Resistant Paper Faced Products:
      a. American Gypsum Company; M-Bloc: www.americangypsum.com/#sle.

b. CertainTeed Corporation; M2Tech 5/8" Type X Moisture & Mold Resistant Drywall: www.certainteed.com/#sle.
c. Continental Building Products; Mold Defense: www.continental-bp.com/#sle.
d. Continental Building Products; Mold Defense Type X: www.continental-bp.com/#sle.
e. Georgia-Pacific Gypsum; ToughRock Mold-Guard: www.gpgypsum.com/#sle.
f. Georgia-Pacific Gypsum; ToughRock Fireguard X Mold-Guard: www.gpgypsum.com/#sle.
g. National Gypsum Company; Gold Bond XP Gypsum Board: www.nationalgypsum.com/#sle.

2.04 GYPSUM WALLBOARD ACCESSORIES

A. Sound Isolation Tape: Elastomeric foam tape for sound decoupling.
   1. Surface Burning Characteristics: Provide assemblies with flame spread index of 75 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
   2. Tape Thickness: 1/4 inch (6 mm).

B. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.

C. Beads, Joint Accessories, and Other Trim: ASTM C1047, rigid plastic, galvanized steel, or rolled zinc, unless noted otherwise.
   1. Corner Beads: Low profile, for 90 degree outside corners.

D. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.
   1. Fiberglass Tape: 2 inch (50 mm) wide, coated glass fiber tape for joints and corners, except as otherwise indicated.
   2. Paper Tape: 2 inch (50 mm) wide, creased paper tape for joints and corners, except as otherwise indicated.
   3. Joint Compound: Drying type, vinyl-based, ready-mixed.
   4. Joint Compound: Setting type, field-mixed.

E. Finishing Compound: Surface coat and primer, takes the place of skim coating.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that project conditions are appropriate for work of this section to commence.

3.02 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. Sound Isolation Tape: Apply to vertical studs and top and bottom tracks/runners in accordance with manufacturer's instructions.

C. Acoustic Sealant: Install in accordance with manufacturer's instructions.

3.03 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. Fire-Resistance-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.

D. Exposed Gypsum Board in Interior Wet Areas: Seal joints, cut edges, and holes with water-resistant sealant.

3.04 INSTALLATION OF TRIM AND ACCESSORIES

A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.

B. Corner Beads: Install at external corners, using longest practical lengths.

C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.

3.05 JOINT TREATMENT

A. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
   1. 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 (0.8 mm).

3.06 TOLERANCES

A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet (3 mm in 3 m) in any direction.

END OF SECTION 092900

SECTION 096723
RESINOUS FLOORING

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. ASTM D638 - Standard Test Method for Tensile Properties of Plastics; 2014.

B. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness; 2015.

C. ASTM D2794 - Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact); 1993 (Reapproved 2024).

D. ASTM D4060 - Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser; 2014.

E. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2019a, with Editorial Revision (2020).

F. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2016a.

G. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes; 2019a.

1.02 RELATED DOCUMENTS

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

1.03 SUMMARY

A. This Section includes one resinous flooring system, one with urethane body. Indicated as (TUF-01) on the drawings.
   1. Application Method: Liquid applied with broadcasted aggregates.

1.04 SUBMITTALS

A. Product Data: For each type of product indicated. Include manufacturer's technical data, application instructions, and recommendations for each resinous flooring component required.

B. Samples for Verification: For each resinous flooring system required, 5 inches (127 mm) square, applied to a rigid backing.

C. Product Schedule: Use resinous flooring designations indicated in Part 2 and room designations indicated on Drawings in product schedule.

D. Installer Certificates: Signed by manufacturer certifying that installers comply with specified requirements.

E. Maintenance Data: For resinous flooring to include in maintenance manuals.

1.05 QUALITY ASSURANCE

A. No request for substitution shall be considered that would change the generic type of floor system specified (i.e. urethane, double broadcast quartz based system). Equivalent materials of other manufactures may be substituted only on approval of Architect. Request for substitution will only be considered only if submitted 10 days prior to bid date. Request will be subject to specification requirements described in this section.

B. Installer Qualifications: Engage an experienced installer (applicator) who is experienced in applying resinous flooring systems similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance, and who is acceptable to resinous flooring manufacturer.
   1. Engage an installer who is certified in writing by resinous flooring manufacturer as qualified to apply resinous flooring systems indicated.
   2. Contractor shall have completed at least 10 projects of similar size and complexity.

C. Source Limitations: Obtain primary resinous flooring materials, including primers, resins, hardening agents, grouting coats, and topcoats, through one source from a single manufacturer, with not less than ten years of successful experience in manufacturing and installing principal materials described in this section. Provide secondary materials, including patching and fill material, joint sealant, and repair materials, of type and from source recommended by manufacturer of primary materials.

D. Manufacturer Field Technical Service Representatives: Resinous flooring manufacture shall retain the services of Field Technical Service Representatives who are trained specifically on installing the system to be used on the project.

1. Field Technical Services Representatives shall be employed by the system manufacture to assist in the quality assurance and quality control process of the installation and shall be available to perform field problem solving issues with the installer.

E. Mockups: Apply mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Apply full-thickness mockups on 48-inch- (1200-mm-) square floor area selected by Architect.
      a. Include 48-inch (1200-mm) length of integral cove base.
   2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

F. Pre-installation Conference:
   1. General contractor shall arrange a meeting not less than thirty days prior to starting work.
   2. Attendance:
      a. General Contractor
      b. Architect/Owner's Representative.
      c. Manufacturer/Installer's Representative.

1.06 DELIVERY, STORAGE, AND HANDLING

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

B. Store materials to prevent deterioration from moisture, heat, cold, direct sunlight, or other detrimental effects. Store material per product data sheet.

C. All materials used shall be factory pre-weighed and pre-packaged in single, easy to manage batches to eliminate on site mixing errors. No on site weighing or volumetric measurements allowed.

1.07 PROJECT CONDITIONS

A. Environmental Limitations: Comply with resinous flooring manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting resinous flooring application.
   1. Maintain material and substrate temperature between 65 and 85 degrees Fahrenheit (29.44 degrees Celsius) during resinous flooring application and for not less than 24 hours after application.

B. Lighting: Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during resinous flooring application.

C. Close spaces to traffic during resinous flooring application and for not less than 24 hours after application, unless manufacturer recommends a longer period.

D. Concrete substrate shall be properly cured for a minimum of 30 days. A vapor barrier must be present for concrete subfloors on or below grade. Otherwise, an osmotic pressure resistant grout must be installed prior to the resinous flooring

1.08 WARRANTY

A. Manufacturer shall furnish a single, written warranty covering both material and workmanship for a period of (2) full years from date of installation, or provide a joint and several warranty signed on a single document by material manufacturer and applicator jointly and severally warranting the materials and workmanship for a period of (2) full years from date of installation. A sample warranty letter must be included with bid package or bid may be disqualified.

PART 2 PRODUCTS

2.01 RESINOUS FLOORING

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include,
   1. Must comply with double broadcasting build. Liquid rich, slurry type systems will not be accepted, and will result in a disqualification from bid.

B. Acceptable Manufactures,
   1. Stonhard Basis of design.

C. Products: Subject to compliance with requirements:
   1. Stonhard, Inc.; Stonshield URT®.

D. System Characteristics:
   1. Color and Pattern: Flagstone, Medium Texture.
   2. Wearing Surface: Standard, or medium.
   3. Integral Cove Base: 4" high cove base w/ cove strip.
   4. Overall System Thickness: Nominal 2mm.

E. System Components: Manufacturer's standard components that are compatible with each other and as follows:
   1. Primer:
      a. Material Basis: Stonhard Quik Primer
      b. Resin: Aromatic urethane.
      c. Formulation Description: (2) two component.
      d. Application Method: Squeegee and roller.

e. Number of Coats: (1) one.

2. Broadcast Media:
   a. Material Basis: Stonshield quartz aggregate.
   b. Type: pigmented.
   c. Finish: standard.
   d. Number of Coats: one.
   e. Pattern: Tweed.
3. Undercoat:
   a. Material Basis: Stonshield URT Undercoat.
   b. Resin: Urethane.
   c. Formulation Description: (2) two-component, Solvent free, UV resistant, Aliphatic urethane.
   d. Type: Clear.
   e. Number of Coats: one.
4. Broadcast Media:
   a. Material Basis: Stonshield quartz aggregate
   b. Type: pigmented.
   c. Finish: standard.
   d. Number of Coats: one.
   e. Pattern: Tweed.
5. Sealer:
   a. Material Basis: Stonseal CA7.
   b. Resin: Urethane.
   c. Formulation Description: (2) two-component, Solvent free, UV resistant, Aliphatic urethane.
   d. Type: Clear.
   e. Finish: Gloss.
   f. Number of Coats: one.
   g. Texture level: Standard or medium.

F. System Physical Properties: Provide resinous flooring system with the following minimum physical property requirements when tested according to test methods indicated:
   1. Tensile Strength / Undercoat: 4,800 psi (33094.85 kPa) per ASTM D638.
   2. Tensile Strength / Sealer: 6,000 psi (41368.56 kPa) per ASTM D638.
   3. Hardness: 60 per ASTM D2240, Shore D
   4. Impact Resistance: greater than 160 inch (4064 mm). lbs. per ASTM D2794.
   5. Abrasion Resistance: 0.10 gm max. weight loss per ASTM D4060, CS-17
   6. Thermal Coefficient of Linear Expansion: 1.2 x 10-5 inch (127 mm)/in oF
   7. Cure Rate: 3 to 4 Hours for foot traffic, 12 hours normal operations
   8. Flammability: Class 1 per ASTM E648.
   9. VOC Content:
      a. Quik Primer – 89 g/l
      b. Stonshield URT Undercoat – 22 g/l
      c. Stonseal CA7 – 100 g/l

2.02 ACCESSORY MATERIALS

A. Joint Sealant: Type recommended or produced by resinous flooring manufacturer for type of service and joint condition indicated. Allowances should be included for Stonflex MP7 joint fill material, and CT5 concrete crack treatment.

PART 3 EXECUTION

3.01 PREPARATION

A. General: Prepare and clean substrates according to resinous flooring manufacturer's written instructions for substrate indicated. Provide clean, dry, and neutral Ph substrate for resinous flooring application.

B. Concrete Substrates: Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with resinous flooring.
   1. Mechanically prepare substrates as follows:
      a. Shot-blast surfaces with an apparatus that abrades the concrete surface, contains the dispensed shot within the apparatus, and recirculates the shot by vacuum pickup, or Diamond Grind with a dust free system.
   2. Repair damaged and deteriorated concrete according to resinous flooring manufacturer's written recommendations.
   3. Verify that concrete substrates are dry.
      a. Perform in situ probe test, ASTM F2170. Proceed with application only after substrates do not exceed a maximum potential equilibrium relative humidity of 80 percent.
      b. Perform anhydrous calcium chloride test, ASTM F1869. Proceed with application only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. of slab in 24 hours.
      c. Perform additional moisture tests recommended by manufacturer. Proceed with application only after substrates pass testing.

C. Use patching and fill material to fill holes and depressions in substrates according to manufacturer's written instructions.

D. Treat control joints and other nonmoving substrate cracks to prevent cracks from reflecting through resinous flooring according to manufacturer's written recommendations. Allowances should be included for Stonflex MP7 joint fill material.

3.02 APPLICATION

A. General: Apply components of resinous flooring system according to manufacturer's written instructions to produce a uniform, monolithic wearing surface of thickness indicated.

1. Coordinate application of components to provide optimum adhesion of resinous flooring system to substrate, and optimum intercoat adhesion.
2. Cure resinous flooring components according to manufacturer's written instructions. Prevent contamination during application and curing processes.
3. At substrate expansion and isolation joints, provide joint in resinous flooring to comply with resinous flooring manufacturer's written recommendations.
   a. Apply joint sealant to comply with manufacturer's written recommendations.

B. Integral Cove Base: Stonshield cove mortar, apply cove base mix to wall surfaces before applying flooring. Apply according to manufacturer's written instructions and details including those for taping, mixing, priming, troweling, sanding, of cove base. Round internal and external corners.
   1. Integral Cove Base: 4" inches high.

C. Apply primer where required by resinous system, over prepared substrate at manufacturer's recommended spreading rate.

D. Broadcast: Immediately broadcast quartz silica aggregate into the primer using manufacturer's specially designed spray caster. Strict adherence to manufacturer's installation procedures and coverage rates is imperative.

E. Undercoat: Remove any surface irregularities by lightly abrading and vacuuming the floor surface. Mix and apply undercoat with strict adherence to manufacturer's installation procedures and coverage rates.

F. Broadcast: Immediately broadcast quartz silica aggregate into the undercoat using manufacturer's specially designed spray caster. Strict adherence to manufacturer's installation procedures and coverage rates is imperative.

G. Apply topcoat(s) in number of coats indicated for flooring system and at spreading rates recommended in writing by manufacturer.

3.03 TERMINATIONS

A. Chase edges to “lock” the flooring system into the concrete substrate along lines of termination.

B. Penetration Treatment: Lap and seal resinous system onto the perimeter of the penetrating item by bridging over compatible elastomer at the interface to compensate for possible movement.

C. Trenches: Continue flooring system into trenches to maintain monolithic protection. Treat cold joints to assure bridging of potential cracks.

D. Treat floor drains by chasing the flooring system to lock in place at point of termination.

3.04 JOINTS AND CRACKS

A. Treat control joints to bridge potential cracks and to maintain monolithic protection.

B. Treat cold joints and construction joints cracks and to maintain monolithic protection on horizontal and vertical surfaces as well as horizontal and vertical interfaces.

C. Vertical and horizontal contraction and expansion joints are treated by installing backer rod and compatible sealant after coating installation is completed. Provide sealant type recommended by manufacturer for traffic conditions and chemical exposures to be encountered.

3.05 FIELD QUALITY CONTROL

A. Material Sampling: Owner may at any time and any numbers of times during resinous flooring application require material samples for testing for compliance with requirements.
   1. Contractor will engage an independent testing agency to take samples of materials being used. Material samples will be taken, identified, sealed, and certified in presence of Contractor.
   2. Testing agency will test samples for compliance with requirements, using applicable referenced testing procedures or, if not referenced, using testing procedures listed in manufacturer's product data.
   3. If test results show applied materials do not comply with specified requirements, pay for testing, remove noncomplying materials, prepare surfaces coated with unacceptable materials, and reapply flooring materials to comply with requirements.

3.06 CLEANING, PROTECTING, AND CURING

A. Cure resinous flooring materials in compliance with manufacturer's directions, taking care to prevent contamination during stages of application and prior to completion of curing process. Close area of application for a minimum of 24 hours.

B. Protect resinous flooring materials from damage and wear during construction operation. Where temporary covering is required for this purpose, comply with manufacturer's recommendations for protective materials and method of application. General Contractor is responsible for protection and cleaning of surfaces after final coats.

C. Cleaning: Remove temporary covering and clean resinous flooring just prior to final inspection. Use cleaning materials and procedures recommended by resinous flooring manufacturer. General contractor is responsible for cleaning prior to inspection.

END OF SECTION 096723

SECTION 099113
EXTERIOR PAINTING

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 surface preparation and the application of paint systems on the following exterior substrates:
   1. Galvanized metal.
   2. Cementious compostion board or (TRM-01).

B. Related Sections include the following:
   1. Division 08 Sections for factory priming windows and doors with primers specified in this Section.
   2. Division 09 Section 09 91 23 - Interior Painting for surface preparation and the application of paint systems on interior substrates.

1.03 SUBMITTALS

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

B. Samples for Verification: For each type of paint system and each color and gloss of topcoat indicated.
   1. Submit Samples on rigid backing, 8 inches (200 mm) square.
   2. Step coats on Samples to show each coat required for system.
   3. Label each coat of each Sample.
   4. Label each Sample for location and application area.

C. Product List: For each product indicated, include the following:
   1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
   2. Printout of current "MPI Approved Products List" for each product category specified in Part 2, with the proposed product highlighted.
   3. Certification: By manufacturer that paints and finishes

1.04 QUALITY ASSURANCE

A. MPI Standards:
   1. Products: Complying with MPI standards indicated and listed in "MPI Approved Products List."
   2. Preparation and Workmanship: Comply with requirements in "MPI Architectural Painting Specification Manual" for products and paint systems indicated.

B. Mockups: Apply benchmark samples of each paint system indicated and each color and finish selected to verify preliminary selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Final approval of color selections will be based on benchmark samples.
      a. If preliminary color selections are not approved, apply additional benchmark samples of additional colors selected by Architect at no added cost to Owner.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).
   1. Maintain containers in clean condition, free of foreign materials and residue.
   2. Remove rags and waste from storage areas daily.

1.06 PROJECT CONDITIONS

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

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

1.07 EXTRA MATERIALS

A. Furnish extra materials described below that are from same production run (batch mix) as materials applied and that are packaged for storage and identified with labels describing contents.
   1. Quantity: Furnish an additional 5 percent, but not less than 1 gal. (3.8 L) of each material and color applied.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Basis of design - Subject to compliance with requirements, provide products by:
   1. Sherwin-Williams Company (The)

B. Additional manufacturers that may be submitted include the following, subject to exact matching of architects selected colors, and accepted substitution in accordance with Section 01 25 00 - Substitution Procedures:
   1. Anchor Paint.
   2. BASF Corp. - Building Systems.
   3. Cloverdale Paint.
   4. Columbia Paint & Coatings, Inc.
   5. Comex Paints (Comex Group).
   6. Conco Paints.
   7. Convenience Products.
   8. Davis Paint Company.
   9. Diamond Vogel Paints.
   10. Dunn-Edwards Corporation.
   11. Durant Performance Coatings.
   12. Duron, Inc.
   13. Envirocoatings Inc.
   14. Euclid Chemical Company.
   15. Farrell-Calhoun Paint.
   16. Hallman/Lindsay Paints.
   17. Hirshfield's, Inc.
   18. H-I-S Paint.
   19. Intrepid Coatings.
   20. Kelly-Moore Paint Company, Inc.
   21. Lanco & Harris Corp.
   22. M.A.B. Paints.
   23. Masterchem Industries.
   24. McCormick Paints.
   25. Micca Paint, Inc.
   26. Miller Paint Company.
   27. Monopole Inc.
   28. PARA Paints.
   29. PPG Architectural Finishes, Inc.
   30. Pratt & Lambert Paints.
   31. Richard's Paint Manufacturing.
   32. Rodda Paint Company.
   33. Rust-Oleum Corporation.
   34. SaverSystems.

35. Sherwin-Williams Company (The).
36. Sun Paints & Coatings.
37. Textured Coatings of America, Inc.
38. Tnemec Company, Inc.
39. United Gilsonite Laboratories.
40. Vista Paint Corporation.

2.02 PAINT, GENERAL

A. Material Compatibility:
   1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
   2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

B. Colors: As indicated in a color schedule. See A-604.

2.03 EXTERIOR LATEX PAINTS

A. Exterior Latex (Semigloss): MPI #11 (Gloss Level 5).

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
   1. Concrete: 12 percent.
   2. Masonry (Clay and CMU): 12 percent.
   3. Wood: 15 percent.
   4. Plaster: 12 percent.
   5. Gypsum Board: 12 percent.

C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

D. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.

3.02 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.

B. Remove plates, machined surfaces, and similar items already in place that are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
   1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
   2. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

C. Clean substrates of substances that could impair bond of paints, including dirt, oil, grease, and incompatible paints and encapsulants.
   1. Remove incompatible primers and reprime substrate with compatible primers as required to produce paint systems indicated.

D. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

3.03 APPLICATION

A. Apply paints according to manufacturer's written instructions.
   1. Use applicators and techniques suited for paint and substrate indicated.
   2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.

B. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

C. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

3.04 FIELD QUALITY CONTROL

A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure at any time and as often as Owner deems necessary during the period when paints are being applied:
   1. Owner will engage the services of a qualified testing agency to sample paint materials being used. Samples of material delivered to Project site will be taken, identified, sealed, and certified in presence of Contractor.

2. Testing agency will perform tests for compliance of paint materials with product requirements.
3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying-paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

3.05 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.06 EXTERIOR PAINTING SCHEDULE

A. Cementitious Composition Board or TRM-01 Substrates:
   1. Latex System: MPI EXT 3.3A.
      a. Prime Coat: Factory Primed.
      b. Intermediate Coat: Exterior latex matching topcoat.
      c. Topcoat: Exterior Latex (semi-gloss).

B. Galvanized-Metal Substrates:
   1. High Performance Coating @ Exposed Steel
      a. See basis of design specialty system listed under Note #2 on Finish Schedule A-604.
   2. Odorless, Alkyd Enamel System @ HM Doors and Frames
      a. See basis of design specialty system listed under Note #3 on Finish Schedule A-604.

END OF SECTION 099113

SECTION 099123
INTERIOR PAINTING

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 surface preparation and the application of paint systems on the following interior substrates:
   1. Steel.
   2. Wood.
   3. Gypsum board.

B. Related Sections include the following:
   1. Division 08 Sections for factory priming windows and doors with primers specified in this Section.
   2. Division 09 Section 09 91 13 - Exterior Painting for surface preparation and the application of paint systems on exterior substrates.

1.03 SUBMITTALS

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

B. Samples for Verification: For each type of paint system and in each color and gloss of topcoat indicated.
   1. Submit Samples on rigid backing, 8 inches (200 mm) square.
   2. Step coats on Samples to show each coat required for system.
   3. Label each coat of each Sample.
   4. Label each Sample for location and application area.

C. Product List: For each product indicated, include the following:
   1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
   2. Printout of current "MPI Approved Products List" for each product category specified in Part 2, with the proposed product highlighted.

1.04 QUALITY ASSURANCE

A. MPI Standards:
   1. Products: Complying with MPI standards indicated and listed in "MPI Approved Products List."
   2. Preparation and Workmanship: Comply with requirements in "MPI Architectural Painting Specification Manual" for products and paint systems indicated.

B. Mockups: Apply benchmark samples of each paint system indicated and each color and finish selected to verify preliminary selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Architect will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.
      a. Wall and Ceiling Surfaces: Provide samples of at least 100 sq. ft. (9 sq. m).
      b. Other Items: Architect will designate items or areas required.
   2. Apply benchmark samples after permanent lighting and other environmental services have been activated.
   3. Final approval of color selections will be based on benchmark samples.
      a. If preliminary color selections are not approved, apply additional benchmark samples of additional colors selected by Architect at no added cost to Owner.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).
   1. Maintain containers in clean condition, free of foreign materials and residue.
   2. Remove rags and waste from storage areas daily.

1.06 PROJECT CONDITIONS

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

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

1.07 EXTRA MATERIALS

A. Furnish extra materials described below that are from same production run (batch mix) as materials applied and that are packaged for storage and identified with labels describing contents.
   1. Quantity: Furnish an additional 5 percent, but not less than 2 gal. (7.6 L) each material and color applied.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Basis of design - Subject to compliance with requirements, provide products by:
   1. Sherwin-Williams Company (The)

B. Additional manufacturers that may be submitted include the following, subject to exact matching of architects selected colors, and accepted substitution in accordance with Section 01 25 00 - Substitution Procedures:
   1. Anchor Paint.
   2. BASF Corp. - Building Systems.
   3. Benjamin Moore
   4. Cloverdale Paint.
   5. Columbia Paint & Coatings, Inc.
   6. Comex Paints (Comex Group).
   7. Conco Paints.
   8. Convenience Products.
   9. Davis-Frost, Inc.
   10. Diamond Vogel Paints.
   11. Dunn-Edwards Corporation.
   12. Durant Performance Coatings.
   13. Duron, Inc.
   14. Euclid Chemical Company.
   15. Ferrell-Calhoun Paint.
   16. Hallman Lindsay Paints.
   17. Hirshfield's, Inc.
   18. H-I-S Paint.
   19. Intrepid Coatings.
   20. Kelly-Moore Paint Company, Inc.
   21. Lanco & Harris Group.
   22. M.A.B. Paints.
   23. Masterchem Industries.
   24. McCormick Paints.
   25. Micca Paint, Inc.
   26. Miller Paint Company.
   27. Mobile Paint.
   28. Modern Masters, Inc.
   29. Monopole Inc.
   30. O'Leary Paint.
   31. PARA Paints.
   32. PPG Architectural Finishes, Inc.
   33. Pratt & Lambert Paints.
   34. Richard's Paint Manufacturing.

35. Rodda Paint Company.
36. Rust-Oleum Corporation.
37. SaverSystems.
38. Sherwin-Williams Company (The).
39. Sun Paints & Coatings.
40. Textured Coatings of America, Inc.
41. Tnemec Company, Inc.
42. Vista Paint Corporation.

2.02 PAINT, GENERAL

A. Material Compatibility:
   1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
   2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

B. Colors: As selected by Architect from manufacturer's full range or as indicated in a color schedule.

2.03 PRIMERS/SEALERS

A. Interior Latex Primer/Sealer: MPI #50.

2.04 WOOD PRIMERS

A. Interior Latex-Based Wood Primer: MPI #39.

2.05 LATEX PAINTS

A. Interior Latex (Eggshell): MPI #52 (Gloss Level 3).

B. Interior Latex (Semigloss): MPI #54 (Gloss Level 5).

C. High-Performance Architectural Latex (Semigloss): MPI #141 (Gloss Level 5).

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
   1. Wood: 15 percent.
   2. Gypsum Board: 12 percent.
   3. Plaster: 12 percent.

C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

D. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.
   1. Beginning coating application constitutes Contractor's acceptance of substrates and conditions.

3.02 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.

B. Remove plates, machined surfaces, and similar items already in place that are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
   1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
   2. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

C. Clean substrates of substances that could impair bond of paints, including dirt, oil, grease, and incompatible paints and encapsulants.
   1. Remove incompatible primers and reprime substrate with compatible primers as required to produce paint systems indicated.

D. Wood Substrates:
   1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
   2. Sand surfaces that will be exposed to view, and dust off.
   3. Prime edges, ends, faces, undersides, and backsides of wood.

4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

E. Gypsum Board Substrates: Do not begin paint application until finishing compound is dry and sanded smooth.

3.03 APPLICATION

A. Apply paints according to manufacturer's written instructions.
   1. Use applicators and techniques suited for paint and substrate indicated.
   2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
   3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.

B. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

C. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

D. Painting Mechanical and Electrical Work: Paint items exposed in equipment rooms and occupied spaces including, but not limited to, the following:
   1. Mechanical Work:
      a. Uninsulated metal piping.
      b. Uninsulated plastic piping.
      c. Pipe hangers and supports.
      d. Tanks that do not have factory-applied final finishes.
      e. Visible portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets.
      f. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
      g. Mechanical equipment that is indicated to have a factory-primed finish for field painting.
   2. Electrical Work:
      a. Electrical equipment that is indicated to have a factory-primed finish for field painting.

3.04 FIELD QUALITY CONTROL

A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure at any time and as often as Owner deems necessary during the period when paints are being applied:

1. Owner will engage the services of a qualified testing agency to sample paint materials being used. Samples of material delivered to Project site will be taken, identified, sealed, and certified in presence of Contractor.
2. Testing agency will perform tests for compliance with product requirements.
3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying-paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

3.05 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.06 INTERIOR PAINTING SCHEDULE

A. Steel Substrates:
   1. High-Performance Architectural Latex System: MPI INT 5.1R. (Factory Primed Interior HM Doors & Frames)
      a. Intermediate Coat: High-performance architectural latex matching topcoat.
      b. Topcoat: High-performance architectural latex (semigloss).

B. Dressed Lumber Substrates: Including wood trim at windows.
   1. Latex System: MPI INT 6.3T.
      a. Prime Coat: Interior latex-based wood primer.
      b. Intermediate Coat: Interior latex matching topcoat.
      c. Topcoat: Interior latex (semigloss).

C. Gypsum Board Substrates:
   1. Latex System: MPI INT 9.2A. (Walls)
      a. Prime Coat: Interior latex primer/sealer.
      b. Intermediate Coat: Interior latex matching topcoat.

c. Topcoat: Interior latex (eggshell).

END OF SECTION 099123

SECTION 104400
FIRE PROTECTION SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fire extinguishers.

B. Fire extinguisher cabinets.

C. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 061000 - Rough Carpentry: Wood blocking product and execution requirements.

1.03 REFERENCE STANDARDS

A. NFPA 10 - Standard for Portable Fire Extinguishers; 2017, with Errata (2018).

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide extinguisher operational features, extinguisher ratings and classifications, color and finish, anchorage details, and installation instructions.

C. Shop Drawings: Indicate locations of cabinets, cabinet physical dimensions, installation procedures, and accessories required for complete installation.

D. Manufacturer's Installation Instructions: Indicate special criteria and wall opening coordination requirements.

E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

F. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.

1.05 FIELD CONDITIONS

A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fire Extinguishers:
   1. JL Industries.
   2. Larsen's Manufacturing Co
   3. Substitutions: See Section 016000 - Product Requirements.

B. Fire Extinguisher Cabinets and Accessories:
   1. JL Industries.
   2. Larsen's Manufacturing Co: www.larsensmfg.com/#sle.
   3. Substitutions: See Section 016000 - Product Requirements.

C. Provide same source products.

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. Size: 10 pound (4.54 kg).
   3. Finish: Baked polyester powder coat, color as selected.
   4. Temperature range: Minus 40 degrees F (Minus 40 degrees C) to 120 degrees F (49 degrees C).

2.03 FIRE EXTINGUISHER CABINETS

A. Cabinet Construction: Non-fire rated.
   1. Formed stainless steel sheet; 0.036 inch (0.9 mm) thick base metal.

B. Cabinet Configuration: Recessed type.
   1. Size to accommodate accessories.

C. Door: 0.036 inch (0.9 mm) metal thickness, reinforced for flatness and rigidity with nylon catch. Hinge doors for 180 degree opening with two butt hinges.

D. Door Glazing: Tempered glass, clear, 1/8 inch (3 mm) thick, and set in resilient channel glazing gasket. Provide full panel glazed door.

E. Cabinet Mounting Hardware: Appropriate to cabinet, with pre-drilled holes for placement of anchors.

F. Fabrication: Weld, fill, and grind components smooth.

G. Finish of Cabinet Exterior Trim and Door: No.4 - Brushed stainless steel.

H. Finish of Cabinet Interior: White colored enamel.

I. Basis of Design: Larsen #2409-R2 Architetural Series.

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. Install cabinets plumb and level in wall openings, 54 inches (1371.6 mm) from finished floor totop of cabinet.

C. Secure rigidly in place.

D. Place extinguishers and accessories in cabinets.

E. Position cabinet signage at locations in accordance with AHJ.

3.03 MAINTENANCE

A. Provide a separate maintenance contract for specified maintenance service.

3.04 MAINTENANCE - SELF-SERVICE FIRE EXTINGUISHERS

A. Monthly Inspections: Inspect self-service fire extinguishers on monthly basis in accordance with manufacturer's instructions, and requirements of the authorities having jurisdiction (AHJ).

B. Annual Inspections: Inspect self-service fire extinguishers on annual basis in accordance with manufacturer's instructions, and requirements of the authorities having jurisdiction (AHJ).

C. Inspection Certification Tag: Provide new tag indicating acceptable condition of fire extinguisher, date of inspection, and name of self-service inspector for each inspection.

END OF SECTION 104400

SECTION 131000

WATER FEATURE PERFORMANCE STANDARD

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes the minimum Performance and Design Requirements for a splash pad. These requirements include the following:

1. Acceptable Flow Rates and Pipe Velocities
2. Required Turnover Rates
3. Acceptable Filter Flow Rates
4. Design Requirements for Gutters
5. Lighting and Grounding Requirements
6. Minimum Reinforcing Requirements and Water/Cement Ratios
7. Design Requirements for Sloping the ~~Pool~~ Floor & Walls
8. Minimum Requirements for Balance Tanks
9. Minimum Chemical Dosing Requirements
10. Minimum Shop Drawing Submittal Requirements

B. This document does not include specifications for equipment and materials. Refer to “Related Sections” for specific equipment and material requirements.

C. Related Sections:

1. SECTION 13 1401 – WATER FEATURE PIPE AND FITTINGS
2. SECTION 13 1502 – WATER FEATURE PUMPS AND MOTORS
3. SECTION 13 1503 – WATER FEATURE FILTERS
4. SECTION 13 1504 – WATER FEATURE CHEMICAL FEED SYSTEMS
5. SECTION 13 1505 – WATER FEATURE OZONE GENERATION AND INJECTION
6. SECTION 13 1507 – WATER FEATURE HEATERS
7. SECTION 13 1511 – WATER FEATURE VALVES, GAUGES, AND METERS
8. SECTION 13 1601 – WATER FEATURE GENERAL ELECTRICAL REQUIREMENTS
9. SECTION 13 1602 – WATER FEATURE CONTROLS
10. SECTION 13 1604 – WATER FEATURE FIELD INSTRUMENTS, SWITCHES, AND ALARMS
11. SECTION 13 1605 – WATER FEATURE CONTROL PANELS
12. SECTION 13 1606 – WATER FEATURE INSTRUMENT POWER SYSTEMS
13. SECTION 13 1609 – WATER FEATURE DISCONNECTS, MCC, AND STARTERS
14. SECTION 13 1610 – WATER FEATURE ELECTRICAL ACCESSORIES
15. SECTION 13 1611 – WATER FEATURE GROUNDING

1.2 REFERENCES

A. Applicable Standards: The following standards are referenced herein.

1. PVC Pipe Institute
2. Uniform Swimming Pool, Spa, & Hot Tub Code
3. ANSI/NSF International Standard 50 – Circulation System Components and Related Materials for Swimming Pool, Spas/Hot Tubs
4. NFPA 70 – National Electrical Code (NEC)
5. ASME/APSP-16 – a.k.a. the Virginia Graeme Baker Pool and Spa Safety Act
6. 2010 ADA Standards for Accessible Design

1.3 DEFINITIONS

A. Balance Tank: A reservoir, open to the atmosphere, from which the recirculation pump takes suction, which receives the gravity flow from the main drain and surface overflow system

B. Makeup Water: Replacement water removed from the splash pad by bather drag out, splashing, evaporation, and filter backwash

C. NTU: Nephelometric Turbidity Unit which is a means of measuring water clarity

D. Perimeter Overflow Gutter: A level trough or ledge around the inside perimeter of the splash pad wet deck containing drains to collect the water on the splash pad surface

E. Water feature Turnover: The circulation of the entire water volume through the filter system

F. Recirculation System: The system of piping and mechanical equipment designed to remove the water from the splash pad filter, disinfect, and return it to the water feature

G. Water Quality: The bacteriological and chemical analysis of the splash pad water that meets the minimum potable water standards as established by the United States Environmental Protection Agency

H. Wet Deck Area: The area of the splash pad that will get wet and will contain and collect the filtered water and return it to the recirculation system

1.4 SUBMITTALS

A. SECTION 01 3300 – SUBMITTAL PROCEDURES

B. Submit Shop Drawings indicating layout and piping plans for the splash pad. Drawings to be accurate and precise showing all pertinent information as indicated in this specification. Drawings to be signed and sealed by a professional engineer having an active license within the jurisdiction of the project.

C. Submit Mechanical Shop Drawings indicating mechanical equipment layout and equipment room piping. A process diagram indicating the treatment and circulation of all water features shall also be submitted as a shop drawing. All drawings to be accurately drawn including all mechanical equipment shown at actual size and dimensions

D. Submit Electrical Shop Drawings indicating power loads, one-line diagrams, and controls for all mechanical equipment

E. Submit Shop Drawing details showing the construction of all edges, inlets drains, skimmers, handrails, grounding, lights, methods of waterproofing, finishes, etc.

1.5 WARRANTY

A. Contractors Warranty: Contractor shall warrant the feature against defects caused by faulty workmanship or materials for a minimum period of two (2) years from Date of Substantial Completion. The warranty will cover all surfaces, sub-surfaces, equipment, piping, valves, etc. and will bind the contractor to repair, at his expense, all defects.

1.6 SYSTEM DESCRIPTION

A. Splash pad systems include the pad, nozzles, controls, piping, mechanical and electrical equipment necessary to hold, circulate, filter, and treat the water to provide a safe aesthetic environment for bathers and guests to interact with the water element.

1.7 DESIGN REQUIREMENTS

A. Pool Recirculation Systems:

1. Water feature recirculation systems shall be designed to continuously operate 24 hours a day 7 days per week
2. All pipes associated with the water feature shall be sized appropriately to maintain the following pipe velocities

    a. Gravity Line: 2.0 to 2.5 ft/s (0.6 to 0.8 m/s)
    b. Direct Suction Line: 2.5 to 3.0 ft/s (0.8 to 1.0 m/s)
    c. Pressurized Discharge Pipe: maximum 5.0 ft/s (1.5 m/s)

B. Water Level Control:

1. Automatic Water Makeup System shall be incorporated with each water feature such that water level is constantly maintained at an elevation suitable for continuous flow through the balance tank regardless of use.
2. Balance tank water level shall be controlled by an automated level controller. Water will be returned to the balance tank from the water feature through the gutter. Gutters shall be constructed so the lip is level within 1/4 inch (6mm) between the highest and lowest point along the entire perimeter of the gutter.

C. Water Treatment System:

1. Children’s pools and splash pads shall be designed with a 30 minute turnover rate. See drawings for specific design.
2. The circulation system shall be designed so 100% of the filtered flow rate can be circulated through the gutter. Perimeter gutter shall be installed around the entire water feature
3. All gutters shall discharge by gravity into a balance tank
4. Water Treatment Pumps shall be installed so the inlet is a minimum 24 inches (0.6m) below the surface of the water feature. Basket strainers shall be installed on the suction side of each treatment pump
5. Treatment Pumps shall be designed to circulate the design volume of filtered water when the filter is in a dirty condition. The engineer shall calculate the hydraulic losses of the system and size the pump for the appropriate total head
6. Filters shall be sized to handle the required circulation flow rate at the following allowable filtration rates:

a. High Rate Sand Filters: 15 gpm/sq. ft (36 cu. m/hr per sq. m) of filter surface area maximum

D. Meters and Instrumentation

1. A flow meter or flow indicator shall be installed on the return line for the water feature
2. Pressure gauges shall be installed such that discharge pressure from each pump and filter pressures may be easily read
3. Temperature indicators shall be installed to read water feature water temperature (upstream of any heating equipment) and the water temperature returning to the balance tank (ADD/ALTERNATE)

E. Water Quality Control, Sanitation, Oxidation, and pH

1. Ozone generation and injection shall be utilized for its superior sanitation and oxidation performance. Ozone is sized based on the anticipated bather load and total water volume to be treated. Ozone shall be controlled by ORP, separately from the chemical residual ORP
2. Residual Sanitizer (Chlorine) and pH (Acid) adjustment shall be accomplished by the use of a Chemical Controller and Automatic Feeder System for each water feature.

F. Water Feature System Automation

1. An automation system shall be incorporated into each mechanical room to monitor system performance and allow operations to control nozzle functions, and know when to address other need such as filter backwash, chemical dosing, water level, safety interlocks, and water temperature
2. The automation system shall monitor water chemistry parameters and temperature history for each water feature and log these for facility records and reporting to the local health department or ministry as required

G. Pool Shell Construction:

1. Water feature shells shall be constructed of concrete or shotcrete and shall be watertight, free from structural cracks, and shall have a nontoxic smooth and slip resistant finish
2. All water feature shells shall be constructed of a concrete/shotcrete mixture having a water/cement ratio of 0.40 and 28-day compressive strength of 5,000 psi (34.5 MPa)
3. Water feature shells shall be steel reinforced according to the American Concrete Institute (ACI) guidelines for watertight concrete structures – ACI-350
4. Corner intersections of walls that protrude or angle into the pool water area shall be rounded with a minimum radius of 2 inches (50mm)

H. Pool Finishes and Markings:

1. Finishes

I. Special Design Requirements for Spa Pools and Hot Tubs

1. Spa pool bather load shall not exceed one (1) person per 10 sq. ft (1.0 sq. m) of spa surface area

PART 2 - PRODUCTS – Not Used

2.1 SUBSTITUTIONS

A. Substitutions of equipment make and models are only allowed if the substituted equipment conforms to the specifications and is mentioned as an approved manufacturer therein. See “Related Sections” in the summary of this specification for reference to equipment specifications.

PART 3 - EXECUTION

3.1 OPERATION

A. Manual testing of the water feature water shall be performed on a daily basis immediately after water is placed in the water feature the first time. During this time, it is important to maintain a balanced water condition to prevent damage to the water feature shell, finishes, and equipment

B. Daily records shall be kept regarding water feature operation, water quality, testing chemical injection, and balanced water chemistry

C. The Contractor is responsible for maintaining balanced water feature water and keeping daily records until the system is formally turned over to the owner. Once the system is formally turned over, the owner is responsible for maintaining balanced water and keeping daily records

3.2 DESIGNATION / LABELING

A. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer

B. Install tags with corrosion resistant chain

3.3 CONTROLS PROGRAMMING

A. Functional Requirements

1. Controls provide all functions described herein for each individual water feature. Water Feature Controller (WFC) includes controlling and monitoring of pumps, water filtration, and chemical feed
2. The Contractor shall refer to the Water Treatment Drawings to determine which pumps, filter controller, and chemical controller are associated with a feature. The system addressed in this specification include:

B. Pump Control

1. All pumps include integrated program controls as well as external control connections. The pump keypad includes a manual start/stop button and other display buttons. The pump can be programmed for external control only and will light up the “External Control Only” LED. Manual controls can be programmed through the pump keypad. External controls will be controlled by the water feature controller. Pump control can be based on a specific speed or a specific flow. A flow meter is required to set the pump to a specific flow. Pump interlocks will be controlled by the controller interlock box next to the controller. In no case shall the pump operate in over-ride of safety interlocks

a. Each pump will have a Vacuum Limit Switch (VLS) that will be preset on site during construction to meet each pump's vacuum limit when the suction is restricted. When the VLS is activated the controller will shut down the associated pump and send a fault signal to the Human Machine Interface (HMI)

2. All feature pumps not associated with water treatment shall also have an operator adjustable timer through the spray controller to control hours of operation as set by the operator through the HMI.

C. Water Filtration System Control

1. Monitor and control the Water Treatment Pumps
2. Operation:

a. General:

i. The operator shall initiate filter backwash sequence

b. Backwash Sequencing – Sand Filters:

i. Step 1 – Operator monitors treatment pump operation and shuts down treatment pump(s) when backwash is initiated.
ii. Step 2 – Operator repositions each of the necessary backwash control valves to allow filter water to flow backwards through the filter at the required flow rate to the waste piping or drain
iii. Step 3 – After the valve is repositioned, the operator restarts the treatment pump(s)
iv. Step 4 – The backwash priority valve shall remain in its restricting position until all of the filter tanks in a give grouping have been backwashed
v. Step 5 – When one tank in a filter grouping has been backwashed for a predetermined time period the operator stops the treatment pump(s) and repositions that tank's backwash valves to normal operating position and the next tank's backwash valves are set to backwash position
vi. Step 6 – After the valves have been positioned, treatment pump(s) are restarted. This cycle continues until each of the filter tanks in a giving grouping have been backwashed
vii. Step 7 – When all filters in a given grouping have been backwashed the operator shall stop the treatment pump(s), return the backwash priority valve to full OPEN position, confirm all valves are in normal operating position and restart the treatment pump(s)

D. Chemical System

1. Function: To monitor and control the water pH and ORP of the closed loop water systems
2. Operation:

a. The chemical controller shall sample and monitor the chemical properties of the system water. The controller shall control the feed pumps to dose liquid chlorine and acid via switching relays in the controller

b. The controller shall monitor treatment pump(s) operation for the system and shall inhibit any chemical injection unless the treatment pump(s) is ON

E. Heater Control – ADD/ALTERANTE

1. Function: In addition to normal thermostat control built into the pool heater the controller shall monitor the temperature of water leaving the mechanical room and insure that the temperature is never more than 104 °F (40 °C)
2. Operation:

a. The temperature probe shall monitor the temperature of the water going out of the mechanical room and back to the water feature. If the temperature of the water ever exceeds 104 °F (40 °C), the PLC will de-energize the pool heater

3. The maximum temperature set point shall be adjustable on the HMI

F. System Alarms and Shutdown Trips

1. Mechanical Room High Water Trip

a. Function: To monitor high water levels on the mechanical room floor and shutdown electrical power
b. Alarm Notification on the door of the Control Panel
c. Operation:

i. The switch shall be installed near the floor as shown in the contract documents
ii. Should the water level switch actuate, the main breaker shall trip de-energizing all water feature equipment within the equipment room
iii. Resetting the alarm shall occur when the main circuit breaker is reset

G. Pump Restart Time Delay

1. Function: To delay restarting all motors and allow a staggered starting after Utility Power Failure
2. Operation:

a. When the Control Panel is energized, several timing delay relays shall begin timing, each relay shall be set for a five (5) minute cascaded delay
b. The relays shall reset on loss of power at the Control Panel

END OF SECTION 131000

SECTION 131001

WATER FEATURE GENERAL

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes the following:

1. Scope of Work
2. Contracts
3. Access to Site
4. Protection of Existing Utilities and Structures
5. Drawings and Specifications
6. Restrictions to the Work

1.2 SCOPE OF WORK

A. Work to be performed under the Agreement consists of furnishing and installing all materials, equipment systems, and labor required to complete the Work as required by the Contract.

B. Perform the Work in accordance with the codes, ordinances, and amendments in effect in the location of the Project.

1.3 CONTRACTS

A. Perform the Work per the Agreement to be executed between the Owner and the Contractor.

1.4 ACCESS TO SITE

A. During the construction period, the Contractor shall have limited use of the premises for construction operations, including use of the Site. Coordinate site limitations with the Owner.

B. Notify the Owner and county agencies, as applicable, a minimum of 48 hours in advance of performing work that necessitates closing or interfering with traffic on public thoroughfares, parking areas, and driveways, or with normal facility operations. Obtain written permission prior to affecting such.

1.5 PROTECTION OF EXISTING UTILITIES AND STRUCTURES

A. The Contractor shall verify the location of all existing utilities including cables, conduits, pipes, water lines, gas lines, etc.

B. The Contractor shall take the proper precautions to avoid damage to such components.

C. In the event of a conflict or discrepancy, the Contractor shall promptly notify the Owner and Engineer and request for necessary relocation.

D. Failure to follow this procedure, places upon the Contractor the responsibility of making repairs or replace such damage at his own expense.

E. The Contractor shall provide necessary safeguards and exercise caution against damage to existing and new structures, structural components, and finishes. The Contractor shall be responsible for any damages resulting from his operations and shall repair or replace such damage at his own expense.

1.6 DRAWINGS AND SPECIFICATIONS

A. The Contractor is responsible for coordinating all phases of the Work contained within the Contract Documents (W-Series and WE-Series Drawings) with other construction trades and Contract Documents including but not limited to Civil, Structural, Mechanical, Electrical, Plumbing, Architectural, and Landscape trade work.

B. The Contractor is responsible for coordinating the installation and purchase of all the electrical components, including electrical devices, power panels, control panels, motor control centers, etc. as indicated on the Water Feature Electrical (WE-Series) Drawings for the complete operation of the systems.

C. The Contractor shall notify the Engineer / Architect of any discrepancies, omissions, or conflicts between various elements of the Contract Documents prior to proceeding with any Work involved in the discrepancies, omissions, or conflicts. Generally, the most stringent requirements shall govern the Work.

1.7 RESTRICTIONS TO THE WORK

A. It is required that existing facilities and utilities continue in normal operation during the period of this Agreement.

B. Conduct the Work with a minimum disturbance or interference, and in such a manner as to not restrict or obstruct entrances, exits, passageways, utility services, or material/supply delivery and pick-up for facility operation.

PART 2 - PRODUCTS

2.1 NOT USED

PART 3 - EXECUTION

3.1 NOT USED

END OF SECTION 131001

SECTION 131202

WATER FEATURE STEEL REINFORCEMENT

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes the following:

1. Reinforcing Steel Bars
2. Wire Fabric
3. Expanded Metal Lath
4. Reinforcing Fibers
5. Supports and Accessories

B. Related Sections:

1. SECTION 13 1203 – WATER FEATURE CONCRETE FORMWORK
2. SECTION 13 1204 – WATER FEATURE CAST IN PLACE CONCRETE
3. SECTION 13 1611 – WATER FEATURE GROUNDING

C. References:

1. ACI 301-05 – STANDARD SPECIFICATIONS FOR STRUCTURAL CONCRETE
2. ACI 318-05 – BUILDING CODE REQUIREMENTS FOR REINFORCED CONCRETE
3. ACI SP-4 – AMERICAN CONCRETE INSTITUTE DETAILING MANUAL
4. ASTM A184– FABRICATED DEFORMED STEEL BAR MATS FOR CONCRETE REINFORCEMENT
5. ASTM A615 – DEFORMED AND PLAIN BILLET-STEEL BARS FOR CONCRETE REINFORCEMENT
6. ASTM A641 – STANDARD SPECIFICATION FOR ZINC COATED (GALVANIZED) CARBON STEEL WIRE
7. ASTM A706/706M – LOW-ALLOY STEEL DEFORMED BARS FOR CONCRETE REINFORCEMENT
8. ASTM A775/775M – EPOXY COATED REINFORCING STEEL BARS
9. ASTM A1064 – STANDARD SPECIFICATION FOR CARBON-STEEL WIRE AND WELDED WIRE REINFORCEMENT, PLAIN AND DEFORMED, FOR CONCRETE
10. ASTM D3963 – EPOXY COATED REINFORCING STEEL
11. AWS D1.4-04 – STRUCTURAL WELDING CODE FOR REINFORCING STEEL
12. CRSI – CONCRETE REINFORCING STEEL INSTITUTE – MANUAL OF STANDARD PRACTICE
13. CRSI 63 – RECOMMENDED PRACTICE FOR PLACING REINFORCING BARS
14. CRSI 65 – RECOMMENDED PRACTICE FOR PLACING BAR SUPPORTS, SPECIFICATIONS, AND NOMENCLATURE

1.2 SUBMITTALS FOR REVIEW

A. SECTION 01 3300 – SUBMITTAL PROCEDURES

B. Product Data: Submit manufacturer's literature and material specification on reinforcement support, chairs, bolsters, spacers, etc. indicating type and location for use. Only approved supports and methods approved by the engineer will be allowed.

C. Shop Drawings: Indicate bar sizes, spacing, locations, and quantities of reinforcing steel and wire fabric, bending and cutting schedules, supporting, and spacing devices, and beam reinforcing elevations.

D. Submit certified copies of mill test reports of reinforcement material analysis. Certify that products meet or exceed specified requirements.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Reinforcing Steel shall be free of heavy rust scales and flakes, or other coating at time of delivery and placing. Properly protect rebar on site after delivery to prevent rust scales and flaking.

B. Deliver bars separated by size and tagged with manufacturer's heat or test identification number.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Reinforcing Steel:

1. For general use: Deformed, new billet steel bars conforming to ASTM A615. Provide Grade 60 bars (400 MPA) unless otherwise noted on Contract Drawings, bars shall have grade identification marks.
2. For freshwater water features, wet pits, and locations exposed to moisture: Deformed, new billet steel bars conforming to ASTM A615, Grade 60 (400 MPa) bars. Provide Epoxy Coated bars as noted on Contract Drawings.
3. Fabricate and bend reinforcing steel in accordance with latest edition of the "ACI Detailing Manual" and details on Contract Drawings.

B. Welded Wire Fabric:

1. Welded Steel Wire Fabric with fiber yield strength of 60,000 psi (400 MPa) conforming to ASTM A185.
2. Provide 4- x 4-inch W1.4/1.4 (100 x 100 – MW9.1/9.1) for 4-inch (100mm) slabs and 6- x 6-inch W2.1/2.1 (150 x 150 – MW13.3/13.3) for 5-inch (125mm) slabs unless otherwise noted on the Contract Drawings
3. Provide mesh in flat sheets only. Mesh rolls will not be acceptable.

C. Expanded Metal Lath:

1. Expanded Metal Lath with galvanized finish conforming to ASTM C847.

D. Reinforcing Fibers:

1. Acceptable Manufacturers

a. Euclid Chemical, Fiberstrand 100
b. W. R. Grace, Grace Fibers
c. Fibermesh, Inc.

2. Fibrillated virgin polypropylene fibers, 3/4-inch (20mm) long.

E. Supports and Accessories

1. Tie Wire:

a. 14-gauge, 0.0641-inch (1.63mm) or 16-gauge, 0.0508-inch (1.29mm) deformed wire conforming to ASTM A496.
b. 14-gauge, 0.0641-inch (1.63mm) or 16-gauge, 0.0508-inch (1.29mm) black, soft, smooth iron wire conforming to ASTM A82.

2. Supports for Reinforcement:

a. Use 5,800 psi (40 MPa) pre-cast concrete chairs or “Dobies” with embedded wire ties where concrete is placed over water or vapor proof membranes.
b. Wire bar type supports complying with CRSI MPS 1-90, Chapter 3, with spacers and upturned legs. Where support legs are in contact with forms, provide supports with plastic protected legs, CRSI Class C.
c. Provide chairs, bar supports, spacers, or hangers as recommended by “ACI Detailing Manual”, latest edition, except slab on grade. Engineer must approve work, materials, and methods.

PART 3 - EXECUTION

3.1 PLACEMENT

A. Provide following minimum concrete cover for reinforcement (ACI 318-89):

1. Concrete cast against and permanently exposed to Earth

a. Exterior Slabs on Grade – 2-inches (50mm)
b. Interior Slabs on Grade – 2-inches (50mm)
c. Sections other than Slabs – 3-inches (75mm)

2. Concrete exposed to Earth, Water, or Weather

a. No. 5 (T16) and smaller bars – 2-inches (50mm)
b. No. 6 (T19) and larger bars – 2-inches (50mm)

3. Concrete not exposed to Earth, Water, or Weather

a. Slabs, Walls, and Joists – 1-inch (25mm)
b. Beams and Columns – 1.2-inches (37mm)

B. Accurately place and support reinforcement with engineer approved chairs, bar supports, spacers, or hangers as recommended by the “ACI Detailing Manual”, latest edition, except slabs on grade work. Support bars in slabs on grade and footings with specified and approved supports to maintain specified concrete cover.

C. Securely anchor and tie reinforcing bars and dowels prior to placing concrete.

D. Coordinate with other trades, locations of all formed openings or penetrations for piping or conduits prior to placing concrete. Accommodate openings and penetrations by providing necessary reinforcement around openings.

E. Avoid splices of reinforcing bars at points of maximum stress. Lap bars 40 bar diameters minimum unless dimensioned otherwise on the Contract Drawings.

F. Run steel reinforcing bars continuous through cold joints.

G. Torches will not be allowed for cutting or bending reinforcing bars. Cut bars using cutter. Do not use torches to heat bars for bending, bend bars cold.

H. Provide full length bars, accurately bent to details. Do not field bend bars partially embedded in concrete except as indicated on the Contract Drawings or specifically permitted by the engineer.

I. Bond and ground all reinforcement in accordance with National Electrical Code (NEC) requirements. When epoxy coated water feature steel reinforcement is specified or used, then the Contractor shall provide #8 AWG copper wire overlaying the encapsulated reinforcing steel to provide the equipotential bonding grid in the shell of the feature.

J. Lay welded wire fabric continuously, with edges and ends of adjoining sheets overlapping at least one full mesh, and not less than 6-inches (150mm), tie splices with 16-gauge, 0.0508-inch (1.29mm) wire. Offset end laps in adjacent sheets to prevent continuous laps.

K. Support welded wire fabric 2-feet (0.6m) on centers throughout the field and 2-feet (0.6m) on center along all edges.

3.2 EXAMINATION

A. Provide 48-hour notice to engineer to allow for inspection of completed concrete reinforcement before placing concrete.

B. Coordinate scheduling of concrete placement to allow for structural engineer inspection and observation and for making necessary adjustments to the reinforcing placement before delivery of concrete.

END OF SECTION 131202

SECTION 131203

WATER FEATURE CONCRETE FORM WORK

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes the following:

1. Formwork Materials
2. Formwork Accessories
3. Concrete Waterstops

B. Related Sections:

1. SECTION 13 1202 – WATER FEATURE STEEL REINFORCEMENT
2. SECTION 13 1204 – WATER FEATURE CAST IN PLACE CONCRETE
3. SECTION 13 1401 – WATER FEATURE PIPE AND FITTINGS
4. SECTION 13 1403 – WATER FEATURE PIPE HANGERS, SUPPORTS, AND ANCHORS

C. References:

1. ACI 117 – SPECIFICATIONS FOR TOLERANCES FOR CONCRETE CONSTRUCTION AND MATERIALS
2. ACI 301 – SPECIFICATIONS FOR STRUCTURAL CONCRETE FOR BUILDINGS
3. ACI 318 – BUILDING CODE REQUIREMENTS FOR STRUCTURAL CONCRETE
4. ACI 347 – GUIDE TO FORMWORK FOR CONCRETE
5. PS 1 – CONSTRUCTION AND INDUSTRIAL PLYWOOD

1.2 SUBMITTALS FOR REVIEW

A. SECTION 01 3300 – SUBMITTAL PROCEDURES

B. Product Data: Submit Manufacturer’s product data, materials, specifications, installation recommendations, and maintenance data for Waterstops and expansion joint material.

C. Shop Drawings: Provide engineered and stamped shop drawings for shoring and bracing, including details, member sizes, and sequencing instructions, when required.

1.3 QUALITY ASSURANCE

A. Perform Work in accordance with ACI 347, 318, and the latest edition of the Building Code adopted by the governing agency.

B. Design Formwork under direct supervision of a Licensed Professional Engineer experienced in design of this Work.

C. Safety: Assume responsibility for safety of Formwork and provide necessary design construction, materials, and maintenance to produce required concrete work safely.

D. All work to be performed in accordance with local Building Code Regulations and OSHA guidelines.

PART 2 - PRODUCTS

2.1 FORMWORK MATERIALS

A. Conform to ACI 347, Chapter 4 – Materials for Formwork, ACI Special Publication No. 4 – Formwork for Concrete, and as herein specified.

B. Lumber

1. Softwood Framing Lumber: In accordance with AFPA – National Design Specification for Wood Construction, with Supplement. Provide Lumber with a moisture content of 19-percent or less.
2. Grade marked by grading rules agency listed in National Design Specification for Wood Construction.
3. Light framing or studs for board or plywood form: 2-inch to 4-inch (50 to 100mm) and larger in nominal width and thickness. Construction Grade.
4. Boards for basic forms and form liners: Construction Grade.
5. Board Pattern: Square Edge.
6. Board Surface: Surfaced Four Sides (S4S).

C. Plywood:

1. For exposed concrete surfaces: HD Overlay Plyform, B-B Grade, Class I or II (exterior) APA stamped, 5/8-inch (16mm) thick minimum.
2. All other locations: Plyform, B-B Grade, Class I or II (exterior) APA stamped, 5/8-inch (16mm) thick minimum.
3. Furnish in largest practicable sizes to minimize the number of joints.

D. Round Column Forms: S

1. Single-use Fiber/Tubes with separate plastic liner, “Spiral Stop” as manufactured by Greenstreak.
2. Single-use Fiber/Tubes with integral plastic liner, “Smooth Tube” as manufactured by Burke.

E. Fiberglass, plastic, and metal forms:

1. May be used, subject to approval by Engineer, if they produce concrete surfaces equivalent to those resulting from the use of plywood forms, in the judgment of the Engineer.

F. Chamfer Strips:

1. 3/4-inch (19mm) Type VE-2 PVC Strips by Vulcan Metal Products, Inc.
2. Approved equal

2.2 FORMWORK ACCESSORIES

A. Form Ties:

1. Removable or Snap-off type, galvanized metal, fixed length, cone type, with waterproofing washer, and free of defects
2. Form Release Agent:

a. Approved Manufacturers

i. Crete-Lease 727 or 20-VOC by Cresset Chemical Company
ii. CleanStrip (J-1 or J-3 VOC) by Dayton Superior
iii. DEBOND Form Coating by L&M Construction Chemicals
iv. Duogard or Duogard II by W. R. Meadows
v. Approved equal that will provide CCS-2 surface minimum as approved by Engineer.

b. Non-staining clear coating that does not contain oil or wax and will not prevent proper adhesion of applied finish.
c. Release Agents shall be compatible with forming materials.

3. Pressure Sensitive Tape:

a. Approved Manufacturers

i. 3M
ii. Approved Equal

b. Polyurethane or Mylar faced adhesive backed paper tape, 1-inch (25mm) wide, used for all Formwork joints.

4. Nails, Spikes, Lag Bolts, Through Bolts, Anchors:

a. Sized as required, of sufficient strength and character to maintain Formwork in place while placing concrete.

2.3 CONCRETE WATERSTOPS

A. Rubber Waterstops:

1. Approved Manufacturers

a. Sika Greenstreak
b. Williams Everlastic Waterstop System
c. BF Goodrich Industrial Products, BFG Vinyl Waterstops
d. W. R. Meadows, Incorporated, Sealtight
e. Earth Shield TPE, PVC

2. Extruded ribbed or dumbbell type, 4-inch (100mm) minimum length, tensile strength equal to concrete design strength.
3. Splice by means of thermal butt fusion.
4. Center bulb styles shall not be used, unless specifically approved by the Engineer.

B. Bentonite/Butyl Rubber Waterstops:

1. Acceptable Manufacturers:

a. Waterstops RX
b. Sika Sikaswell 2
c. Parastop II

2. Waterstop shall be 75-percent Bentonite and 25-percent butyl rubber blended to form a rope material having sectional dimension of 1-inch (25mm) by 3/4-inch (19mm).

3. Bentonite/Butyl Rubber Waterstops shall only be approved for use in conjunction with sealing existing concrete to new concrete joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify lines, levels, and centers before proceeding with Formwork. Ensure all dimensions agree with Contract Documents, notify the Engineer of any discrepancies.

3.2 ERECTION – FORMWORK

A. Earth forms are only permitted where pre-approved by the Engineer or Architect.

B. Erect formwork, shoring, and bracing to achieve design requirements in accordance with ACI 301.

C. Provide bracing to ensure stability of Formwork. Shore to strengthen Formwork subject to overstressing by construction loads.

D. Arrange and assemble Formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores.

E. Arrange Formwork, aligning joints, lock forms in place making joints water tight. Tape inside of joints. Keep form joints to a minimum.

F. Provide 3/4-inch (19mm) tooled edges or chamfer strips on external corners of all exposed concrete, except as noted on Contract Documents. Outside corners of all pool edges shall have a minimum 2-inch (50mm) tooled edge

G. Maintain required clear cover between reinforcing bars and Formwork.

3.3 APPLICATION – FORM RELEASE AGENT

A. Apply Form Release Agent on Formwork in accordance with the Manufacturer’s recommendations.

B. Apply Form Release Agent prior to placement of reinforcing steel, anchoring devices, and embedded items.

C. Do not apply Form Release Agent where concrete surfaces will receive special finishes or applied coverings that are affected by Form Release Agents. Soak inside surfaces of untreated forms with clean water. Keep surfaces coated prior to placement of concrete.

D. Do not allow Form Release Agent on reinforcing steel or concrete surfaces where bonding is intended to occur or at locations of cold joints.

3.4 INSERTS, EMBEDDED PARTS, AND OPENINGS

A. Provide formed openings where required for items embedded in or passing through concrete Work.

B. Locate and set in place items that will be cast directly into concrete. Coordinate with all other trades to ensure all items to be embedded into concrete are installed and set prior to placing concrete.

C. Locate and coordinate all pipe penetrations as shown on the Contract Documents. Notify Structural Engineer of any penetrations not shown on the Contract Documents

where the structural members are shown, obtain approval from the Engineer prior to placing concrete. Install any additional reinforcement as directed by the Structural Engineer.

D. Install Waterstop Flanges for all water feature pipe penetrations into water holding structures and Link Seals for penetrations into non-water holding structures.

E. Coordinate with other trades in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other trades.

F. Install accessories in accordance with the Manufacturer's instructions. Accessories shall be straight, level, and plumb. Ensure items are not disturbed during concrete placement.

G. Install Concrete Waterstops in accordance with the Manufacturer's instructions continuous without displacing reinforcement. Joints shall be watertight.

H. Bentonite/Butyl Rubber Waterstops shall be applied at all below grade construction joints a minimum of 2-inches (50mm) from the exterior face of concrete. To prevent movement, attach water stop to the concrete with harden nails every 12- to 18-inches (300 to 450mm) or use approved epoxy continuous along Waterstop. Prevent damage to Waterstop while placing concrete

I. Provide temporary ports or openings in Formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.

J. Close temporary openings with tight fitting panels, flush with inside face of forms, and neatly fitted so joints will not be apparent in exposed concrete surfaces.

3.5 FORM CLEANING

A. Clean forms as erection proceeds, to remove foreign matter within forms.

B. Clean formed cavities of debris prior to placing concrete.

C. Flush with water or use compressed air to remove foreign matter. Ensure that water and debris drain to exterior through temporary openings or clean-out ports.

3.6 FORMWORK TOLERANCES

A. Construct Formwork to maintain tolerances required by ACI 301.

B. Camber slabs and beams in accordance with ACI 301.

3.7 FIELD QUALITY CONTROL

A. Inspect erected Formwork, shoring, and bracing to ensure that Work is in accordance with Formwork design, and that supports, fastenings, wedges, ties, and items are secure.

B. Do not reuse plywood Formwork more than three (3) times for concrete surfaces to be exposed to view or Formwork that has become split, frayed, delaminated, or otherwise damaged. Do not patch Formwork.

3.8 FORM REMOVAL

A. Do Not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads.

B. Loose forms carefully. Do not wedge pry bars, hammers, or tools against finished concrete surfaces scheduled for exposure to view.

C. Store removed forms in a manner that surfaces to be in contact with fresh concrete will not be damaged. Discard damaged forms.

END OF SECTION 131203

SECTION 131204

WATER FEATURE CAST IN PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes the following:

1. Concrete Materials
2. Admixtures
3. Miscellaneous Materials
4. Concrete Mixes
5. Cementitious and Reactive Waterproofing

B. Related Sections:

1. SECTION 03 0000 - CONCRETE
2. SECTION 13 1202 – WATER FEATURE STEEL REINFORCEMENT
3. SECTION 13 1203 – WATER FEATURE CONCRETE FORMWORK
4. SECTION 13 1401 – WATER FEATURE PIPE AND FITTINGS
5. SECTION 13 1403 – WATER FEATURE PIPE HANGERS, SUPPORTS, AND ANCHORS
6. SECTION 31 0000 – EARTHWORK

C. References:

1. Project Documents: Geotechnical Soils Report
2. ACI 107 – SPECIFICATION FOR TOLERANCES FOR CONCRETE CONSTRUCTION AND MATERIALS
3. ACI 211.5R – GUIDE FOR SUBMITTAL OF CONCRETE PROPORTIONS
4. ACI 301 – SPECIFICATION FOR STRUCTURAL CONCRETE FOR BUILDINGS
5. ACI 302.1R – GUIDE FOR CONCRETE FLOOR AND SLAB CONSTRUCTION
6. ACI 303.1 – STANDARD SPECIFICATION FOR CAST-IN-PLACE ARCHITECTURAL CONCRETE
7. ACI 304 – MEASURING, MIXING, TRANSPORTING, AND PLACING CONCRETE
8. ACI 305R – SPECIFICATION FOR HOT WEATHER CONCRETING
9. ACI 306.1 – STANDARD SPECIFICATION FOR COLD WEATHER CONCRETING
10. ACI 308.1 – STANDARD SPECIFICATION FOR CURING CONCRETE
11. ACI 318 – BUILDING CODE REQUIREMENTS
12. ACI 350 – CODE REQUIREMENTS OF ENVIRONMENTAL ENGINEERING CONCRETE STRUCTURES
13. ACI 503.2 – BONDING PLASTIC CONCRETE TO HARDENED CONCRETE WITH A MULTI-COMPONENT EPOXY ADHESIVE
14. ASTM C33 – STANDARD SPECIFICATION FOR CONCRETE AGGREGATES

15. ASTM C88 – STANDARD TEST METHOD FOR SOUNDNESS OF AGGREATES BY USE OF SODIUM SULFATE OR MAGNESIUM SULFATE
16. ASTM C94/C94M – STANDARD SPECIFICATION FOR READY-MIX CONCRETE
17. ASTM C150 – STANDARD SPECIFICATION FOR PORTLAND CEMENT
18. ASTM C260 – STANDARD SPECIFICATION FOR AIR-ENTRAINING ADMIXTURES FOR CONCRETE
19. ASTM C309 – STANDARD SPECIFICATION FOR LIQUID MEMBRANE-FORMING COMPOUNDS FOR CURING CONCRETE
20. ASTM C494 – STANDARD SPECIFICATION FOR CHEMICAL ADMIXTURES FOR CONCRETE
21. ASTM C618 – STANDARD SPECIFICATION FOR COAL FLY ASH AND RAW OR CALCINED NATURAL POZZOLAN FOR USE IN CONCRETE
22. ASTM C948 – STANDARD TEST METHOD FOR DRY AND WET BULK DENSITY WATER ABSORPTION AND APPARENT POROSITY OF THIN SECTIONS OF GLASS-FIBER REINFORCED CONCRETE

D. Related Products Installed But Not Supplied Under This Section:

1. Inserts, bolts, boxes, templates, and fastening devices for other Work, Including those for bases for Mechanical and Electrical.
2. Concrete Accessories.

1.2 SUBMITTALS FOR REVIEW

A. SECTION 01 3300 – SUBMITTAL PROCEDURES

B. Product Data: Submit Manufacturer's product literature for each type of admixture, bonding agent, curing compound, non-shrink grout, epoxy, and sealer for approval by the Engineer.

C. Concrete Mix Design: Submit Concrete Mix Design for each concrete mix type to be used. Include the following information:

1. Mix Identification Designation
2. Statement of Intended Use for Mix
3. Mix Proportions, including Admixtures
4. Wet and Dry Unit Weight
5. Entrained Air Content
6. Design Slump
7. Design Compressive Strength
8. Water/Cementitious Material Ratio
9. Aggregate Source
10. Admixtures
11. Strength Qualification Data:

    a. Submit required average strength qualification data and documentation per ACI 301 4.2.3.
    b. If trial batches are used to qualify average strength, mix design shall be prepared by an independent testing laboratory and shall achieve average compressive strength of a minimum of 1,200 psi (8.25 MPa) greater than

specified strength with slump within 1-inch (25mm) of maximum permitted and air content within 0.05-percent of maximum allowable.

c. If field test data is used to qualify average strength, submit separate qualification data for each production facility that will supply concrete to the project, include copies of concrete testing agency's reports from which the data was compiled.

D. Test Reports: Provide Test Reports of control tests, special tests, and core tests prepared and distributed by an independent testing laboratory.

E. Samples: Submit one (1) 12-inch by 12-inch (300 by 300mm) sample of colored concrete for color verification

1.3 QUALITY ASSURANCE

A. Testing Agency: All testing shall be conducted by an approved testing laboratory. Test results will be submitted to the Engineer before final acceptance.

B. Records of Work: Maintain and keep accurate records listing time, location, and date of concrete placement. Include delivery tickets from concrete supplier. Delivery Tickets shall show the following information:

1. Name of Ready-Mix batch plant
2. Serial number of Ticket
3. Date and truck number
4. Name of Contractor
5. Name and Location of the Project
6. Amount of Concrete
7. Time Loaded
8. Type, Name, and Amount of Admixtures used
9. Amount and Type of Cement
10. Total Water Content
11. Sizes, Weights, and Types of sand and aggregates

C. MOCKUP

1. Construct and erect a field sample for Architectural Concrete surfaces receiving special treatment or finish as a result of Formwork in location specified by the Engineer or Architect.
2. Sample shall be of sufficient size, approximately 4-feet by 8-feet (1.2 by 2.4m), to indicate and detail special treatment or finish, including any scoring, joints, joint sealants, etc that will be in the finished Work.
3. Remove panels at the completion of the Project.

1.4 PROJECT CONDITIONS

A. Environmental Requirements

1. Cold Weather Concreting Procedures

a. When ambient air temperatures on the day of placement are expected to drop below 40 °F (4.4 °C), placement, preparation, protection, and curing of concrete shall comply with ACI 306.1.

b. Minimum temperature of concrete upon delivery shall conform to ACI 301 4.2.2.7. Concrete temperature at placement shall conform to minimum values of ACI 306.1 Table 3.2.1 and shall not exceed minimum values.
c. No frozen material shall be used.
d. Forms, reinforcement, and fillers shall be free from frost.
e. Do not place concrete on frozen ground.

2. Hot Weather Concreting Procedures

a. When placing concrete in hot weather follow the recommendations of ACI 305R.
b. When ambient air temperatures on the day of placement are expected to exceed 90 °F (32.2 °C), mix ingredients shall be cooled before mixing. Flake ice or well-crushed ice of a size that will melt completely during mixing may be substituted for all or part of mix water.
c. Protect and prevent rapid drying. Start finishing and curing as soon as possible. The Engineer may approve the use of fog spray or evaporation retardant to lessen rapid evaporation from concrete surface.

3. Concrete shall not be placed during rain, sleet, or snow. Precipitation shall not be allowed to increase the mixing water nor damage the finish surface. The Engineer may approve placement of concrete if it is determined that there is adequate protection from damage due to environmental conditions.

PART 2 - PRODUCTS

2.1 CONCRETE MATERIALS

A. Portland Cement:

1. General Usage: ASTM C150, Type II with C3A ≤ 5% or Type V, provided from one (1) source.

B. Coarse Aggregate:

1. Meet requirements of ASTM C33 or nonconforming aggregate that by test or actual service produces concrete of required strength and conforms to local governing codes.
2. Aggregate shall be uniformly graded as follows:

a. Flat Work – Size No. 67

Sieve No. (U.S. Series)	**Opening Size** inches (mm)	**Percent Passing** (% by weight)
1 in.	1.0 (25)	100
3/4 in.	0.75 (19)	90 to 100
3/8 in.	0.375 (9)	20 to 55
4	0.187 (4.75)	0 to 10
8	0.0937 (2.36)	0 to 5

b. All Other – Size No. 57

Sieve No. (U.S. Series)	**Opening Size** inches (mm)	**Percent Passing** (% by weight)

1-1/2 in.	1.5 (37)	100
1 in.	1.0 (25)	95 to 100
1/2 in.	0.5 (12)	25 to 60
4	0.187 (4.75)	0 to 10
8	0.0937 (2.36)	0 to 5

C. Fine Aggregates:

1. Clean, washed hardrock having hard, strong, durable particles, which do not contain deleterious substances, such as clay lumps, shale, schist, alkali, mica, coated grains, or soft and flaky particles.
2. Clean natural sand, which does not contain deleterious substances, such as clay lumps, shale, schist, alkali, mica, coated grains, or soft and flaky particles.
3. Aggregate shall be uniformly graded as follows:

Sieve No. (U.S. Series)	**Opening Size** inches (mm)	**Percent Passing** (% by weight)
3/8 in.	0.375 (9)	100
4	0.187 (4.75)	95 to 100
8	0.0937 (2.36)	80 to 100
16	0.0469 (1.18)	50 to 85
30	0.0234 (0.60)	25 to 60
50	0.0117 (0.30)	10 to 30
100	0.0059 (0.15)	2 to 10

D. Mix Water:

1. Clean potable water conforming to ASTM C94.
2. Free from deleterious amounts of acids, alkalis, salts, and organic matter.

2.2 ADMIXTURES

A. Mineral

1. Fly Ash Pozzolan – Meets requirements of ASTM C618, Class F or C and with loss of ignition (LOI) of 3-percent maximum.

B. Chemical

1. No Admixture shall contain calcium chloride nor shall calcium chloride be used as an Admixture. All chemical admixtures used shall be from the same manufacturer.
2. Approved Manufacturer
   a. Master Builders Incorporated
   b. SIKA Corporation
   c. W R Grace Construction Products
3. Air Entrainment Agent
   a. Meets requirements of ASTM C260
   b. Quality Standard – Daravair or Darex II AEA by W R Grace
4. Water Reducer

a. Meets requirements of ASTM C494, Type A
b. Quality Standard – Daracem 50/55, WRDA-64, or WRDA-82 by W R Grace

5. Water Reducer, Set Retarder

a. Meets requirements of ASTM C494, Type D
b. Quality Standard – Daratard-17 or Daratart-40 by W R Grace

6. High Range Water Reducer

a. Meets requirements of ASTM C494, Type F or G
b. Quality Standard – Darachem-100 or WRDA-19 By W R Grace

7. Non-Chloride Accelerator

a. Meets requirements of ASTM C494, Type C
b. Quality Standard – Daraset or Polarset by W R Grace

C. Evaporation Retardant

1. Approved Manufacturers

a. Sure Film J-74 by Dayton Superior
b. Confilm by Master Builders Incorporated

D. Bonding Agents

1. Approved Manufacturers

a. Day-Chem Ad Bond (J-40) by Dayton Superior

2.3 MISCELLANEOUS MATERIALS

A. Curing Compounds:

1. Do not use concrete curing compounds without the Engineer's or Architect's written approval.
2. Curing Compounds shall not be used to replace moist curing unless specifically accepted by the Engineer.

B. Non-shrink Grout:

1. Approved Manufacturers

a. Master Builders Incorporated – Master Flow 928
b. Dayton Superior – Sure-Grip
c. L&M Construction Chemicals – Crystex Non-Shrink Grout
d. Euclide Chemical Company – Hi-Flow Grout
e. U.S. Grout Corporation – Five Star Grout
f. A.C. Horn, Incorporated – Horn Non-Metallic Grout
g. UPCO Company – UPCON
h. Sonneborn Building Products – Sonogrout
i. Burke – Non-Ferrous, Non-Shrink Grout

2. Pre-packaged, non-shrink, non-metallic, natural aggregate grout conforming to ASTM C1107, Grade B or C.

3. Grout shall be fluid with extended working times and temperatures, capable of achieving at least 95-percent bearing strength under base plates and free of gas producing or gas-releasing agents.

C. Anchor Bolt Epoxy

1. Approved Manufacturers

a. Hilti Corporation
b. Approved Equal

2. Anchor Bolt Epoxy shall conform to the design strength requirements of ACI 318 and should follow the Manufacturer's recommendations.
3. Provide as an injectable adhesive, furnished in a side-by-side refill pack that keeps component A and component B separate and shall be designed to accept static mixing nozzle through which both components are thoroughly mixed.

D. Expansion Joint Filler

1. Wet Areas, such as water feature decks:

a. Acceptable Products

i. Deck-O-Joint
ii. Deck-O-Foam
iii. Deck-O-Seal
iv. Approved Equal

b. Non-bituminous joint filler, 1/2-inch (12mm) thick by depth of concrete slab.

2. Non-Wet Areas:

a. Acceptable Manufacturers

i. A.C. Horn Company
ii. W R Meadows Company
iii. Approved Equal

b. Pre-molded asphalt-impregnated type, conforming to ASTM D1751.
c. Pre-compressed, neoprene rubber-impregnated, expanding foam may be used in lieu of pre-molded type.

2.4 CONCRETE MIXES

A. It is intended that concrete for all parts of the concrete Work be homogeneous, and when hardened, possess the required strength, durability, water tightness, appearance, resistance to deterioration and abrasion, and other qualities as specified or required.

B. No water shall be added at anytime during mixing cycle above the amount required to meet specified water/cement ratio. No reduction in the amount of cement will be allowed.

C. Mix Designs to meet the following requirements:

1. Mix No. 1 – 5,000 psi (34.4 MPa) concrete for use on water retaining structures.

a. Minimum weight of cement per cubic yard – 564 lbs.

b. Air Entrainment – 6 percent, +/- 1.5%.
c. Water/Cement Ratio – 0.40 maximum by weight.

2. Admixtures:

a. Mix design shall show proposed admixture, amount, usage instructions, and justification for proposed use. Do not use any admixture without the Engineer's/Architect's written approval.
b. Mineral – An amount equal to 15-percent of weight of cement may be added.

i. If added, fly ash shall be considered with the cement in determining the amount of water necessary to provide the specified water/cement ratio.

c. Chemical:

i. 4-inch (100mm) slump maximum prior to use of high range water reducer.
ii. 8-inch (200mm) slump maximum with use of high range water reducer.
iii. Use accelerator or retarder if necessary, to meet environmental conditions.

2.5 CEMENTITIOUS AND REACTIVE WATERPROOFING

A. Cementitious and Reactive Waterproofing should only be included in the mix design when specified by the Engineer.

B. Cementitious Waterproofing

1. Approved Manufacturers

a. XYPEX Chemical Corporation
b. Approved Equal

2. Obtain crystalline waterproofing products from a single manufacturer.
3. Product shall be added to concrete mix at time of batching.
4. Follow all Manufacturer recommendations and instructions for dose rates into concrete mix.

C. Reactive Waterproofing

1. Approved Manufacturers

a. HYCRETE Incorporated
b. Approved Equal

2. Obtain Reactive Waterproofing products from a single manufacturer.
3. Product shall be compatible with specified concrete mix design.
4. Follow all Manufacturer's recommendations and instructions for dose rates into the concrete mix.

PART 3 - EXECUTION

3.1 PREPARATION

A. Refer to overall Project Specifications for inspection requirements.

B. Verify requirements for concrete cover over reinforcement in accordance with SECTION 13 1202 – WATER FEATURE STEEL REINFORCEMENT.

C. Coordinate locations and install inserts, bolts, boxes, templates, pipes, conduits, and other accessories required by all other trades prior to inspection and placing concrete.

D. Verify area where concrete is to be placed is free from standing water, dirt, debris, etc.

E. Clean previously placed concrete with a steel brush, blowing the concrete clean using compressed air, and wetting or applying bonding agent in accordance with Manufacturer's instructions.

F. Verify that all grounding connections are installed prior to placing concrete. All Steel Reinforcement must be grounded in accordance with the National Electrical Code (NFPA 70).

3.2 PLACEMENT

A. Place concrete in accordance with ACI 318.

B. Place concrete on properly prepared undisturbed subgrade materials or engineered fill. Refer to the Geotechnical Soils Report for recommendations.

C. Maintain records of concrete placement as described in this section.

D. Place concrete continuously between predetermined expansion, control, and construction joints.

E. Do not interrupt successive placement; do not permit cold joints to occur.

F. Place concrete in nearly uniform layers.

G. Do not drop concrete in free fall over 5-feet (1.5m).

H. Consolidate concrete during and immediately after depositing using mechanical vibrators in accordance with ACI 301. Do not use vibrators to move or transport concrete inside of forms.

I. Do not use contaminated, deteriorated, or retempered concrete. Avoid accumulation of hardened concrete.

J. Do not use aluminum in concrete.

3.3 ACCEPTABLE TOLERANCES

A. All tolerances for concrete work shall be in accordance with ACI Standards unless specifically specified otherwise.

B. Tolerances for block outs and openings:

1. Size: ± 1/8-inch (3mm)
2. Location: ± 1/4-inch (6mm)

C. Tolerances for stairs and landings:

1. Treads: ± 1/8-inch (3mm)
2. Risers: ± 1/16-inch (1.5mm)

D. Walls and Slabs:

1. Variation from plumb: 1/4-inch (6mm) maximum
2. Variation from thickness:1/4-inch (6mm)
3. Variation from location: 1/2-inch (12mm)

3.4 SPECIAL REQUIREMENTS

A. Footings:

1. Bear 18-inch (450mm) minimum into undisturbed earth or on mechanically compacted engineered fill. Step Footings at a ratio of 1.5 horizontal to 1 vertical (1.5:1) unless detailed otherwise. Exterior Footings shall bear below finish grades. See Contract Documents
2. Level tops to finish Footing and leave rough.
3. Where joints are required, bulkhead, waterstop, key horizontally, and dowel with two (2) #4 (T12) rebar, 4-feet (1.2m) long.

B. Foundations and Walls:

1. Leave Steel Reinforcement projecting where required for floor ties.

C. Exterior Slabs

1. Dusting with cement is not permitted.
2. For continuous placing and as shown on the Contract Documents, saw cut a 1-inch (25mm) deep control joint before shrinkage occurs.

D. Equipment Support Pads (Housekeeping Pads)

1. Coordinate the location of required equipment bases, support pads, etc with other trades and as required in all specification sections.
2. All equipment support pads shall be 4-inches (100mm) in height, unless otherwise noted on the Contract Documents.

E. Anchor Bolts:

1. Embedded Anchors:

a. Place Anchor Bolts not tied to reinforcement steel immediately following leveling of concrete. Reconsolidate concrete around Bolt immediately after placement. Do not place bolts during finishing process.

2. Epoxy Anchors:

a. Install as per the Manufacturer’s recommendations and instructions.

F. Expansion Joints:

1. Install Expansion Joints only in locations as shown on the Contract Documents, or where approved by the Engineer.
2. Expansion Joint fiber can be held in place by nailing or taping the material to the existing section of concrete prior to placement.
3. Joint sealant compound shall be applied over the top of the fiber, flush with the finish surface and continuous along the entire joint. The joint shall be watertight.

3.5 CONCRETE FINISHES

A. All Concrete Finishes shall be coordinated with the Architect/Landscape Architect. The following are recommendations when no architectural finish is specified.

B. Finish No. 1 – Exposed Vertical Surfaces

1. Sack Rubbed Finish.
2. Immediately after removing forms, remove joints, marks bellies, projections, loose materials, and cut back metal ties from surfaces to be exposed.
3. Repair minor voids as specified in this section and rub exposed surface with carborundum to smooth.
4. Grind ridges smooth with the face of the exposed concrete.
5. Provide a smooth and even surface.

C. Finish No. 2 – Interior Flatwork

1. Steel Trowel Finish.
2. Float and Steel Trowel interior slabs after concrete has set enough to avoid bringing water and fines to the surface.
3. If power troweling is used, obtain approval or finish from the Engineer.

D. Finish No. 3 – Exterior Flatwork

1. Broom Finish.
2. Round edges including edges formed by expansion joints.
3. Remove edge marks.

3.6 CURING AND PROTECTION

A. Keep concrete moist a minimum of seven (7) days for regular concrete and three (3) days for high early strength concrete. Do not use concrete curing compounds without the Engineer/Architect's written approval. Curing Compounds shall not be used to replace moist curing unless accepted by the Engineer/Architect.

B. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.

C. Maintain concrete with minimal moisture loss at relatively constant temperature for a period necessary to hydration of cement and hardening of concrete.

D. Protect newly placed concrete from precipitation until it has sufficiently hardened to avoid excess water in mix and damaging the surface finish. Concrete with damaged surfaces will be replaced at the direction of the Engineer.

3.7 FIELD QUALITY CONTROL

A. Provide free access to Work and cooperate with individuals performing tests, inspectors, Engineers and Architects.

B. Four (4) concrete cylinders shall be taken for every 75 or less cubic yards (60 cu. m) of each class of concrete placed.

C. One (1) additional test cylinder will be taken during cold weather concreting and cured on the job site under the same conditions as concrete it represents.

D. One slump test will be taken for each set of test cylinders taken.

E. Concrete not conforming to required lines, details, dimensions, tolerances, or specified requirements will be noted as defective. Defective concrete will be removed and replaced or repaired as directed by the Engineer and at the Contractor's expense.

F. Contractor to perform water tightness testing in accordance with ACI-350.1-01 and inform owner and engineer of test results. Engineer reserves the right to reject concrete work if water tightness testing criteria are not met. In lieu of the aforementioned test, the contractor may request permission to perform a bucket test via the following: Place a bucket filled with water on a pool step (weighed down), ensure water level inside bucket is the same as in the pool, mark the water levels inside and outside the bucket, check and compare the marks 24 hours later.

3.8 PATCHING AND REPAIRING

A. Allow Engineer/Architect or inspector to inspect concrete surfaces immediately upon removal of forms.

B. Excessive honeycomb or embedded debris in concrete is not acceptable and will be noted as defective. Defective concrete will be removed and replaced or repaired as directed by the Engineer and at the Contractor's expense.

C. Do not patch, repair, or replace exposed architectural finished concrete except upon the direction of the Architect or Engineer.

D. Minor defects, defects less than 1/2-inch (12mm) deep and tie holes, not exposing reinforcing can be repaired by chipping, cleaning, and applying epoxy adhesive. Apply non-shrink grout prior to development of tack-free condition of epoxy adhesive.

END OF SECTION 131204

SECTION 131304

WATER FEATURE ELASTOMERIC WATERPROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes the following:

1. Surface Preparation
2. Application of Elastomeric Waterproofing
3. Testing
4. Repairing

B. Related Sections:

1. SECTION 13 1204 – WATER FEATURE CAST IN PLACE CONCRETE
2. SECTION 13 1401 – WATER FEATURE PIPE AND FITTINGS
3. SECTION 13 1403 – WATER FEATURE PIPE HANGERS, SUPPORTS, AND ANCHORS

C. Reference

1. ASTM C836 – STANDARD SPECIFICATION FOR HIGH SOLIDS CONTENT, COLD LIQUID-APPLIED ELASTOMERIC WATERPROOFING MEMBRANE
2. ASTM D412 – STANDARD TEST METHOD FOR VULCANIZED RUBBER AND THERMOPLASTIC ELASTOMERS
3. ASTM D624 – STANDARD TEST METHOD FOR TEAR STRENGTH OF CONVENTIONAL VULCANIZED RUBBER AND THERMOPLASTIC ELASTOMERS
4. ASTM D2240 – STANDARD TEST METHOD FOR RUBBER PROPERTY-DUROMETER HARDNESS
5. ASTM E96 METHOD E – STANDARD TEST METHODS FOR WATER VAPOR TRANSMISSION OF MATERIALS

1.2 SUBMITTALS FOR REVIEW

A. SECTION 01 3300 – SUBMITTAL PROCEDURES

B. Product Data: Provide manufacturer’s product literature and installation instructions, including surface preparation procedures, handling, storage, application, protection and care, and repairs.

1. Provide manufacturer’s product literature for fillers, flashings, and sealants that may be required as part of the Work.

C. Sample: Provide five (5) 4- x 4-inch (100 x 100mm) samples of membrane of the thickness, color, and texture as specified in this section and as shown on the Contract Documents.

D. License Certificate: Provide a currently dated applicator's license certificate issued by the manufacturer verifying the applicator's qualifications to install the product and acceptance of the manufacturer to fully warrant the product.

E. As-Built Plans: Submit at the end of construction an as-built plan showing the location and date of repairs, patches, and cold joints in the elastomeric waterproofing membrane.

F. Warranty: Provide a written warranty executed by the manufacturer and the Installer, agreeing to repair or replace failures in the membrane that occur within ten (10) years after the date of final payment.

1.3 QUALITY ASSURANCE

A. Applicator: Company specializing in performing the Work of this section having a minimum of five (5) years of experience with projects of similar size and scope.

B. Single Source Responsibility: Provide primers, and other undercoat materials produced by the same manufacturer as the finish coats. Provide coatings for the entire project from only one manufacturer and supplier.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials to the job site in the manufacturer's original, new, unopened containers clearly marked with the supplier's name, brand name, and type of material.

B. Storage and Handling: Store containers in a well-ventilated, clean, dry, and covered area.

1. Do not store in direct sunlight.
2. Avoid contamination with water or moisture.
3. Keep all containers tightly closed until ready for use.
4. Handle products to avoid damaging containers.

1.5 PROJECT CONDITIONS

A. Environmental Conditions:

1. Apply coatings only when the temperature of the surfaces to be coated and surrounding air temperatures are above 50 °F (10 °C), unless otherwise permitted by the manufacturer's printed instructions.
2. Do not apply coatings under any of the following conditions:

a. In rain, fog, or mist
b. When relative humidity exceeds 85%
c. At temperatures less than 5 °F (3 °C) above dew point
d. To damp or wet surfaces

B. Safety and Health Conditions:

1. Provide adequate ventilation during application of the materials to protect the applicator from breathing vapors and prevent contact with the skin or eyes.
2. Wear approved protective clothing, respirator, and gloves during application.

C. Protection:

1. Keep all products away from heat, sparks, and flames during application and curing. Do not allow spark producing equipment, i.e., welders, torches, etc. during application and until all vapors are dissipated.
2. Vapors from solvents can carry considerable distances and care should be taken to post “WARNING” signs, “CAUTION” tapes, and “NO SMOKING” signs, etc. within a minimum 100-feet (30m) from the Work area.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers

1. CIM Industries, Incorporated
2. Perma-Gard III by Neogard Division of Jones-Blair Company
3. EnviroLastic by Sherwin-Williams Industrial & Marine

B. Minimum Physical Properties:

Properties	Test Method	Values
Tensile Strength, psi / MPa	ASTM D412	1,000 / 6.9
Elongation at Break, min %	ASTM D412	300%
Tear Strength, psi / MPa	ASTM D624 (DIE C)	180 / 1.2
Moisture Vapor Transmission	ASTM E96 METHOD E	0.03 perms / 100 mil
Shore Hardness	ASTM D2240	65

2.2 ELASTOMERIC COATING SYSTEMS

A. Elastomeric coating shall be a tough, corrosion and chemical resistant cold fluid-applied waterproofing membrane specifically for use in water applications.

B. The elastomeric coating shall contain a minimum of 88-percent solids by volume and be a fast cure two-component, aromatic, protective membrane.

C. All additives utilized for strength, flexibility, and inhibiting ultraviolet (UV) degradation, shall be especially developed for submerged environmental conditions.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that the concrete work and rockwork has been properly placed, troweled smooth, and cured for a minimum of 28 days prior to application.

1. Concrete and rockwork should be water cured without the uses of concrete curing agents.
2. If concrete curing agents were used contact the manufacturer for recommendations prior to applying the product.

B. Examine the concrete and rockwork surfaces where the elastomeric coating systems will be applied, for compliance with the manufacturer’s application requirements. Verify surfaces do not contain voids, gaps, or “honey-comb” surfaces and is free of ridges and sharp projections. Verify that the surfaces are thoroughly dry.

C. Verify piping or conduits that penetrate the elastomeric waterproofing membrane is installed a minimum of 6-inches (150mm) above or through the concrete or rockwork surface.

3.2 PREPARATION

A. Concrete and rockwork surfaces shall be smooth and free of defects. Grind burs and excess concrete as required, chip and fill voids and “honey-combs” as required.

B. Cracks: Visible hairline cracks in concrete, up to 1/16-inch (1.5mm) in width, shall be cleaned and treated with bitumen-modified polyurethane coating material a minimum distance of 2-inches (50mm) on each side of the crack to yield a thickness of 30 dry mils minimum. Large cracks, over 1/16-inch (1.5mm) in width, shall be detailed with sheet flashing.

C. Cold Joints and Control Joints: All cold joints occurring in floors, walls, and where two or more concrete edges intersect shall be free of excess concrete and burs, then detailed with sealant and sheet flashing. All control joints shall be detailed with sheet flashing.

D. Building Expansion Joints: Building expansion joints shall be filled with silicon and covered with a sheet flashing a minimum of 6-inches (150mm) each side of the expansion joint. The sheet flashing shall be installed loosely allowing 1-inch (25mm) overlap across the expansion joint.

E. Pipe Penetrations: All pipe penetrations that extend through the surface where elastomeric waterproofing membrane is installed shall have non-shrink grout installed if necessary, between the link seal and the finished surface. Liquid Flashing or sheet flashing shall be placed around all pipe penetrations as recommended by the manufacturer.

F. Cleaning: All surfaces shall be free from oil, grease, loose powder, debris, and dust. Thoroughly wash the surface with a power broom and strong non-sudsing detergent, rinse and dry prior to application or as directed by the manufacturer.

G. Corners, cracks, construction joints, and control joints shall be clean and free of oil, grease, loose powder, debris, and dust prior to applying waterproofing.

3.3 APPLICATION

A. Priming: Apply base coat or bonding agents as recommended by the manufacturer.

B. Apply elastomeric waterproofing by brush, roller, or sprayer according to the manufacturer’s recommendations.

C. Apply an even, continuous 100-mil layer of waterproofing over the entire water feature, including horizontal, vertical, and sloped concrete surfaces and/or over smoothed rockwork surfaces as indicated on the Contract Documents.

D. The waterproofing shall extent beyond the limits of the water feature as indicated in the Contract Documents.

E. Where flashing is used to cover cracks, construction joints, or control joints the waterproofing shall be applied in a continuous manner over the flashing. The

waterproofing should completely cover liquid and sheet flashing. Field seams at flashings will not be accepted.

F. In locations where pipe penetrate the waterproofing, the waterproofing membrane shall be applied completely around the pipe, covering the flashing, and extending along the pipe a minimum of 1-inch (25mm) above the flashing for pipes 4-inches (100mm) or less in diameter, and 3-inches (75mm) above the flashing for pipes greater than 4-inches (100mm) in diameter.

G. Waterproofing shall be terminated at the edges in a manner that prevents the cured membrane from “peeling” off the surface to which it was applied.

3.4 TESTING

A. After the waterproofing membrane has cured, visually inspect the waterproofing for defects and damage.

B. Cap and support all pipe penetrations through the waterproofing prior to testing the waterproofed areas. Install plugs in all drains.

C. Completely fill areas where waterproofing has been applied to the water level indicated on the Contract Documents.

D. The elastomeric waterproof membrane area shall be flood tested for 48-hours after the system has cured and prior to installation of any protection course.

E. Repair any leaks or damaged areas that may appear.

3.5 PATCHING, REPARING, AND COLD JOINTS

A. Patching, repairing, and cold joints shall be performed in strict compliance with the manufacturer’s recommendations.

B. The location and date of any patches or repairs shall be noted on an as-built plan by the applicator and construction manager. The location of cold joints shall also be noted on the as-built plan.

3.6 PROTECTION

A. Install protection boards as required to protect the installed waterproofing membrane from damage during construction. Protection boards are not to be considered as adequate protection from welding sparks, slag, etc.

B. Only authorized individuals shall be allowed to walk or work upon the waterproofing membrane and only when wearing soft-sole shoes.

C. Protect membrane from welding sparks, slag, etc. If welding does occur in the area where the membrane has been installed and has not been protected by a permanent covering and additional water test, as described in this section will be required before the permanent protective covering can be installed.

D. Immediately after the water test has been performed and any repairs made, the waterproofing membrane shall be covered. If any additional welding occurs before the entire liner has been covered, an additional water test will be required until the entire waterproofing membrane has been protected with a permanent covering.

END OF SECTION 131304

SECTION 131305

WATER FEATURE ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes the following:
   1. Safety Kit
   2. Safety Signage

B. Related Sections:
   1. SECTION 13 1204 – WATER FEATURE CAST IN PLACE CONCRETE
   2. SECTION 13 1401 – WATER FEATURE PIPE AND FITTINGS
   3. SECTION 13 1502 – WATER FEATURE PUMPS AND MOTORS
   4. SECTION 13 1503 – WATER FEATURE FILTERS
   5. SECTION 13 1511 – WATER FEATURE VALVES, GAUGES, AND METERS
   6. SECTION 13 1611 – WATER FEATURE GROUNDING

C. References:
   1. ASTM A967 – STANDARD SPECIFICATION FOR CHEMICAL PASSIVATION TREATMENTS FOR STAINLESS STEEL PARTS
   2. ASTM D751 – STANDARD TEST METHODS FOR COATED FABRICS
   3. ASTM D3773 – STANDARD TEST METHODS FOR LENGTH OF WOVEN FABRICS
   4. ASTM D3774 – STANDARD TEST METHODS FOR WIDTH OF WOVEN FABRICS
   5. ASTM D3775 – STANDARD TEST METHODS FOR WARP (END) AND FILLING (PICK) COUNT OF WOVEN FABRIC
   6. ASTM D3776 – STANDARD TEST METHODS FOR MASS PER UNIT AREA (WEIGHT) OF FABRIC
   7. ASTM G154 – STANDARD PRACTICE OF OPERATING FLUORESCENT ULTRAVIOLET LAMP APPARATUS FOR EXPOSURE TO NONMETALLIC MATERIALS
   8. National Sanitation Foundation (NSF) – Standard 50 Specifications
   9. National Fire Protection Association (NFPA) 70 – National Electrical Code (NEC) – Article 680-21
   10. Underwriters Laboratories (UL)
   11. 2010 ADA Standards for Accessible Designs

1.2 SUBMITTALS FOR REVIEW

A. SECTION 01 3300 – SUBMITTAL PROCEDURES

B. Product Data Sheets: Submit manufacturer’s product data sheets on all products contained in this section for approval. Data sheets must substantiate conformance

with applicable standards and include printed recommendations, dimensions, ratings, and capacities.

1. Indicate on submittal which materials, models, data, ratings, and options are being selected.

C. Shop Drawings: Indicate layout, general assembly, components, dimensions, clearances, and method of assembly.

D. Maintenance Data: Include manufacturer's literature, maintenance recommendations, and replacement parts list.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Accept components on site in factory packing and inspect for damage.

B. Protect all components received at site from physical damage, including effects of weather, water, and construction.

PART 2 - PRODUCTS

2.1 SAFETY SIGNAGE

A. Approved Suppliers

1. Recreonics
2. Lincoln Aquatics
3. Custom Fabricator

B. Signage shall be coordinated with the architect and facility operator for layout and format of each sign.

C. Signage shall comply with local code requirements as to size of lettering and content.

D. The following are minimum recommendations:

1. SPLASH PAD RULES: Provide one (1) sign for each pool listing the following rules, coordinate with owner and architect for additional rules for each pool:
    a. All persons using the Splash Pad do so at their own risk. Owner and Management are not responsible for accidents or injuries.
    b. No food or beverages may be served on the wet deck.
    c. No animals allowed on the wet deck.
    d. No glass allowed on the wet deck.
    e. No running or rough play in splash pad area.
    f. Do not swallow the pool water, it is recirculated.
    g. Do not use pool if you are ill with diarrhea in the last 2 weeks.
2. NO LIFEGUARD ON DUTY: Provide a minimum of one (1) warning sign indicating there is NO LIFEGUARD ON DUTY.
3. POOL CAPACITY: Provide one (1) sign for each pool stating the maximum number of people allowed in each pool.
4. POOL HOURS: Provide one (1) sign for each fenced pool area stating the hours of operation for the Pool.

PART 3 - EXECUTION

3.1 GENERAL

A. Install products, equipment, and accessories in accordance with manufacturer's recommendations, local building codes, and Public Health Department requirements.

3.2 POOL SIGNAGE

A. Contractor shall locate Pool Signage as shown on the Contract Documents.

B. When Signage is not shown on the Contract Documents, the Contractor shall refer to the architect or landscape architect for placement.

END OF SECTION 131305

SECTION 131401

WATER FEATURE PIPE AND FITTINGS

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes the following:

1. Furnishing and installing PVC pipe and tubing
2. Furnishing and installing PVC pipe joints and fittings
3. Furnishing and installing Above Grade Copper Pipe and Fittings

B. Related Sections:

1. SECTION 13 1402 – WATER FEATURE PIPE TESTING AND CLEANING
2. SECTION 13 1403 – WATER FEATURE PIPE HANGERS, SUPPORTS, AND ANCHORS
3. SECTION 13 1501 – WATER FEATURE MECHANICAL IDENTIFICATION
4. SECTION 13 1502 – WATER FEATURE PUMPS AND MOTORS
5. SECTION 13 1503 – WATER FEATURE FILTERS
6. SECTION 13 1504 – WATER FEATURE CHEMICAL FEED SYSTEMS
7. SECTION 13 1505 – WATER FEATURE OZONE GENERATION AND INJECTION
8. SECTION 13 1507 – WATER FEATURE HEATERS
9. SECTION 13 1511 – WATER FEATURE VALVES, GAUGES, AND METERS

C. References:

1. ASME B16.18 – CAST COPPER ALLOY SOLDER JOINTS
2. ASTM B88 – STANDARD SPECIFICATION FOR SEAMLESS COPPER WATER TUBING
3. ASTM D1248 – STANDARD SPECIFICATION FOR POLYETHYLENE MOLDING AND EXTRUSION MATERIALS
4. ASTM D1785 – STANDARD SPECIFICATION FOR POLY (VINYL CHLORIDE) (PVC) PLASTIC PIPE, SCHEDULES 40, 80 AND 120
5. ASTM D2464 – STANDARD SPECIFICATION FOR THREADED POLY (VINYL CHLORIDE) (PVC) PLASTIC PIPE FITTINGS, SCHEDULE 80
6. ASTM D2466 – STANDARD SPECIFICATION FOR POLY (VINYL CHLORIDE) (PVC) PLASTIC PIPE FITTINGS, SCHEDULE 40
7. ASTM D2467 – STANDARD SPECIFICATION FOR SOCKET-TYPE POLY (VINYL CHLORIDE) (PVC) PLASTIC PIPE FITTINGS, SCHEDULE 80
8. ASTM D2564 – STANDARD SPECIFICATION SOLVENT CEMENT FOR POLY (VINYL CHLORIDE) PVC PIPE AND FITTINGS
9. ASTM D2657 – STANDARD PRACTICE FOR HEAT FUSION JOINING OF POLYOLEFIN PIPE AND FITTINGS
10. ASTM D2683 – STANDARD SPECIFICATION SOCKET-TYPE POLYETHYLENE FITTINGS FOR OUTSIDE DIAMETER-CONTROLLED POLYETHYLENE PIPE AND TUBING

11. ASTM D2774 – STANDARD PRACTICE FOR UNDERGROUND INSTALLATION OF THERMOPLASTIC PRESSURE PIPING
12. ASTM D2837 – STANDARD TESTING METHOD FOR OBTAINING HYDROSTATIC DESIGN BASIS FOR THERMOPLASTIC PIPE MATERIALS
13. ASTM D2855 – STANDARD PRACTICE FOR MAKING SOLVENT-CEMENTED JOINTS WITH POLY (VINYL CHLORIDE) (PVC) PIPE AND FITTINGS
14. ASTM D3035 – STANDARD SPECIFICATION FOR POLYETHYLENE (PE) PLASTIC PIPE (DR-PR) BASED ON CONTROLLED OUTSIDE DIAMETER
15. ASTM D3261 – STANDARD SPECIFICATION FOR BUTT FUSION POLYETHYLENE (PE) PLASTIC FITTINGS OR POLYETHYLENE (PE) PLASTIC PIPE AND TUBING
16. ASTM D3350 – STANDARD SPECIFICATION FOR POLYETHYLENE PLASTICS PIPE AND FITTINGS MATERIALS
17. ASTM F412 – STANDARD TERMINOLOGY RELATING TO PLASTIC PIPING SYSTEMS
18. ASTM F905 – STANDARD PRACTICE FOR QUALIFICATION OF POLYETHYLENE SADDLE-FUSION JOINTS
19. ASTM F1056 – STANDARD SPECIFICATION FOR SOCKET FUSION TOOLS FOR USE IN SOCKET FUSION JOINTING POLYETHYLENE PIPE OR TUBING AND FITTINGS
20. AWWA C207 – STEEL PIPE FLANGES FOR WATERWORKS SERVICE – SIZES 4 INCH THROUGH 144 INCHES
21. AWWA C508 – AWWA STANDARDS FOR SWING-CHECK VALVE FOR WATERWORKS SERVICE 2 INCHES THROUGH 24 INCHES NPS
22. AWWA C509 – AWWA STANDARD FOR RESILIENT SEATED GATE VALVES FOR WATER AND SEWER WORKS
23. AWWA C901 – STANDARD FOR POLYETHYLENE (PE) PRESSURE PIPE AND TUBING, ½ INCH THROUGH 3-INCH, FOR WATER SERVICE
24. AWWA C906 – STANDARD FOR POLYETHYLENE (PE) PRESSURE PIPE AND FITTINGS, 4 INCH THROUGH 63-INCH
25. PPI TR-4 – HYDROSTATIC DESIGN BASES, PRESSURE DESIGN BASES, AND MINIMUM REQUIRED STRENGTH RATINGS FOR THERMOPLASTIC PIPING MATERIALS OR PIPE

1.2 SUBMITTALS FOR REVIEW

A. SECTION 01 3300 – SUBMITTAL PROCEDURES

B. Product Data: Submit manufacturer’s literature including printed recommendations, compliance with Standards and Testing agencies, dimensions and sizes for all piping material, and fittings.

1. Indicate on submittal which materials, models, data, ratings, and options are being selected

C. Project Record Documents: The Contractor shall record actual horizontal and vertical locations of pipes, fittings, valves, and accessories for all site piping.

1. As-built information shall be given to the owner
2. Information format shall be specified by the owner.

1.3 MATERIALS HANDLING

A. Upon receiving of shipments, the Contractor shall check to ensure that the correct products and quantities have been delivered. The receiver shall have a procedure for reconciling any shipping discrepancies

B. Shipment shall be inspected for cuts, abrasions, scrapes, gouges, tears, and punctures

C. Unloading of shipments shall be done in accordance with manufacturer's recommendations

D. Pipes shall not be rolled or pushed off the delivery truck

E. All fabricated parts or fittings shall not be pushed or dumped off or dropped off the delivery truck

F. Wire rope slings and chains shall not be permitted to move pipe or fittings

G. Small diameter pipe shall not be stored inside of larger diameter pipe

H. Storage facility shall be clear of debris

I. Stacking and storage of pipe and fitting shall conform to manufacturer's recommendations

J. Non-UV protected components shall not remain in unprotected outdoor storage for more than two (2) years

K. Pipe shipped by trucking shall have the first third of the load covered with tarpaulins to ensure against diesel smoke contamination

PART 2 - PRODUCTS

2.1 POLYVINYL CHLORIDE (PVC) PIPING

A. Approved Manufacturers and Suppliers

1. Georg Fischer Harvel
2. JM Eagle
3. Pacific Plastics Incorporated
4. North American Pipe Corporation
5. Approved Equal

B. Buried Unplastisized Polyvinyl Chloride (uPVC) Pressure Pipe:

1. To comply with ASTM D1785, Schedule 40
2. If buried depth of pipe exceeds manufacturers recommended loading, Schedule 80 Pipe will be used
3. Schedule 80 pipe will be used for all sleeves

C. Above Grade Unplastisized Polyvinyl Chloride (uPVC) Pressure Pipe:

1. To comply with ASTM D1785, Schedule 80
2. Light gray in color

D. Screwed and Socketed PVC Pipe:

1. To comply with ASTM D2464

2.2 POLYVINYL CHLORIDE (PVC) FITTINGS AND JOINTS

A. Approved Manufacturers and Suppliers

1. Spears Manufacturing
2. LASCO Fittings
3. JM Eagle
4. Naco Industries
5. Approved Equal

B. Buried Unplastisized Polyvinyl Chloride (uPVC) Fittings:

1. To comply with ASTM D2466 or ASTM D2467
2. Flanged or solvent weld. No “slip type” or “push on type” gasket joints will be permitted
3. Gasket Material for flanged couplings to be composed of Viton®, EPDM, or Teflon® (PTFE)
4. Solvent Cement to comply with ASTM D2564

C. Above Grade Unplastisized Polyvinyl Chloride (uPVC) Fittings:

1. To comply with ASTM D2467
2. Flanged or solvent weld. No “slip type” or “push on type” gasket joints will be permitted
3. Gasket Material for flanged couplings to be composed of Viton®, EPDM, or Teflon® (PTFE)
4. Solvent Cement to comply with ASTM D2564
5. All PVC pipe exposed to sunlight shall be coated to resist deterioration due to ultraviolet radiation
6. Color to match above grade piping, light gray

D. Screwed and Socketed PVC Fittings:

1. To comply with ASTM D2464

E. Flanges:

1. Dimensions and drilling to comply with ANSI Standards
2. Rated as 250 lbs. (113.5 kg) flanges
3. Gasket Material for flanged couplings to be composed of Viton®, EPDM, or Teflon® (PTFE)
4. Back-up rings, bolts, washers, nuts, and threaded studs shall be 316L Stainless Steel

2.3 COPPER PIPE AND FITTING

A. Approved Manufacturers and Suppliers

1. Mueller Industries
2. NIBCO

B. Above Grade Copper Pipe

1. To comply with ASTM B88
2. Type L, Hard Drawn
3. Solder: ASTM B32, Grade 95TA

C. Above Grade Copper Fittings:

1. To comply with ASME B16.18 or ASME B16.22

PART 3 - EXECUTION

3.1 GENERAL

A. All pipe installation shall be in strict accordance with the instruction and recommendations provided by the pipe manufacturer.

B. Size of any section of pipe for which size is not indicated or any intermediate section erroneously shown undersized shall be the same size as the largest pipe connecting to it.

C. Pipe sizes shown on the Contract Documents are nominal.

D. Design Velocities in pipe shall not exceed 5.5 feet per second (1.7 m/s).

E. All Pipe used to transport water that will encounter the general population shall be NSF 50 Approved for potable water use.

F. Pipe shall have a print line every 2-feet (0.6m) stating the manufacturer, product, trade name, material, size, and dimension ratio, manufacturing standard, production lot code, and date of manufacturing.

G. Fitting shall be individually marked with the following information: description, material, manufacturing standard, and production lot number.

3.2 PREPARATION

A. Hot dip galvanize all items that are not factory furnished or 316L Stainless Steel.

B. Determine depth, size, and alignment of existing utilities before beginning excavation.

C. Use only tools and components required to construct and installed joints in accordance with the manufacturer’s recommendations.

D. All field connection methods and procedures required that the component ends to be free of surface defects before the connection is made.

3.3 PVC PIPE INSTALLATION

A. Below Grade Piping (Site Piping)

1. Obtain written approval from governing Municipality prior to connecting to main lines. Connect to main lines as indicated on the Contract Documents and as approved by governing Municipality.
2. Verify dimensions and elevations of main lines are as indicated on the Contract Documents. Immediately notify Owner/Engineer of any discrepancies or conflicts.
3. Make connections to main lines and visually inspect for leakage with line under pressure prior to backfilling.
4. Install pipe to indicated elevation to within tolerance of 5/8-inch (15mm). Avoid installing pipe with high and low points. Install air/vacuum valves at all high points.
5. Exercise due care to avoid deposit of excavation material and other foreign substance in interior of pipe. Remove foreign material from pipe before proceeding with the Work. Plug pipe during work stoppages to prevent debris from entering pipes.

6. Place a minimum of 4-inch (0.1m) deep bed of approved bedding material.
7. Where two or more pipes are placed side by side in the same trench maintain clear spacing between pipes to all for hand operated mechanical compaction equipment or 12-inches (0.3m) whichever is greater.
8. Joint deflection greater than two (2) degrees will not be allowed.
9. PVC pipe saddles shall be secured to the pipe with two (2) 316L Stainless Steel pipe clamps and both saddle and straps shall be wrapped in a fiberglass liner.
10. Where pipes extend under footings run pipe in Schedule 80 pipe sleeves. Sleeves shall be next larger pipe size and extend 10-feet (3m) beyond front and back face of footing
11. Repair broken small diameter pipes with glued couplings, large diameter pipes with flexible repair couplings.
12. Install liner boots and provide watertight joints between liner and liner boot at all pipe penetrations.
13. Install link seal through all wall penetrations that have dry conditions on both sides of the wall.
14. Install water stop flanges at all wall penetration that have wet conditions on either side of the wall.
15. Welded (glued) buried pipe does not require thrust blocks, except at locations shown on the Contract Documents and immediately after flexible couplings.

B. Above Grade Piping

1. Locate equipment in location shown on the Contract Documents. Position or rotate equipment to result in good appearance and easy access to all components for maintenance and repairs prior to installing piping.
2. Install, level, and secure equipment. Provide shims, anchors, support straps, angles, grouted bases, or other items as required to accomplish proper installation.
3. Install flanges on pipe larger than 3-inches (80mm) wherever connections are made to pumps, valves, strainers, and other equipment to facilitate removal for servicing. For pipes smaller than 3-inches (80mm) use union connections.
4. Install piping, flues, breaching ducts, and supports so they do not interfere with equipment access.
5. Change pipe size within three pipe diameters of final connection to pumps, filters, and other equipment where it is necessary to reduce pipe size.
6. Cut pipe accurately to job measurements within plus or minus 1/4-inch (6mm) and install without springing or forcing, true to line and grade, generally square with building and structures.
7. Adequately support pipe, fittings, and accessories to prevent undue stress and to comply with SECTION 13 1403.
8. Arrange pipe and hangers to allow for expansion, contraction, and structural settlement
9. Make changes of direction with manufactured fittings.
10. Street elbows, bushings, reducing flanges, close nipples, or bending pipe will not be allowed
11. Pipe shall not contact structure except at penetrations shown on the Contract Documents.

12. Run pipe full size through shutoff valves, balance valves, and control valves unless otherwise noted on the Contract Documents.
13. Seal pipes penetrating and existing wall through core drilled holes with “Link Seal” type expansion seals.
14. Seal pipes penetrating new walls under construction through a PVC sleeve with water stop flange and a Link Seal placed between pipe and approved sleeve.
15. Provide dielectric connections between copper and dissimilar metals Install connections in vertical sections of piping only.
16. The Contractor shall coordinate pipe routing with electrical duct banks and heating/ventilation duct work.
17. All pipes that are installed above grade and outdoors shall have a heavy coat of light color latex base paint that is chemically compatible with PVC pipe and fittings. Compatibility should be confirmed by paint manufacturer.

C. Joints and Solvent Welds

1. Install above grade, below grade, buried, and imbedded PVC piping using solvent weld fittings in accordance with ASTM D2564, ASTM 2774, and ASTM D2855.
2. Remove any burrs and chamber pipe ends after cutting then prepare each fitting and pipe end with solvent primer.
3. Join each fitting individually and allow enough time for the joint to seal solidly before assembly of adjacent joints.
4. After joining, an even ring of primer shall be visible around entire fitting.
5. If fittings are installed without visible primer, fitting shall be removed and discarded and piping re-cut, re-chambered, and joint made up again using a new fitting.

END OF SECTION 131401

SECTION 131402

WATER FEATURE PIPE TESTING AND CLEANING

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes the following:

1. Testing and Cleaning of the piping system

B. Related Sections:

1. SECTION 13 1401 – WATER FEATURE PIPE AND FITTINGS
2. SECTION 13 1511 – WATER FEATURE VALVES, GAUGES, AND METERS

1.2 SUBMITTALS FOR REVIEW

A. SECTION 01 3300 – SUBMITTAL PROCEDURES

B. Prior to installing pipe, provide a plan to remove foreign materials from pipes that may have gained access into newly installed or repaired main lines.

C. Certification: Provide certification that the piping system to be tested has been thoroughly cleaned and meets or exceeds specified requirements prior to testing pipeline.

D. Test Reports: Provide results of every test passing or failing. The Contractor and Owner's Representative shall sign each Test Report. Reports shall include a description of the pipeline being tested, date, start time, pressure at the start of the test, pressure at the second part of the test, ending time, and pressure at the end of the test. If any additional water was added to the pipeline during the test, the quantity and times must be noted. Any other comments specific to the test shall also be noted.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION

3.1 GENERAL

A. All newly laid and installed piping shall be subjected to a Hydrostatic Pressure Test.

B. Prior to test, verify all piping, valves, and fittings have been laid and properly installed. Verify bolts on all flanges are tight and secure.

C. Test each pipeline within five (5) days after completion of the pipeline section. Each section of pipeline must successfully pass the Pressure Test and have been thoroughly flushed prior to submittal of payment.

D. The Hydrostatic Pressure Test shall not be done in conjunction with a line disinfection process.

E. A Leakage Test shall be conducted in connection with the Pressure Test, if and only if directed by the Engineer.

F. The Contractor shall furnish all the necessary equipment and manpower for completing the Hydrostatic Pressure Test and Leakage Test.

G. The Contractor shall provide sufficient flanges, plugs, or caps so that a pipe that has successfully passed the Tests can and shall remain under pressure for the duration of the construction period or until start-up.

H. Keep all personnel a safe distance away from test points during testing.

I. The test section shall always be supervised during the test.

J. All piping shall be restrained against possible movement from catastrophic failure at joints and connections. Never conduct Test on unrestrained piping.

K. All joints of test sections shall be properly cured and/or cooled before testing can begin.

L. Mechanical connections must be completely installed and tightened per manufacturer's instructions.

M. If backfill provided restraint, backfill shall be properly placed and compacted. Joints and connections must be exposed for inspection.

N. End closures must be suitable for pressure service and pressure-rated for the test pressure.

O. Fill out appropriate worksheet indicating information of section tested. Samples of worksheets are found immediately following this specification.

3.2 HYDROSTATIC PRESSURE TESTS FOR PVC PIPE AND FITTINGS

A. Test the pipeline at 1.5 times the maximum static pressure anticipated in the pipeline, or at 70 psi (482 kPa), whichever is greater.

B. Prior to testing, the pipeline shall be flushed or vacuumed to remove all construction debris and foreign material from the pipeline.

C. Perform the Hydrostatic Pressure Test using the following procedure:

1. Install flanges on both ends of the pipeline and at any tees or branches in the line as required
2. Install a test pressure gauge at the lowest end of the pipeline. The full scale reading of the test gauge shall not be more than 15-percent of the specified test pressure. For a test pressure of 70 psi (482 kPa) the maximum gauge reading would be 80 psi (551 kPa).
3. Slowly fill the pipeline with clean water.
4. Expel any air from the pipeline, make necessary taps at points for highest elevation before test made and insert plugs after the test has been completed.
5. Bring pipe to specified test pressure plus 10 psi (69 kPa), by means of a pump connected to the pipe in a manner satisfactory to the Engineer. The pressure on the gauge must be corrected to account for the elevation for which the gauge is installed.
6. Maintain the specified test pressure plus 10 psi (69 kPa) for one (1) hour by adding additional water as required.

7. At the end of the hour, reduce the pressure in the line by 10 psi (69 kPa) to the specified test pressure.
8. Immediately after the pressure has been reduced to the specified test pressure begin Part 2 of the test. Part 2 of the test shall last for two (2) hours.
9. A successful test shall consist of maintaining the specified test pressure for the entire two (2) hour duration without a drop in pressure on the test pressure gauge.
10. During the test period, neither additional water nor air is to be added to the pipeline, unless a Leakage Test had been requested by the Engineer, and only if requested.

D. After the Hydrostatic Pressure Test has been completed the line shall be flushed as described in Section 3.3.

3.3 LEAKAGE TEST FOR PVC PIPE AND FITTINGS ONLY

A. The Leakage Test shall serve as a secondary acceptance test and is to be used solely at the discretion of the Engineer and if the Hydrostatic Pressure Test failed.

B. The Test shall be performed in the same manner as the Hydrostatic Pressure Test described in Section 3.2. However, once the two (2) hour period described in Section 3.2.C.8 is started, water shall be added to the system as required to maintain the specified test pressure for the entire two (2) hour duration.

C. The amount of leakage is defined as the quantity of water added to the pipeline to maintain the specified test pressure for the entire two (2) hours.

D. No pipe installation will be accepted until the leakage test is less than 10 gallons per mile (38 liters per 1,609m), per 2-inch (50mm) diameter, per day.

3.4 FLUSHING PIPELINES FOR PVC

A. All pipelines shall be thoroughly flushed or vacuumed before and immediately after the Pressure Test.

B. If the line is damaged after the initial Pressure Test, the lines shall be thoroughly flushed or vacuumed and the Pressure Test repeated.

C. Flushing will only remove the lighter solids and cannot be relied upon to remove heavy material or debris that was allowed to enter the pipe during installation.

D. Extreme care and thorough inspection shall be practiced during installation of pipelines to prevent small stones, pieces of concrete, particles of metal, sand, dirt, or other foreign material from gaining access into the pipelines.

E. Once the line has been thoroughly flushed, flanges, plugs, and/or caps shall be installed on the pipeline. The pipe shall be filled with water and shall remain full for the duration of construction or until start-up.

3.5 QUALITY ASSURANCE

A. Should any test of pipe fail to maintain pressure or exceed the allowable leakage for the entire two (2) hour duration, the Contractor, at his own expense, shall locate and repair or replace defective pipe, fittings, or connections and then re-test the pipe again until test results are within the specified allowances.

B. The Engineer or Owner may direct the Contractor to repair specific leaks regardless of the test results, if leaks are found in the pipeline.

END OF SECTION 131402

(Pertains to Section 13 1402.3.2) Date:_____

PVC PIPE PRESSURE TEST For: _____

SITE CONDITIONS:

Ambient Air Temperature: _____ °F or °C (circle one)

Description of section being tested: -

_____

Nominal Pipe Diameter: _____ inches or mm (circle one)

Pipe Length: _____ Feet or Meters (circle one)

Testing Media: _____ (Water or Other, please specify)

Maximum Pressure Reading: _____ psi or kPa (circle one)

TESTING DATA:

Section Testing Pressure: _____ psi or kPa (circle one)

Initial time of bringing section to test pressure + 10 psi (69 kPa):
_____ a.m. or p.m.

Time when pressure test began:
_____ a.m. or p.m.

Time when pressure test ended:
_____ a.m. or p.m.

Pressure at end of test: _____ psi or kPa (circle one)

Test Passed? _____ Yes or _____ No

_____

(Contractor's Signature)

_____

(Owner's Representative's Signature)

SECTION 131403

WATER FEATURE PIPE HANGERS, SUPPORTS, AND ANCHORS

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes the following:

1. Pipe and Equipment Hangers and Supports
2. Equipment Pads and Supports
3. Sleeves, Seals, and Waterstop Flanges
4. Thrust Blocks
5. Flexible Couplings

B. Related Sections:

1. SECTION 13 1204 – WATER FEATURE CAST IN PLACE CONCRETE
2. SECTION 13 1401 – WATER FEATURE PIPE AND FITTINGS
3. SECTION 13 1502 – WATER FEATURE PUMPS AND MOTORS
4. SECTION 13 1503 – WATER FEATURE FILTERS
5. SECTION 13 1504 – WATER FEATURE CHEMICAL FEED SYSTEMS
6. SECTION 13 1505 – WATER FEATURE OZONE GENERATION AND INJECTION
7. SECTION 13 1507 – WATER FEATURE HEATERS
8. SECTION 13 1511 – WATER FEATURE VALVES, GAUGES, AND METERS

C. References:

1. ASME B31.9 – BUILDING SERVICES PIPING
2. ASTM A536 – STANDARD SPECIFICATION FOR DUCTILE IRON CASTING
3. ASTM F708 – STANDARD PRACTICE FOR DESIGN AND INSTALLATION OF RIGID PIPE HANGERS
4. MMS SP58 – PIPE HANGERS AND SUPPORTS – MATERIALS, DESIGN AND MANUFACTURER
5. MMS SP69 – PIPE HANGERS AND SUPPORTS – SELECTION AND APPLICATION

1.2 SUBMITTALS FOR REVIEW

A. SECTION 01 3300 – SUBMITTAL PROCEDURES

B. Product Data: Provide manufacturers catalog data including type of material and load capacity.

C. Shop Drawings: The Contractor shall provide drawings indicating hanger schedule and layout showing location, type, and material of hanger, sign and sealed by a Structural Engineer.

D. Design Data: Indicate load carrying capacity of trapeze, multiple pipes, and riser support hangers.

E. Manufacturer's Installation Instructions: Indicate special procedures and assembly of components.

F. Warranty: Submit manufacturer's warranty and ensure forms have been completed in the owner's name and registered with the manufacturer.

PART 2 - PRODUCTS

2.1 PIPE HANGERS AND SUPPORTS

A. Acceptable Manufacturers

1. Grinnell
2. Eaton B-Line

B. Pipe Hangers:

1. Conform to ASME B31.9 and ASTM F708.
2. All Hangers shall be fiberglass or stainless steel. Galvanized is acceptable only for installations in non-marine or non-coastal environments subject to approval by the Engineer.
3. Hangers for pipe sizes 1/2-inch to 1-1/2-inch (15mm to 40mm): adjustable swivel, split ring style
4. Hangers for pipe sizes 2-inch (50mm) and larger: adjustable, clevis style.
5. Multiple or Trapeze Hangers: fiberglass channels with spacers and hanger rods. Galvanized material is acceptable for non-marine or non-coastal environments subject to approval by the Engineer.
6. Hangers shall be sized to support the pipe when full of water.

C. Hanger Rods:

1. Use rod threaded at both ends or continuously threaded. Stainless steel rod for marine environments. For non-marine or non-coastal environments galvanized steel is acceptable, subject to approval by the Engineer.
2. Sized adequately to support pipes full of water.

D. Fasteners:

1. Shall be fiberglass or stainless steel. Galvanized is acceptable only for non-marine or non-coastal environments, subject to approval by the Engineer.

2.2 WALL SLEEVES and SEALS

A. Acceptable Manufacturers

1. Linkseal
2. GPT industries
3. Innerlynx

B. Sleeves: Molded, non-metallic high density polyethylene

C. Fasteners: 316L Stainless Steel

D. Pressure Plates: Molded glass reinforced nylon

E. Elastomers: EPDM

2.3 WATERSTOP FLANGES

A. Acceptable Manufacturers

1. ASA Manufacturing Incorporated
2. Lawson Aquatics
3. Approved Custom Fabrication

B. PVC Waterstop Sleeve Fittings

1. Shall be constructed of PVC and be capable of being primed and glued in place.
2. Waterstop shall be place between the water-retaining side of the wall and the reinforcing steel
3. Waterstop shall be tied in place to the reinforcing steel.

C. Fiberglass Waterstop Sleeve Fittings

1. Shall be constructed of fiberglass and be capable of accepting Schedule 40 and Schedule 80 PVC pipe with socket-to-socket connections.

2.4 FLEXIBLE COUPLINGS

A. Acceptable Manufacturers

1. Cascade Waterworks
2. Baker Couplings
3. Trupply – Dresser Couplings

B. Ductile Iron end and center rings complying with ASTM A536.

C. EPDM or Viton® gaskets.

D. Fasteners shall be 316L Stainless Steel, including nuts, bolts, and washers.

E. Coupling shall be designed for below ground installation.

PART 3 - EXECUTION

3.1 Installation

A. General:

1. Acceptable pipe supports are shown in the General Details section of the Contract Documents.
2. Support Valves and Equipment adequately at both flanges, if in a horizontal position, and by the top flange if in a vertical position.

B. Pipe Hangers and Supports

1. Support horizontal and vertical piping as scheduled.
2. Install hangers to provide a minimum 1/2-inch (13mm) space between finished covering and adjacent work.
3. Place hangers within 12-inches (0.3m) of each horizontal elbow.
4. Use hangers with 1-1/2-inch (38mm) minimum vertical adjustment
5. Support horizontal pipe with a 5-feet (1.5m) maximum spacing between hangers, or as determined by Structural Engineer.
6. Provide lateral restraints at bends in pipe as required and as directed by the Structural Engineer
7. Support vertical piping at every floor the pipe passes through. Provide intermediate supports where spacing exceeds 10-feet (3m) between supports.

8. Support for vertical piping shall include both vertical and lateral support.
9. Install couplings or similar tight fitting metal sleeve at each floor support for vertical piping. Couplings or sleeves shall rest on and transmit load to support.
10. Where several pipes can be installed in parallel and at the same elevation, provide multiple or trapeze hangers.
11. Provide copper plated hangers and supports for copper piping.
12. Design hangers for pipe movement without disengagement of supported pipe.
13. Size Hanger Rods, screws, bolts, nuts, etc according to manufacturer's sizing charts for mass and pipe size being supported.
14. Do not use wire or other makeshift devices for hangers.
15. Pipe located near the floor may be supported with galvanized steel stanchions welded to end plates and secured to pipe and floor.
16. To prevent sway and lateral movement due to thrust, provide angle iron bracing anchored into walls or overhead framing at bends. In seismic zones, use appropriate sway suppression devices.

C. Equipment Pads and Supports

1. Provide Equipment, or Housekeeping, Pads of concrete, minimum of 4-inches (0.1m) thick and extending a minimum of 3-inches (75mm) beyond supported equipment, unless otherwise noted on the Contract Documents.
2. Provide templates, anchor bolts, and accessories for mounting and anchoring equipment.
3. Provide shims, anchors, support straps, angles, grouted bases, or other items required to accomplish proper installation.
4. Construction of galvanized steel stanchions welded to end plates secured to the floor and pipe or equipment.

D. Sleeves, Seals, and Water Stop Flanges

1. Set Sleeves in position in form work. Provide adequate reinforcing around sleeves.
2. Size Sleeves large enough to allow for movement due to expansion and contraction.
3. Extend Sleeves through floors 1-inch (25mm) above finished floor level. Chalk Sleeves.
4. Install "Link Seal" type waterproof seal at all penetrations to floors, ceilings, or walls that do not penetrate water retaining structures.
5. Install water stop flanges with a bead of Swell Seal around pipe at the base of the flange for all penetrations into water retaining structures.
6. Waterstop shall be placed between the water-retaining side of the wall and the reinforcing steel.
7. Provide a minimum 2-inch (50mm) cover of concrete for all Waterstop Flange couplings.
8. Waterstop shall be tied in place to the reinforcing steel.

E. Thrust Blocks

1. Install concrete anchor blocks, thrust blocks, and support blocks with tie downs to support pipe, fittings, or valves as indicated on the drawings.

2. For buried piping install concrete thrust blocks at the first bend after mechanical fasteners, or after a pipe penetrates a wall.
3. Thrust blocks may not be required for glued or welded pipe, subject to approval by the Engineer.

F. Flexible Couplings

1. Install Flexible Couplings in areas of anticipated differential settlement including, but not limited to:
   a. Building wall penetrations.
   b. Retaining and site wall penetrations.
2. Install two (2) couplings per pipeline with a minimum of 2-feet (0.6m) spacing between couplings
3. Support couplings to prevent pipe pullout.
4. Provide concrete thrust block at first bend after flexible couplings.
5. When couplings are used to repair broken pipes, install concrete thrust blocks upstream and downstream from the coupling.

END OF SECTION 131403

SECTION 131404

WATER FEATURE WHITE GOODS

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes the following:
   1. Prefabricated Gutter
   2. Gutter Drains
   3. Perimeter Grating

B. Related Sections:

   1. SECTION 13 1204 – WATER FEATURE CAST IN PLACE CONCRETE
   2. SECTION 13 1205 – WATER FEATURE SHOTCRETE
   3. SECTION 13 1305 – WATER FEATURE ACCESSORIES
   4. SECTION 13 1401 – WATER FEATURE PIPE AND FITTINGS
   5. SECTION 13 1502 – WATER FEATURE PUMPS AND MOTORS
   6. SECTION 13 1503 – WATER FEATURE FILTERS
   7. SECTION 13 1511 – WATER FEATURE VALVES, GAUGES, AND METERS

C. References:

   1. National Sanitation Foundation (NSF) – Standard 50 Specification
   2. NFPA 70 – National Electrical Code (NEC) – Article 680-21
   3. Underwriters Laboratories (UL)
   4. Virginia Graeme Baker Pool and Spa Safety Act (VGB)

1.2 SUBMITTALS FOR REVIEW

A. SECTION 01 3300 – SUBMITTAL PROCEDURE.

B. Product Data: Submit manufacturer’s literature including printed recommendations, compliance with Standards and Testing Agencies, dimensions and sizes of products.

   1. Indicated on submittal which materials, models, data, ratings, and options are being selected.

C. Shop Drawings: Indicated layout, general assembly, components, dimensions, clearances, and method of assembly.

D. Maintenance Data: Include manufacturer’s literature, maintenance recommendation, and replacement parts list.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Accept components on site in factory packing and inspect for damage.

B. Protect components received at site from physical damage, including effects of weather, water, and construction.

PART 2 - PRODUCTS

2.1 PREFABRICATED GUTTER

A. Approved Manufacturers and Suppliers

1. ASA Manufacturing
2. Lawson Aquatics

B. Prefabricated Gutters shall be constructed of multiple layers of premium fiberglass and resin. Interior of gutters shall have a smooth gel coat finish. A water stop flange shall be integral to the gutter construction

C. Individual fiberglass sections to be available in either straight or curved sections in lengths up to 10-feet (3m) and are to be flanged, pre-drilled, and include the necessary stainless-steel hardware for bolting the sections together.

D. Gutter outlets shall be sized as shown on the Contract Documents. The Contractor shall verify all pipe connection sizes.

E. Gutter shall be installed as per manufacturer's recommendations for leveling and assembly. All gutters shall be level within 1/8-inch (3mm) along the entire perimeter.

F. The Contractor shall provide Perimeter Grating that is compatible with the gutter system.

2.2 GUTTER DRAINS

A. Approved Manufacturers and Suppliers

1. Pentair Pool Products
2. Hayward Industries
3. Recreonics
4. Lincoln Aquatics

B. Gutter Drain fittings shall be NSF 50 approved.

C. Gutter Drain fittings shall be constructed of a non-corrosive and non-conductive material, such as ABS or PVC.

D. The Contractor shall provide gutter drain fittings as shown on the Contract Documents and shall verify the pipe connection sizes.

2.3 PERIMETER GRATING

A. Approved Manufacturers and Suppliers

1. Lawson Aquatics
2. RenoSys
3. Natare
4. Recreonics
5. Lincoln Aquatics

B. Perimeter grating shall be constructed of UV stabilized PVC, FRP, or other non-corrosive and non-conductive material. Stone or precast concrete grating shall be non-porous.

C. The top surface must have a raised, non-slip pattern to meet the static coefficient of friction when wet or dry.

D. The space between the pieces must not exceed 3/8-inches (10mm) and provide a minimum open area of 37.5-percent per foot to allow unrestricted water flow.

E. The contractor shall submit standard color ships to landscape architect for approval of grate color.

F. The Contractor shall verify the thickness of the grate is compatible with the construction of the gutter.

PART 3 - EXECUTION

3.1 GENERAL

A. Install products, equipment, and accessories in accordance with manufacturer's recommendations, local building codes, and Public Health Department requirements.

B. Locate skimmers, inlets, jets, drains, and etc. in locations shown on the Contract Documents.

3.2 PREFABRICATED GUTTER SYSTEM

A. Install gutter system as per manufacturer's recommendations, including leveling and support devices.

3.3 GUTTER DRAINS

A. Install gutter drains as shown on the Contract Documents. The Contractor shall verify the spacing of the gutter drains.

B. The Contractor shall slope the gutter to the gutter drains.

3.4 PERIMETER GRATING

A. Install Perimeter Gutter as shown on the Contract Documents. The Contractor shall install the grating as recommended by the manufacturer.

B. The Contractor shall verify that the grating thickness is compatible with the gutter installation.

C. The grating shall be flush with the pool deck or pool shell as per installation condition.

END OF SECTION 131404

SECTION 131501

WATER FEATURE MECHANICAL IDENTIFICATION

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes the following:

1. Equipment Name Plates
2. Valve Tags
3. Stencils
4. Pipe Markers

B. Related Sections:

1. SECTION 13 1401 – WATER FEATURE PIPE AND FITTINGS
2. SECTION 13 1502 – WATER FEATURE PUMPS AND MOTORS
3. SECTION 13 1503 – WATER FEATURE FILTERS
4. SECTION 13 1504 – WATER FEATURE CHEMICAL FEED SYSTEMS
5. SECTION 13 1505 – WATER FEATURE OZONE GENERATION AND INJECTION
6. SECTION 13 1507 – WATER FEATURE HEATERS
7. SECTION 13 1511 – WATER FEATURE VALVES, GAUGES, AND METERS

C. References:

1. The latest published edition of a reference shall be applicable, unless identified by a specific edition date.
2. All materials, installation and workmanship shall comply with the applicable requirements and standards addressed within the following references:

a. ANSI / ASME A13.1 “Scheme for the Identification of Piping Systems”.
b. ANSI Z535.1 “Safety Color Code”.

1.2 SUBMITTALS FOR REVIEW

A. SECTION 01 3300 – SUBMITTAL PROCEDURES

B. Submit product data sheets on all products contained in this section for approval. Data sheets must substantiate conformance with applicable standards.

C. Shop Drawings: Provide drawings indicating wording, symbols, letter size, and color coding for mechanical identification.

1. Submit process diagrams indicating equipment numbers and valve tag numbers with a valve schedule and chart. Schedule shall indicate valve position during normal and shutdown operation.
2. Approved drawing shall be mounted on foam board, laminated, and mounted on mechanical room wall.

1.3 Coordination

A. Coordinate installation of mechanical identification devices with the completion of covering and painting of services where devices are to be applied.

B. Coordinate installation of mechanical identification devices with the location of access panels and doors.

C. Install identifying devices before installing acoustical ceiling tiles or similar concealment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Provide manufacturers standard products that conform to ANSI / ASME A13.1 requirement for lettering size, background size, background color and angle of installation.

B. Provide mechanical identification materials manufactured by:

1. Brady Corporation
2. ASG Technologies
3. Seton Identification Products
4. Approved Contractor Submitted Alternate

2.2 EQUIPMENT NAME PLATES

A. General: Provided an engraved multi-layered plastic laminated nameplate for all mechanical equipment purchased for this project. Nameplate to be 1/16-inch-thick black with white letters. Provide an additional engraved nameplate for each disconnect and controller connected to the mechanical equipment.

B. Mechanical Equipment: Nameplate shall be a minimum of 3-inches high x 6-inches wide engraved with 3/4-inch high (minimum) lettering identifying the Equipment Tag as shown on the mechanical drawings and schedules. If necessary, the size of the plate should be enlarged to accommodate 3/4-inch characters. Do not reduce the letter height.

C. Disconnects and Controllers: Nameplate shall be a minimum of 2-inches high x 4-inches wide engraved with 1/2-inch high (minimum) lettering exactly matching the connected equipment nameplate. If necessary, the size of the plate should be enlarged to accommodate 1/2-inch characters. Do not reduce the letter height.

D. Access Panels: Provide a 1/16-inch-thick white nameplate with black letters identifying access to concealed valves or equipment such as those found above acoustical ceilings tiles. The nameplate shall be 3/4-inches high x 2-1/2-inches wide. Coordinate the information to be engraved on each plate so that it exactly matches the valve tag or equipment nameplate. The minimum letter height shall be 1/4-inch. Install these nameplates on the ceiling support to the right of the tile that would provide access.

2.3 VALVE TAGS

A. General: Provide valve tags on all controlling valves installed and related to this project. Match service abbreviations and identification number with mechanical drawings.

B. Valve Tags shall be approximately 19 gauge brass and no less than 1-1/2-inches in diameter. Tag shall be stamped and black filled with a service abbreviation and ID number. The service abbreviation shall be on the top line and be no less than 1/4-inches in height. The ID number shall be on the bottom line not less than 1/2-inch in height. If necessary, to accommodate longer abbreviations or number sequences increase tag size to 2-inches in diameter.

C. Attach valve tag to the stem or body of the valve so that the tag is visible but does not interfere with the valve operation.

2.4 STENCILS

A. Description: Stencils with clean cut symbols and letters of the following size:

1. 3/4- to 1-1/4-inch (19 to 32mm) Outside Diameter of Insulation or Pipe: 8-inch (200mm) long color field, 1/2-inch (13mm) high letters.
2. 1-1/2- to 2-inch (40 to 50mm) Outside Diameter of Insulation or Pipe: 8-inch (200mm) long color field, 3/4-inch (19mm) high letters
3. 2-1/2- to 6-inch (65 to 150mm) Outside Diameter of Insulation or Pipe: 12-inch (300mm) long color field, 1-1/4-inch (32mm) high letters
4. 8- to 10-inch (200 to 250mm) Outside Diameter of Insulation or Pipe: 24-inch (600mm) long color field, 2-1/2-inch (63mm) high letters
5. Larger than 10 inch (250mm) Outside Diameter of Insulation or Pipe: 32-inch (800mm) long color field, 3-1/2-inch (88mm) high letters

2.5 PIPE MARKERS

A. Identify all piping, concealed or exposed, with plastic pipe markers, plastic tape markers or stenciled painting.

B. Pipe Markers shall comply with ANSI / ASME A13.1 2007 "Scheme for the Identification of Piping Systems" and be installed as required and indicated below using legends spelled out fully with few abbreviations and directional arrows to indicate flow. Arrows must have the same background color as the pipe marker legend or be incorporated into the pipe marker.

C. Pipe marker color shall conform to ANSI Z535.1 "Safety Color Code".

D. Minimum information indicating flow direction arrow and identification of fluid being conveyed as follows:

Pipes carrying unfiltered water to be labeled as:	RAW WATER
Pipes carrying filtered water to be labeled as:	FILTERED WATER
Backwash piping labeled as:	BACKWASH
Chlorine piping labeled as:	CHLORINE
Ozone gas piping labeled as:	OZONE
Acid piping labeled as:	ACID
Soda Ash piping labeled as:	BASE

E. Plastic Pipe Markers: Supply and install factory fabricated, semi rigid plastic pipe marker.

1. Pipes with an overall diameter of 6-inches or less (including insulation), shall be marked with a wrap-around pipe marker formed as a pre-tensioned device to

extend 360° around the pipe at each location. Marker to be equipped with a 1/2-inch strip of adhesive on the inside to further secure the marker in a permanent position.

2. For pipes with an overall diameter greater than 6-inches (including insulation) provide a semi rigid plastic strap-on pipe marker with a height no less than 3 times the letter height supplied with no less than two nylon straps to secure the marker in place

F. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings in contrasting color. Pipe must be clean and dry prior to placement to ensure adhesion. Flow directional arrow markings shall wrap completely around pipe for pipes with an overall diameter of 6-inches or less (including insulation) or wrap no less than 20-inches around on pipe larger than 6-inches diameter.

G. Underground Plastic Pipe Markers: Provide bright colored continuously printed plastic ribbon tape identifying flow direction and fluid content. Tape shall be minimum 6-inches (150mm) wide by 4 mil (0.1mm) thick with a minimum tensile strength of 120 lbs., manufactured for direct burial service resistant to alkaline, acids, and other destructive agents usually found in soil.

PART 3 - EXECUTION

3.1 PREPARATION

A. All surfaces that are to receive adhesive applied mechanical identification nameplates or adhesive pipe marking tape should be clean and dry prior to application.

3.2 INSTALLATION

A. Equipment Name Plates

1. Install plastic name plates with a 2 mil. permanent double-faced adhesive covering entire surface of the nameplate or with stainless steel mechanical fasteners.
2. Identify pumps, filters, controllers, generators, and all other equipment with plastic name plates
3. Identify control panels and major control components outside panels with plastic name plates

B. Valve Tags

1. Attach each valve tag using the following solid brass (or other suitable material approved by the engineer) products: Jack chain, 1-1/2-inch “S” hooks, or #6 beaded chain.
2. Attach in a manner that tags are easily visible but do not obstruct the operation of the valve.

C. Stencils

1. Apply stencil painting in accordance with the manufacturer’s instructions.

D. Pipe Markers

1. Mark pipe in accordance with manufacturer’s instructions.

2. Install identifying markers/stencils in clear view so they are visible for a normal standing position and align with axis of piping.
3. Spacing between identifying markers/stencils not to exceed 20-feet (6m). Install above and below every floor penetration and on either side of every wall penetration and insure there is at least one marker per pipe in every room. Install pipe markers insuring visibility at each primary valve, branch, and any change in piping direction.
4. Flow directional arrow markings shall wrap completely around pipe for pipes with an overall diameter of 6-inches or less (including insulation) or wrap no less than 20-inches around on pipe larger than 6-inches diameter.
5. Install underground plastic pipe markers 6- to 8-inches (150 to 200mm) below finish grade, directly above buried pipe.

END OF SECTION 131501

SECTION 131502

WATER FEATURE PUMPS AND MOTORS

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes the following:

1. Pump Performance
2. Fresh Water Pumps
    a. End Suction, Close Coupled, Centrifugal Pumps

B. Related Sections:

1. SECTION 13 1401 – WATER FEATURE PIPE AND FITTINGS
2. SECTION 13 1403 – WATER FEATURE PIPE HANGERS, SUPPORTS, AND ANCHORS
3. SECTION 13 1501 – WATER FEATURE MECHANICAL IDENIFICATION
4. SECTION 13 1503 – WATER FEATURE FILTERS
5. SECTION 13 1504 – WATER FEATURE CHEMICAL FEED SYSTEMS
6. SECTION 13 1505 – WATER FEATURE OZONE GENERATION AND INJECTION
7. SECTION 13 1507 – WATER FEATURE HEATERS
8. SECTION 13 1511 – WATER FEATURE VALVES, GAUGES, AND METERS
9. SECTION 13 1602 – WATER FEATURE CONTROLS
10. SECTION 13 1609 – WATER FEATURE DISCONNECTS, MCC, AND STARTERS

C. References:

1. ANSI B16.5 – STANDARDS OF PIPES AND FITTINGS
2. AMERICAN WATER WORKS ASSOCIATION (AWWA) – SPECIFICATION E101-88
3. NATIONAL FIRE PROTECTION ASSOCIATION (NFPA) 70 or NATIONAL ELECTRICAL CODE (NEC)
4. NATIONAL SANITATION FOUNDATION (NSF) STANDARD 50
5. Occupational Safety and Health Administration (OSHA) Regulations
6. UNDERWRITERS LABORATORIES (UL)

1.2 SUBMITTALS FOR REVIEW

A. SECTION 01 3300 – SUBMITTAL PROCEDURES

B. Product Data: Submit manufacturer’s literature including pump and motor general assembly, dimensions, weights, clearances, service connections, wiring diagrams and controls.

1. Provide pump curves showing performance characteristics of pump and system, operating point indicated, required NPSH and efficiency curves.

2. Provide name plate data and ratings.

C. Shop Drawings: Indicate layout, clearances, and methods of assembly and installation.

D. Operation and Maintenance Data: Provide manufacturer's installation instructions, and specifications, start-up procedures, assembly drawings, troubleshooting check lists, scheduled maintenance recommendations, replacement parts list and repair data.

E. Warranty: Submit manufacturer's warranty and ensure forms have been completed in the owner's name and registered with the manufacturer.

F. Manufacturer's Certification: Submit documentation from the manufacturer certifying that pumps conform with NSF 50 guidelines.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the Work of this Section with a minimum five (5) years documented experience.

B. Comply with all applicable requirements of Division 16 Sections.

C. Comply with NFPA 70 and local energy codes.

D. Comply with BSEN and local energy codes.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Coordinate delivery with installation time to assure minimum holding time.

B. Accept pumps and components on site in factory packaging. Immediately upon receipt of shipment, inspect, and check for damage.

C. Protect pumps and components from physical damage including effects of weather, water, and construction debris.

D. Store pumps in accordance with Manufacturer's recommendations.

PART 2 - PRODUCTS

2.1 PUMP PERFORMANCE

A. Provide pumps matching discharge, electrical, and performance characteristics as shown on the equipment schedules on the Contract Documents.

2.2 FRESH WATER PUMPS

A. End Suction, Close Coupled, Centrifugal Pumps

1. Acceptable Manufacturers

a. Pentair
b. Hayward
c. Herborner

2. Casing

a. Molded from glass reinforced, corrosion-resistant thermoplastic with Bronze Wear Ring.

3. Impeller

a. Polycarbonate

4. Mechanical Seal
    a. Ceramic
5. Shaft and Shaft Sleeve
    a. Stainless steel with neoprene sleeve.
6. Pump and Motor Assembly
    a. Mounted on molded glass reinforced, corrosion resistant thermoplastic supporting both pump and motor ends.
    b. Motor to have Class F insulation with temperature rise as specified by NEMA Standards for class of insulation used and shall have a 1.15 service factor.
    c. Motor noise level to be less than 80-dBa at 3-feet (1m) or provided with a sound shroud.
7. Basket Strainer
    a. Body to be integral with pump housing.
    b. Transparent acrylic or Plexiglas lid with an ethylene propylene “O” ring.
    c. Quick release to allow strainer basket to be removed quickly and easily.
    d. 304 stainless-steel basket with 3/16-inch (5mm) rectangular holes and 75-percent open area. Holes in basket shall not be larger than 50-percent of minimum size of the pump it is protecting.
    e. Provide 1/4-inch (6mm) Ball Cock Valve to be installed in top of the strainer or lid to relieve trapped air.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces, substrates, and conditions for compliance with requirements of other sections in which the related Work is specified, and determine if surfaces, substrates, and conditions affecting performance of the Work of this Section are satisfactory. Do not proceed with the Work of this Section until unsatisfactory conditions have been corrected in a manner acceptable to the Installer. Starting installation shall constitute acceptance of surfaces, substrates, and conditions.

3.2 INSTALLATION

A. Install pumps and motors in strict compliance with the manufacturer’s recommendations to ensure manufacturer’s warranty conditions are met.

B. Locate pumps in locations indicated on the Contract Documents. Mount pumps on concrete housekeeping pads with embedded anchor bolts. Build templates for pump mounting from actual base plates delivered to site with pump and motor.

C. Inspect pumps and remove any dirt or foreign material from the pump suction and discharge. Check motor to make sure no foreign objects have entered through fan and cooling openings.

D. Verify clearances around the pump meet the manufacturer’s recommendations.

E. Pump and motor shall be leveled and grouted in place.

F. Piping connected to pump suction must be eccentric and aligned with the pump inlet. Piping connected to pump discharge must be concentric and aligned with the pump outlet.

G. Pipe enlargements at the pump suction and discharge must be made with reducer fittings. Bushing type fittings are not acceptable and will be replaced with eccentric or concentric reducers.

H. Check pump for alignment, lubrication, and rotation.

I. Provide drains for bases and seals, piped to and discharging into floor drains.

J. Provide connection to electrical service in accordance with all applicable sections of Division 16.

3.3 FIELD QUALITY CONTROL

A. Test entire system with pump manufacturer’s representative present.

B. Test to include three-point pump performance by measuring the amp draw and voltage, the discharge pressure, and the rate of flow.

C. Rate of flow must be within 10-percent above the approved curve for acceptance.

D. Discharge pressure head must be within 5-percent above the approved curve for acceptance.

E. Submit three (3) copies of the test results to the Engineer.

END OF SECTION 131502

SECTION 131503

WATER FEATURE FILTERS

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes the following:

1. High Rate Sand Filters
   a. Vertical Tank Configuration
   b. Sand and Activated Filter Media
   c. Backwash Control Valving
2. Backwash Sumps

B. Related Sections:

1. SECTION 13 1401 – WATER FEATURE PIPE AND FITTINGS
2. SECTION 13 1403 – WATER FEATURE PIPE HANGERS, SUPPORTS, AND ANCHORS
3. SECTION 13 1501 – WATER FEATURE MECHANICAL IDENTIFICATION
4. SECTION 13 1502 – WATER FEATURE PUMPS AND MOTORS
5. SECTION 13 1504 – WATER FEATURE CHEMICAL FEED SYSTEMS
6. SECTION 13 1505 – WATER FEATURE OZONE GENERATION AND INJECTION
7. SECTION 13 1507 – WATER FEATURE HEATERS
8. SECTION 13 1511 – WATER FEATURE VALVES, GAUGES, AND METERS
9. SECTION 13 1602 – WATER FEATURE CONTROLS

C. References:

1. UNDERWRITERS LABORATORY, INC (UL) STANDARD 508 for Industrial Control Equipment
2. ANSI B16.5 – STANDARDS OF PIPES AND FITTINGS
3. ASTM A53 – STANDARD SPECIFICATION FOR PIPE, STEEL, BLACK AND HOT-DIPPED, ZINC-COATED, WELDED AND SEAMLESS
4. ASTM A108 – STANDARD SPECIFICATION FOR STEEL BAR, CARBON AND ALLOY
5. ASTM A242 – STANDARD SPECIFICATION FOR HIGH-STRENGTH LOW ALLOY STRUCTURAL STEEL
6. NATIONAL FIRE PROTECTION ASSOCIATION (NFPA) 70 or NATIONAL ELECTRICAL CODE (NEC)
7. NATIONAL SANITATION FOUNDATION (NSF) STANDARD 50
8. Occupational Safety and Health Administration (OSHA) Regulations

1.2 SUBMITTALS FOR REVIEW

A. SECTION 01 3300 – SUBMITTAL PROCEDURES

B. Product Data: Submit manufacturer's literature including printed recommendations, dimensions and sizes, installation instructions, specifications, startup procedures and maintenance schedules for the filters, control panels, auto flushing valves and accessories.

1. Indicate on each submittal which materials, models, data, and options are being selected.

C. Shop Drawings: Provide certified engineering drawings and calculations to demonstrate structural strength of filter vessels.

D. Operation and Maintenance Data: Provide manufacturer's installation instructions, specifications, start-up procedures, assembly drawings, troubleshooting checklists, scheduled maintenance recommendations, replacement parts list and repair data.

E. Manufacturer's Certification: Submit documentation from the manufacturer certifying that Control Console meets UL Standard 508, Industrial Controller.

F. Manufacturer's Certification: Submit documentation from the manufacturer certifying that the Filter Vessels conform with NSF Standard 50 guidelines.

G. Warranty: Submit manufacturer's warranty and ensure forms have been completed in the owner's name and registered with the manufacturer.

H. Filter Manufacturers shall guarantee to repair or replace any filter tank, lateral, diverter, or internal header found defective due to any structural failure caused by delamination, fatigue, rust, scaling, corrosion, and UV rays for a period of five (5) years form date of final payment, except for Pentair Triton filters, which have one (1) year warranty.

1.3 REGULATORY REQUIREMENTS

A. All Work shall conform to applicable state and local codes, specifically, local electrical and health codes as they apply to public water features.

1.4 DELIVERY, STORAGE, AND HANDLING

A. All components of the filter system shall be supplied in wooden creates to facilitate shipments, handling and/or storage on the job site.

B. Coordinate delivery with installation time to assure minimum holding time.

C. Accept filters and components on site in factory packing. Immediately upon receipt of shipment, inspect and check for damage.

D. Protect filters and components from physical damage including effects of weather, water, and construction debris.

PART 2 - PRODUCTS

2.1 HIGH-RATE SAND FILTERS

A. Vertical Filter Configuration

1. Approved Manufacturers

a. Pentair Triton Commercial
b. Neptune-Benson
c. Hayward Industrial Products

2. Shall be capable of filtering water rates of 15 gpm/sq ft (10 lps/sq m) and backwashing rates from 15 gpm/sq ft (10 lps/sq m) to 20 gpm/sq ft (13.5 lps/sq m) of the filter media area.
3. Backwash Cycle shall be accomplished by reversing the flow through the vessel using filtered water from adjacent vessel(s). Backwash with raw source water is not acceptable.
4. Vertical Filter System shall include the following:
    a. Filter Vessel
    b. Distribution Piping
    c. Header Piping
5. Vessel:
    a. Constructed of molded colorfast polymeric material or seamless filament wound fiberglass reinforced plastic.
    b. Automatic air-relief valve.
    c. Drain port location in the bottom of the vessel.
    d. Inspection cover in the top of the vessel.
    e. Internal distribution piping to direct water evenly across the entire sand surface.
6. Distribution Piping:
    a. Influent and effluent connections shall be sized as shown on the Contract Documents.
    b. Influent and effluent pipes shall be fitted with Schedule 80 PVC flanged fittings with a minimum strength requirement of 1,500 lb-ft (207 kg-m) of bending moment and 200 lb-ft (28 kg-m) of torque.
    c. Internal distribution and collection system constructed of ABS plastic and Schedule 80 PVC pipe, fabricated with flow distributors threaded into Schedule 80 PVC pipe
    d. All distributors and laterals shall be threaded and replaceable.
    e. All internal components shall be hydraulically balanced to prevent migration of filter media during the filtration cycle.
    f. Each tank shall uniformly fluidize media in backwash cycle without channeling or breakthrough at any on location.
7. Header Piping:
    a. All header piping and fittings to be constructed of Schedule 80 PVC.
    b. Piping and fittings to be connected with flanges.
    c. Flanges to meet ANSI Standard pattern and designed with a minimum strength requirement of 1,500 ft-lb (207 kg-m) of bending moment and 200 lb-ft (28 kg-m) of torque.
    d. Backwash control valve(s) shall be supplied with each filter.
    e. Provide a backwash sight glass with each filter system.
    f. Header piping shall include all piping and fittings which connect two or more filters and valves into a system to provide a single influent, effluent, and backwash connection point.
    g. Header piping and fittings shall be sized as shown on the Contract Documents.

2.2 SAND AND ACTIVATED FILTER MEDIA

A. Grade #20 Silica Sand conforming to the following shall be used for both horizontal and vertical sand filters:

1. Effective size: 0.018-inch (0.45mm)
2. Uniformity Coefficient: 1.5
3. Mean Diameter: 0.0243-inch (0.61mm)
4. Standard Deviation: 0.00432-inch (0.11mm)
5. Conforming to the following gradation:

Sieve No. (U.S. Series)	Opening Size Inches (mm)	Percent Retained on Sieve (% by weight)
20	0.033 (0.838)	2
30	0.023 (0.584)	58
40	0.016 (0.406)	36
50	0.012 (0.305)	4

B. Activated Filter Media (AFM)

1. Filter media for vertical sand filters shall be AFM engineered & activated glass media produced by Dryden Aqua.
2. Supply and install Grade 1, Grade 2 and Grade 3 AFM in quantities appropriate for the specific filter according to filter manufacturer specified media levels.
   a. Grade 3 media (2.0-4.0mm) shall be used as underlayment support below filter laterals. Fill to mid-point of top of lateral assembly as recommended by filter manufacturer.
   b. Grade 2 media (1.0-2.0 mm) shall be used as a base layer above laterals approximately 20-30-percent of total filter bed depth (above laterals).
   c. Grade 1 media (0.4-1.0 mm) shall be used as the top layer filling to manufacturer specified bed depth, 70-80-percent of total bed depth (above laterals) leaving required freeboard above media bed.

2.3 BACKWASH CONTROL VALVING

B. Acceptable Manufacturers

1. ASAHI AMERICA
2. Approved Filter Manufacturer
3. Approved Equal

C. Vertical Sand Filter System

1. Multiport Type Control Valve
   a. Include the following settings:
      i. Filter: Normal operation
      ii. Backwash: For cleaning filter sand bed
      iii. Rinse: For rinsing after backwash
      iv. Waste: Bypassing filter for draining or lowering pool water
      v. Recirculate: Water bypasses filter
      vi. Closed: Shuts off flow from the pump to the filter

b. All construction materials shall be either PVC, CPVC, ABS, or similar thermoplastic material.
c. Control Valves shall be sized to meet the flow requirements of the filter system with minimal pressure loss of less than 10 psi (69 kPa).
d. Control Valves shall include a integral sight glass sufficient in size to enable operator visual inspection of the backwash water.
e. Selection of the Control Valve setting shall be operated with a level action handle for ease of function selection.
f. Selection of the Control Valves shall be provided with a liquid filled pressure gauge.
g. Backwash Control Valves shall be proven to operate properly with filter system selected and approved for use by the filter manufacturer.

2. Tandem Butterfly Valves (up to 8-inches (200mm) diameter)

a. Body construction shall be one piece thermoplastic PVC conforming to Cell Classification 12454. Body shall be wafer type conforming to ANSI B 16.5 bolt circle.
b. Disc shall be PVC or Polypropylene.
c. Stem shall be 316L Stainless Steel non-wetted type.
d. External metallic trim shall be 300 Series Stainless Steel, epoxy or powder coated.
e. Seals: Full Seat design, Isolating stem from median and functioning as a gasket for mating flanges. Material shall be EPDM.
f. Tandem Butterfly arrangement shall consist of two (2) butterfly valves mounted to a flanged T-style fitting.
g. Tandem mounting kit and hardware shall be manufactured stainless-steel and allow independent adjustment of opening and closing of valves.
h. Tandem mounting kit shall be of a design that fully supports valves and actuator.
i. Valves shall operate in opposite directions (i.e., one valve is opening as the other valve is closing).
j. All valves shall be tested by the manufacturer prior to shipment. Test documents shall be available upon request.

1.2 BACKWASH SUMPS

A. Backwash Sumps

1. Acceptable Manufacturers

a. ASA Manufacturing Incorporated
b. Approved Equal

2. Sumps shall be constructed of premium fiberglass and resin with a durable smooth gelcoat interior.
3. Include a heavy-duty grate cover.
4. Drainpipe shall discharge from the bottom of the box. Side discharges may only be used as approved by the Engineer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces, substrates, and conditions for compliance with requirements of other sections in which related Work is specified, and determine if surfaces, substrates, and conditions affecting performance of the Work of this section are satisfactory. Do not proceed with the Work of this section until unsatisfactory conditions have been corrected in a manner acceptable to the Installer. Starting installation constitutes acceptance of surfaces, substrates, and conditions.

3.2 INSTALLATION

A. Install filters in strict compliance with the Manufacturer's recommendations to ensure the Manufacturer's warranty conditions can be met.

B. Locate filters in locations indicated on the Contract Documents, on smooth and level concrete housekeeping pads.

C. Inspect filters removing any dirt or foreign material from the Filter vessel and influent, effluent, and distribution piping.

D. Verify access to filter man ways, control panel, drains, and valves in accordance with the Manufacturer's recommendations.

E. Install appropriate amount of filter media in each Filter vessel in accordance with manufacturer's recommendations.

F. Assemble header piping and valves on site as indicated on the Contract Documents. Pipes may need to be trimmed in the field. Header piping shall be installed without springing or forcing, true to line and grade, and square with the filter system.

G. Mount filter control console in the location indicated on the Contract Documents.

H. Run drain lines from filter drain locations with Schedule 40 pipe to floor drain and anchor drain pipe to unistrut supports and concrete floor as required.

I. Install backwash site glass in accordance with the Manufacturer's recommendation. Sight glass shall be installed in line so backwash flow from each vessel shall flow directly through the site glass.

J. Pipe backwash effluent line to backwash holding tank or sump or to the sanitary sewer line connection.

3.3 Backwash Sump

A. Provide a backwash sump as indicated on the Contract Documents.

B. Sump shall be sized to accommodate one (1) filter at a backwash rate of 25 gpm (95 lpm) per square foot (929 sq cm) of filter area for a minimum duration of five (5) minutes.

C. Backwash effluent lines from the filters shall discharge a minimum of 1.5 times the effluent lines size or 6-inches (150mm), depending upon requirements of the local jurisdiction, above the top of the tank or sump and be in a manner to prevent backwash water from splashing out.

D. Backwash sump shall have a drain in the bottom connected to the sanitary sewer line. The line shall be sized to meet the flow requirements provided by the Civil Engineer.

END OF SECTION 131503

SECTION 131504

WATER FEATURE CHEMICAL FEED SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes the following:

1. Chemical Test Kits
2. Chemical Metering Pump
3. Liquid Chlorine Feed System
4. Acid Feed System
5. Chemical Control Unit

B. Related Sections:

1. SECTION 13 1401 – WATER FEATURE PIPE AND FITTINGS
2. SECTION 13 1403 – WATER FEATURE PIPE HANGERS, SUPPORTS, AND ANCHORS
3. SECTION 13 1501 – WATER FEATURE MECHANICAL IDENTIFICATION
4. SECTION 13 1502 – WATER FEATURE PUMPS AND MOTORS
5. SECTION 13 1503 – WATER FEATURE FILTERS
6. SECTION 13 1505 – WATER FEATURE OZONE GENERATION AND INJECTION
7. SECTION 13 1507 – WATER FEATURE HEATERS
8. SECTION 13 1511 – WATER FEATURE VALVES, GAUGES, AND METERS
9. SECTION 13 1602 – WATER FEATURE CONTROLS

1.2 SUBMITTALS FOR REVIEW

A. SECTION 01 3300 – SUBMITTAL PROCEDURES

B. Product Data: Submit manufacturer’s literature including printed recommendations, dimensions and sizes, and accessories for each system type.

1. Indicate on the submittal which materials, models, data, and options are being selected.

C. Manufacturer’s Certification: Submit documentation from the manufacturer certifying that the chemical systems conform with National Sanitation Foundation (NSF) Standard 50 guidelines.

D. Operation and Maintenance Data: Provide manufacturer’s installation instructions, specifications, start-up procedures, assembly drawings, troubleshooting checklists, scheduled maintenance recommendations, replacement part lists and repair data.

E. Warranty: Submit manufacturer’s warranty and ensure forms have been completed in the owner’s name and registered with the manufacturer.

1.3 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacturing products specified in this Section with a minimum five (5) years of documented experience.

B. Installer Qualifications: Company specializing in performing the Work of this Section with a minimum of five (5) years of documented experience.

C. Chemical Control System: Provide with on-site start-up, on-site operator training, and on-site warranty service, all of which shall be performed by a representative trained and authorized by the Manufacturer.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Coordinate delivery with installation time to assure minimum holding time.

B. Accept chemical feed equipment and accessories on-site in original factory packaging. Immediately upon receipt of shipment, inspect, and check for damage.

C. Protect chemical feed equipment and accessories from physical damage including the effects of weather, water, and construction debris.

PART 2 - PRODUCTS

2.1 CHEMICAL TEST KITS

A. Acceptable Manufacturers

1. Liquid Reagent Test Kits

a. Taylor: Professional Complete Chlorine Testing Lab
b. Or approved equal

2. Portable Digital Test Meters

a. Myron L Company: Ultrameter III
b. Or approved equal

B. Liquid Reagent Test Kit:

1. Furnish one (1) test kit containing liquid reagents enough for at least five (5) complete tests for each of the following parameters:

a. Bromine (1-10 ppm) or Chlorine (1-10 ppm). Both free and total measuring capabilities
b. pH, Acid and Base demand (6.8 – 8.4)
c. Total Alkalinity
d. Calcium Hardness
e. Cyanuric Acid

2. Kit shall be provided in a portable molded plastic carrying case containing all reagents, comparators, waterproof instructions, and chemistry guide.

C. Portable Digital Test Meter

1. Furnish one (1) accurate portable digital test meter capable of analyzing the following six (9) parameters with auto ranging and auto temperature compensation:

a. pH
b. Total Dissolved Solids (TDH)

c. ORP in millivolts (mV)
d. Alkalinity
e. Hardness
f. Langelier Saturation Index (LSI)
g. Temperature in °F and °C
h. Mineral / Salt
i. Conductivity

2. Meter shall be direct reading, not colormetric or requiring reagents.
3. Meter shall be waterproof to 3-feet (1m) and buoyant.
4. Meter shall have a four (4) digit LCD display for full 9999 readings.
5. Meter shall log up to 100 readings with a date and time stamp and be capable of downloading .test data, with optional docking port, to a computer for records and reporting.
6. Meter shall be factory calibrated to NIST Standards with certification available upon request.
7. Furnish standard solution, minimum of 2 oz (59ml), for calibration of pH and conductivity, and for ORP and pH sensor storage.

2.2 CHEMICAL METERING PUMPS

A. Diaphragm Type Pump

1. Acceptable Manufacturers

a. LMI Milton Roy
b. PULSAtron
c. Graco

2. Housing of chemically resistant glass fiber reinforced thermoplastics

a. Fittings – PVDF
b. Seal Rings – Teflon, Viton (dependant on selected model)
c. Suction Tubing – Polyethylene
d. Diaphragms and Seals – Teflon

3. Materials that shall NOT be used: PVC, Acrylic, Stainless Steel, Ceramic, Vinyl, and Hypalon.
4. All interior pump components, seats, valves, etc to be compatible with the solution it is pumping
5. Pump drive shall be totally enclosed with no moving parts.
6. Electronics shall be housed in a chemical resistant enclosure.
7. Check Valve: Teflon.
8. Provide a Filter, Regulator, and Lubricator for each pump.
9. Provide a foot valve with integral one-piece strainer and enough polyethylene tubing with factory installed compression connections to run from the chemical storage tank to the pump, for each pump.
10. Provide a wall mounting bracket composed of polypropylene and associated hardware for each pump.
11. Metering pump shall incorporate a variable feed capability to adjust feed rates.

B. Peristaltic Type Pumps

1. Acceptable Manufacturers
    a. Stenner
    b. ProMinent Fluid Controls, Incorporated
2. NSF Standard 50 listing.
3. Housing of polycarbonate plastic rated for indoor or outdoor use.
4. Peristaltic Tube: Material appropriate to be in contact with liquid being pumped.
5. Suction and Discharge Tubing: Material of construction appropriate to be in contact with chemicals being pumped.
6. Electronics shall be housed in a chemical resistant enclosure.
7. Suction Weight: Ceramic.
8. Provide a foot valve with integral one-piece strainer and enough polyethylene tubing with factory installed compression connections to run from the chemical storage tank to the pump, for each pump.
9. Provide a wall mounting bracket composed of polypropylene and associated hardware for each pump.
10. Metering pump shall incorporate a variable feed capability to adjust feed rates.

2.3 LIQUID CHLORINE FEED SYSTEM

A. Chlorine Feed System shall dose stored Liquid Sodium Hypochlorite solution of a concentration of 10-percent by the means of a Chemical Metering Pump, which is activated upon a signal from the Chemical Control Unit.

B. Chlorine Feed System consists of the following:

1. Chemical Metering Pump
2. Chlorine Storage Tank
3. Containment Tank

C. Chlorine Storage Tank

1. Constructed of one-piece heavy-duty polyethylene or Nalgene with UV stabilizer.
2. Translucent with molded calibrations on the tank.
3. Flat bottom design.
4. Tight sealing, rigid high-strength lids.
5. Capacity: as indicated on the Contract Documents and equipment schedules.
6. Tank shall be sufficiently anchored to the floor to resist vertical loads (seismic or wind).

D. Containment Tank

1. Constructed of one-piece heavy-duty polyethylene or Nalgene with UV stabilizer.
2. Translucent with molded calibrations on the tank.
3. Flat bottom design.
4. Overall height shall be at least 2-inches (50mm) lower than the acid storage tank height.
5. Inside diameter shall be at least 4-inches (100mm) larger than the acid storage tank outside diameter.
6. Capacity shall be at least 10-percent larger than the acid storage tank.

7. Containment tanks may not be necessary if double-walled storage tanks are approved by local codes and regulations. Verify approval with the Owner's Representative and Engineer.

2.4 ACID FEED SYSTEM

A. Acid Feed System shall dose stored muriatic acid solution with a concentration of 32-percent by the means of a Chemical Metering Pump, which is activated upon a signal from the Chemical Control Unit.

B. Acid Feed System consists of the following:

1. Chemical Metering Pump
2. Acid Storage Tank
3. Containment Tank

C. Acid Storage Tank

1. Constructed of one-piece heavy-duty polyethylene or Nalgene with UV stabilizer.
2. Translucent with molded calibrations on the tank.
3. Flat bottom design.
4. Tight sealing, rigid high-strength lids.
5. Capacity: as indicated on the Contract Documents and equipment schedules.
6. Tank shall be sufficiently anchored to the floor to resist vertical loads (seismic or wind).

D. Containment Tank

1. Constructed of one-piece heavy-duty polyethylene or nalgene with UV stabilizer.
2. Translucent with molded calibrations on the tank.
3. Flat bottom design.
4. Overall height shall be at least 2-inches (50mm) lower than the acid storage tank height.
5. Inside diameter shall be at least 4-inches (100mm) larger than the acid storage tank outside diameter.
6. Capacity shall be at least 10-percent larger than the acid storage tank
7. Containment tanks may not be necessary if double-walled storage tanks are approved by local codes and regulations. Verify approval with the Owner's Representative and Engineer.

2.5 Chemical Control Unit

A. Acceptable Manufacturers

1. BECS Technology
2. ProMinent Fluid Controls, Incorporated
3. ControlOMatic
4. Blu-Sentinel by Evoqua
5. Hayward

B. Chemical Control Unit shall be modular design and shall be supplied as one integrated package from a single source. Control Unit consists of the following:

1. Chemical Control Unit model as indicated on the Contract Documents equipment schedules.

2. Flow Cell and Sensor Assembly with Industrial Grade Probes.
3. Automatic Probe Rinse.

C. Chemical Control Unit

1. Integrated microprocessor-based electronic water treatment control system to continuously monitor water chemistry and for automatic control of the chemical feed systems.
2. Housing shall be a NEMA Type 3 lockable fiberglass cabinet with a visible LCD graphic display and accessible touch pad for direct access to all menus, sub-menus, and for entering numerical data.
3. The following parameters shall be continuously monitored and displayed in the LCD graphic display:
    a. Display Range and Accuracy
        i. pH Level: 1.0 to 9.95 with a resolution of 0.01 units
        ii. ORP Level: 0 to 1000 mV with a resolution of 1 mV
        iii. Sanitizer Residual: 0 to 20 ppm with a resolution of 0.1 ppm
        iv. Total Dissolved Solids (TDS): 1 to 1000 ppm with a resolution of 1 ppm
        v. Temperature: 32 to 120 °F (0 to 50 °C) with a resolution of 0.01 °F
4. Modes of operation shall include: OFF, Manual, Automatic, and Timer Cycle
5. In Manual Mode the Controller shall:
    a. Allow the Operator access to all outputs to chemical feeders, heaters, cleaners, and controller accessories.
    b. Allow operator access to all alarms and controls.
6. In Automatic and Timer Cycle Mode the Controller shall:
    a. Automatically activate the appropriate chemical feeders in order to maintain pH, ORP, and sanitizer set point values within the following tolerances:
        i. pH within +/- 0.1 pH unit
        ii. ORP within +/- 10 mV
        iii. Sanitizer Residual within +/- 0.1 ppm
        iv. Heater within +/- 2.0 °F
    b. Be able to operate in either standard on / off feed control or proportional feed control with adjustable dead band and progressive control zones.
    c. Monitor all alarm conditions.
    d. Automatically clean and rinse probes on an adjustable seven (7) day program.
    e. Capable of being programmed for four (4) separate timed events, each having independent daily on and off settings.
7. Visible indicator lights shall activate when pH and ORP and/or Sanitizer chemicals are being fed and the heater is operating.
8. All set point and calibration levels shall be operator adjustable with the numeric keypad on the unit.
9. Controller alarms shall include:

a. Visible high- and low-level alarms for pH, ORP and/or Sanitizer, and temperature with optional feed lockouts and alarm buzzer options.
b. Continuous monitoring for failure of pH and ORP and/or Sanitizer probes using dynamic probe testing and alert if failure occurs before water chemistry gets out of range.
c. A low flow warning message to alert the Operator when a low or no flow condition exists. Should a low or no flow condition exist, the system shall disable all chemical feed functions.

10. Controller shall have a broad memory capable of logging up to 68 days with frequency of logged input points shall be adjustable from every minute for every four (4) hours and shall record data on the following:

a. pH and ORP and/or Sanitizer readings.
b. Any alarm conditions.
c. Any set point adjustments and feed event history.

11. Controller shall include a memory storage battery with a minimum reserve power for six (6) months.

D. Flow Cell and Sensor

1. Control System shall include a remote mounted flow cell and sensor assembly enclosed in a non-corrosive, lockable fiberglass enclosure with a window.
2. Incorporate the following features:

a. An integral self-air purging sensing chamber with see-through inspection cover and two sensing electrodes.
b. A paddle wheel-style flow switch with see-through cover and “on stream” light.
c. Flow switch shall indicate flow through sample stream and signal controller to initiate an alarm condition and to shut off feed circuits in the event flow should stop.
d. Flow switch shall operate on low voltage and be made of non-corrosive material.
e. Valves for isolating all assembly components and a water sample test valve shall be provided and be constructed entirely of non-corrosive materials.
f. ORP sensing electrode shall incorporate at least one (1) square centimeter of 99.999-percent pure platinum.
g. Both electrodes shall contain not less than 50 milliliters of electrolyte gel to lengthen electrode life.
h. Gel used in each electrode shall be inorganic to prevent degradation by chlorine or bromine.
i. Each electrode shall use a porous Teflon liquid junction to minimize the chance of liquid junction clogging and prolong electrode life.
j. Electrodes utilizing organic gels or wood, or ceramic liquid conjunctions are considered equal to these specifications.

PART 3 - EXECUTION

3.1 GENERAL

A. Supply all labor, equipment, and materials to construct, test and put into operation complete system lines, valves, tanks, and injectors in accordance with the Contract Documents and as directed by the Engineer of Record.

B. Install all piping without bending, springing, or forcing, true to line and grade, in a neat and workman like manner and properly supported.

C. Install tubing in adequate lengths so equipment can be moved or adjusted in positions and locations for maintenance purposes without disconnecting tubing.

D. Inspect all equipment and remove any dirt or foreign material before attaching inlet, outlet piping or tubing.

E. Injectors shall tap into filtered water return lines and shall incorporate shutoff valves to allow disconnection of feed lines while filters are operating.

F. Install the entire systems to meet applicable state and local codes, including but not limited to NSF guidelines.

3.2 INSTALLATION

A. Liquid Chemical Feed Systems

1. Locate Liquid Chemical Feed (Liquid Chlorine and/or Acid) Systems in locations indicated on the Contract Documents.
2. Provide a 4-inch (100mm) wide by 6-inch (150mm) tall containment curb surrounding the chemical storage tanks. Curb shall provide spill containment. Do not allow liquid chlorine and acid storage tanks to be placed within the same containment curbed area.
3. Mount chemical metering pump in the locations shown on the Contract Documents, approximately 48-inches (1.2m) above the finished floor elevation and to the side of each tank. Do not mount the pump directly above the chemical tanks.
4. Upon delivery of the chemical storage tanks, inspect for defects or shipping damage. Any discrepancies, or product problems, should be noted on both the driver’s bill of landing and the Contractor’s packing list.
5. When unloading tank(s) from the delivery truck, avoid contact with sharp objects.
6. Do not allow tank(s) to be rolled over on the fittings. Large bulk storage tank(s), whenever possible, should be removed from the delivery truck bed by use of a crane or other suitable lifting device.
7. Keep unloading area free of rocks, sharp objects, and other materials that could damage the tank.
8. If tank(s) are unloaded on their side, carefully brace to prevent rolling.
9. Test by filling the tank(s) with water prior to use, to prevent chemical loss through unsecured fittings, shipping damage, or manufacturing defects. Tanks should be tested for a minimum of five (5) hours.
10. Do not mount heavy equipment on tank sides.
11. Do not allow weight on tank fittings. Fully support pipes and valves connected to tanks.
12. Supply enough liquid chemicals to fill the tank(s) to a level within 3-inches (75mm) from the top of tank(s).

B. Chemical Control Unit

1. Mount the Chemical Control Unit on the wall in the general location as indicated on the Contract Documents and where the controller, probes, and automatic rinse unit may be easily accessible
2. Install isolation valves on the influent and effluent sides of the probe housing.
3. Factory Representative shall be on site to calibrate and perform initial start-up of the chemical controller. Calibration should be performed testing water at the control unit using the sampling valve and comparing this sample with several samples taken from the pool, one from the edge of the pool and one from the center of the pool a minimum of 18-inches (450mm) below water level. No samples should be taken from the surface of the pool.
4. Supply enough cleaning solution to fill probe rinse tank.
5. Provide a phone line or wireless connection near the chemical controller.
6. If a printer has been provided, install the printer on a wall shelf in a location where it will be protected from moisture and water spray and is easily accessible.

END OF SECTION 131504

SECTION 131505

WATER FEATURE OZONE GENERATION AND INJECTION

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes the following:

1. Ozone Generation Systems including Safety Interlocks and Controls
2. Air Preparation and Oxygen Concentration Systems
3. Ozone Injection and Contacting Systems
4. Ozone Degassing and Destruct Systems
5. Ambient Ozone Monitoring and Alarms

B. Related Sections:

1. SECTION 13 1401 – WATER FEATURE PIPE AND FITTINGS
2. SECTION 13 1403 – WATER FEATURE PIPE HANGERS, SUPPORTS, AND ANCHORS
3. SECTION 13 1501 – WATER FEATURE MECHANICAL IDENTIFICATION
4. SECTION 13 1502 – WATER FEATURE PUMPS AND MOTORS
5. SECTION 13 1503 – WATER FEATURE FILTERS
6. SECTION 13 1504 – WATER FEATURE CHEMICAL FEED SYSTEMS
7. SECTION 13 1507 – WATER FEATURE HEATERS
8. SECTION 13 1511 – WATER FEATURE VALVES, GAUGES, AND METERS
9. SECTION 13 1602 – WATER FEATURE CONTROLS

1.2 SUBMITTALS FOR REVIEW

A. SECTION 01 3300 – SUBMITTAL PROCEDURES

B. Product Data: Submit manufacturer’s literature including printed recommendations, dimensions and sizes for Ozone Generator, Air Preparation System, Injection and Contacting Components, Degas Valves, Destruct Units, Ambient Monitor, and accessories.

1. Indicate on each submittal which materials, models, data, and options are being selected.

C. Manufacturer’s Certification: Submit documentation from the Manufacturer certifying that the Ozone System, including all components, conform with the National Sanitation Foundation (NSF) Standard 50 guidelines.

D. Operation and Maintenance Data: Provide the Manufacturer’s installation instructions, specifications, start-up procedures, assembly drawings, troubleshooting checklists, schedule maintenance recommendations, and replacement part lists and repair data.

E. Warranty: Submit manufacturer’s warranty and ensure forms have been completed in the owner’s name and registered with the manufacturer.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Coordinate delivery with installation time to assure minimum holding time.

B. Accept Ozone Generator, Air Preparation System, Injection and Contacting System, Degas and Destruct Units, and Monitors and accessories on site in original factory packaging. Immediately upon receipt of shipment, inspect and check for damage.

C. Protect Ozone Generator, Air Preparation System, Injection and Contacting System, Degas and Destruct Units, and Monitors and accessories from physical damage including effects of weather, water, and construction debris.

PART 2 - PRODUCTS

2.1 Overall Ozone System

A. Manufacturers

1. Atavis Plasma Systems
2. Ozone Water Systems
3. CMP DEL Ozone

B. An Ozone System shall consist of a modular package incorporating the following components:

1. Ozone Generator
2. Air Preparation Components
    a. Oxygen Concentrator
    b. Air Compressor
3. Injector and Bypass Assembly
4. Mixing/Reaction/Degassing Tank
5. Degas Valve
6. Off-gas Destruct Unit
7. Ambient Ozone Monitor
8. Ambient Ozone Alarm Strobe Light

C. Materials:

1. Valves and Fittings for the purpose of ozone gas conveyance shall be Type 316L Stainless Steel.
2. Tubing and pipe for ozone gas conveyance shall be Type 316L Stainless Steel or Teflon™.
3. Seals, gaskets, O Rings, etc. for ozone gas conveyance to be Teflon™ or Aflas™.
4. All exposed hardware and fasteners to be 316L Stainless Steel.

D. The System shall provide for complete ozone isolation during shutdown.

E. The Ozone Generator and components shall be NSF Standard 50 listed for safety and performance standards.

2.2 OZONE GENERATOR

A. The Ozone Generator shall be of the corona discharge type, producing ozone at high concentrations (greater than 5.0-percent by weight) to provide efficiency of operation

and enhance mass transfer to the process water. No Ultraviolet (UV) ozone generation systems will be allowed.

B. Ozone shall be generated and maintained under vacuum until the point of injection into the process water and is to always be kept under vacuum.

1. Pressurized ozone systems will not be allowed.
2. Partial loss of vacuum shall be compensated for by automatic feed gas flow reduction.
3. Critical vacuum loss shall cause a system fault and initiate system shutdown.

C. Generator module shall be all 316L Stainless Steel, glass, and ceramic construction. No Generators utilizing combustible materials or ozone affected materials shall be allowed.

D. Each Ozone Generator module shall be water cooled, utilizing a vertical tube in shell cooling design.

E. Electrodes shall be gas filled glass tubes providing individualized fusing for power supply protection.

F. Ozone Generator shall permit variable production within a range of 0- to 100-percent of rated output.

G. Power requirements of the ozone generation (not including oxygen system) shall not exceed 20.0 Watts per gram of ozone produced per hour.

H. Ozone Generator shall be controlled by an internal Programmable Logic Controller (PLC), to automatically control start-up and shutdown sequencing, fault protections, ORP control, oxygen concentrator feed gas operation, and remote start/stop.

I. The generator shall be capable of continuous operation for one (1) year with no major cleaning or disassembly.

2.3 CONTROLS AND SAFETY INTERLOCKS

A. All control circuitries shall be powered by a Class B low voltage power supply or GFCI protected and powered through an isolating step-down transformer.

B. Each Ozone Generator shall be furnished as a package which shall include the following safety controls fully interlocked through the controller:

1. Door safety switch(s)
2. External emergency shutoff button
3. Loss of Vacuum
4. Low Feed Gas Pressure
5. Low Oxygen Concentration
6. Water Backflow Detection
7. Thermal protection on high voltage transformer and generator module
8. Standby Mode control function
9. Phase Loss Detection/Protection

C. Each Ozone Generator shall be further furnished with the following external/remote control and monitoring circuitry interfaced through the controller:

1. Ambient Ozone Monitor interlocked to the Ozone Generator shutdown and an Alarm
2. System ON/OFF
3. Emergency Stop
4. System Fault Alarm Conditions
5. Normal System Operation indications

D. The controller shall use low voltage DC circuitry for all sensor inputs.

E. The controller shall store run time, settings, and historic information on system events in non-volatile memory for retrieval by service personnel for diagnostic and troubleshooting purposes.

F. The controller shall display text messages or diagnostic indicators controlled by the controller indicating the cause of any fault event such as: Water Backflow, Door Open, Overheating, Low Feed Gas Pressure, Loss of Vacuum, etc.

G. Each Ozone Generator shall be provided with circuitry to permit deactivation from either the local control panel or from a remote location.

H. Each Ozone Generator shall provide input circuitry for connection of a remote monitoring/alarm equipment and output circuitry to indicate normal operation and abnormal system fault conditions to an external monitoring system.

I. Water backflow protection shall be provided within the Ozone Generator enclosure. The device shall be interlocked with the Ozone Generator's controller initiating system fault shutdown and isolating the Generator to prevent damage by water ingress to the generator module.

2.4 AIR PREPARATION COMPONENTS

A. Oxygen Concentrator

1. Oxygen Concentrator(s) shall be incorporated to automatically supply low pressure, 0-15 psig (0-103 kPa), oxygen rich feed gas to the Ozone Generator(s) at the required flow rate.
2. Oxygen Concentrators shall be capable of supplying oxygen, at the rated flow rate (or higher), to the Ozone Generator(s) at a minimum of 85-percent purity and less than -60 °C dew point.
3. Approved Manufacturer for external Oxygen Concentrators: AirSep Corporation.

2.5 INJECTION SYSTEM AND BYPASS

A. Introduction of ozone to the process water shall be via side-stream method incorporating venturi driven suction.

B. Approved Manufacturer: Mazzei Injector Corporation.

C. Venturi Injector shall be manufactured of Kynar™ for resistance to oxidation by ozone.

D. Venturi Injector(s) shall be sized to provide a total suction rate 1.3 to 1.5 times the total rate of ozone gas flow from the Ozone Generator(s) to develop the necessary negative pressure within the Generator and ozone conveyance lines.

E. Venturi Injector(s) shall further be sized with a liquid to gas ratio (V_L/V_G) of 0.05 or less and an outlet pressure of at least 15 psi (103 kPa) to assure efficient mass transfer.

F. Each Venturi Injector shall be furnished with stainless steel fittings to adapt to ozone conveyance tubing and will include a stainless-steel ball valve and check valve with appropriate seal materials as described in 2.1.C.

2.6 MIXING/CONTACT/DEGASSING TANK

A. The Contact Vessel shall be constructed of fiberglass reinforced plastic (FRP) with ozone resistant epoxy-based vinyl ester resin interior coat.

B. The Vessel must be NSF 50 listed.

C. The Vessel must be rated for 50 psi (344 kPa) minimum working pressure.

D. The Vessel shall be vertically mounted.

E. Internal baffles shall be incorporated to eliminate short circuit flow through the Vessel.

F. Plumbing Connections: Inlet and Outlet fittings shall be sized as shown on the Contract Documents or to limit flow velocity to less than 6-feet per second (1.83 m/s).

G. A Degas fitting shall be incorporated in the top of the Vessel for connection to the Degas Valve.

H. Vessel drain fitting shall be 1-1/2- to 2-inches (40 to 50mm) minimum and be fitted with a ball valve accessible for maintenance.

I. All fastening hardware on flanges, man ways, and viewing port shall be 316L Stainless Steel.

2.7 OZONE DEGAS VALVE

A. A Degas Valve shall be incorporated and fitted to the top of the Contact Tank for the purpose of automatically venting of undissolved, ozone-containing gases from the tank and directing them to the Ozone Destruct Unit.

B. The Degas Valve body shall be constructed of PVC and ozone resistant materials used for valve seat, float, and mechanism.

C. All fastening hardware shall be 316L Stainless Steel.

2.8 CATALYTIC OZONE DESTRUCT UNIT

A. The Ozone Destruct Unit shall incorporate a preheated dry bed catalyst to remove greater than 99.5-percent of the ozone content from the off-gas.

B. Low power heater shall be incorporated to preheat saturated off-gas to above the dewpoint to prevent condensation, protecting the metal oxide catalyst bed from moisture contamination.

C. The Destruct Unit shall be constructed of 304 or 316 stainless steel with inlet fitting appropriate for connection to the Degas Valve.

D. The Destruct Unit shall be sized to handle the full ozone production capacity of the system.

E. The Destruct Unit shall incorporate minor demisting capability and automatic drain valve for condensate build-up.

F. All fastening hardware shall be 316L Stainless Steel.

2.9 AMBIENT OZONE MONITOR

A. Shall measure the level of ozone present in the room housing the ozone equipment and shall shutdown the Ozone Generator when the ozone level exceeds a warning level of 0.1 ppm and a high alarm of 0.3 ppm.

B. The Monitor shall have a range of 0-10 ppm by volume with an accuracy within 3-percent of actual.

C. The Monitor shall employ an electrochemical gas diffusion sensor requiring no expendable reagents.

2.10 AMBIENT OZONE ALARM INDICATOR STROBE LIGHT

A. Manufacturer: Edwards, N. 49R-N5 or approved equal

B. Strobe Color: Red

C. Nominal VA Rating: 25 Watts

D. Voltage: 120 VAC, 0.22 Amps

E. Mounting: Standard 4-inch (100mm) octagon (indoor only) electrical box.

F. Alarm strobe shall illuminate on activation of Ambient Ozone Alarm and shall remain on until reset at the Ambient Ozone Monitor.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces, substrates, and conditions for compliance with requirements of other sections that relate to the Work specified. Determine if surfaces, substrates, and conditions affecting the performance of the Work of this section are satisfactory. Do not proceed with the Work of this section until unsatisfactory conditions have been corrected in a manner acceptable to the Installer. Starting installation constitutes acceptance of surfaces, substrates, and conditions.

B. Each system shall be capable of fitting into the space shown on the Contract Documents.

C. The Manufacturer shall supply a standard installation kit, which includes any necessary accessories and fittings for installation.

D. Provide complete installation instructions, and operations and maintenance manual with troubleshooting guide for each system.

3.2 INSTALLATION

A. The entire system shall be designed and installed to meet all applicable State and local codes.

B. Nationally recognized standards, as applicable, shall be adhered to.

C. Equipment enclosure shall be firmly attached to the flooring by lagging it into the concrete slab or housekeeping pad through holes provided according to instructions provided by the Manufacturer.

D. Install the Ozone Generator according to instructions provided by the Manufacturer.

E. All equipment, piping, meters, and appurtenances shall be to the Manufacturer's specification.

F. Leave sufficient space between equipment and pipes to allow for maintenance, replacement, and inspection.

G. Valves, pipe labels, meters, and displays must be visible and have sufficient space to access, if applicable.

H. Install ORP probe and controller as specified by the Manufacturer.

I. The Ozone Destruct Unit shall be installed at an elevation that is higher than the Degas Valve to prevent the possible flow of water into the Ozone Destruct Unit.

J. All Installer supplied fasteners and hardware shall be 316L Stainless Steel.

3.3 FIELD OPERATION AND START-UP

A. In the event of remote or local start, the Ozone Generator shall first be purged with dry oxygen from the feed gas system, then ramp up voltage to determined levels.

B. In the event of remote or local stop including reaching high ORP the Generator will initiate shutdown and purge with dry oxygen from the feed gas system before complete shutdown and isolation.

C. Upon any system fault the Generator shall automatically and immediately cease ozone production and purge with dry oxygen from the feed gas system before complete shutdown and isolation. Manual acknowledgement and re-start shall be required.

D. A factory trained representative shall be on site for start-up of the system and training of operation personnel.

END OF SECTION 131505

SECTION 131507

WATER FEATURE HEATERS

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes the following:
   1. Electric Water Heaters

B. Related Sections:
   1. SECTION 13 1401 – WATER FEATURE PIPE AND FITTINGS
   2. SECTION 13 1403 – WATER FEATURE PIPE HANGERS, SUPPORTS, AND ANCHORS
   3. SECTION 13 1501 – WATER FEATURE MECHANICAL IDENTIFICATION
   4. SECTION 13 1502 – WATER FEATURE PUMPS AND MOTORS
   5. SECTION 13 1503 – WATER FEATURE FILTERS
   6. SECTION 13 1504 – WATER FEATURE CHEMICAL FEED SYSTEMS
   7. SECTION 13 1505 – WATER FEATURE OZONE GENERATION AND INJECTION
   8. SECTION 13 1510 – WATER FEATURE HEAT EXCHANGERS
   9. SECTION 13 1511 – WATER FEATURE VALVES, GAUGES, AND METERS
   10. SECTION 13 1602 – WATER FEATURE CONTROLS

C. References:
   1. ASME SECTION 8D – BOILER AND PRESSURE VESSELS
   2. NFPA 30 – FLAMMABLE AND COMBUSTIBLE LIQUIDS CODE
   3. NFPA 54 – NATIONAL FUEL GAS CODE
   4. NFPA 70 – NATIONAL ELECTRICAL CODE (NEC)
   5. UL 174 – HOUSEHOLD ELECTRIC STORAGE TANK WATER HEATERS
   6. UL 1453 – ELECTRIC BOOSTER AND COMMERICAL STORAGE TANK WATER HEATERS

1.2 SUBMITTALS FOR REVIEW

A. SECTION 01 3300 – SUBMITTAL PROCEDURES

B. Product Data: Submit manufacturer’s literature including printed recommendations, dimensions and sizes for Pool and Spa Heaters and accessories.
   1. Indicate on each submittal which materials, models, data, and options are being selected.

C. Shop Drawings: Submit shop drawings indicating heater dimensions, clearances, anchors, attachments, lifting points, tappings, drains, and venting.

D. Manufacturer’s Certification: Submit documentation from the Manufacturer certifying that the Pool and Spa Heaters conform with the National Sanitation Foundation (NSF) Standard 50 guidelines.

E. Operation and Maintenance Data: Provide the Manufacturer's installation instructions, specifications, start-up procedures, assembly drawings, troubleshooting checklists, schedule maintenance recommendations, and replacement part lists and repair data.

F. Warranty: Submit manufacturer's warranty and ensure forms have been completed in the owner's name and registered with the manufacturer.

1.3 QUALITY ASSURANCE

A. Manufacturer: A Company specializing in manufacturing products specified in this Section with a minimum five (5) years of documented experience.

B. Installer Qualifications: A Company specializing in performing the Work of this Section with a minimum of five (5) years of documented experience.

C. Ensure products and installation of specified products are in conformance with recommendations and requirements of the following organizations:

1. American Gas Association (AGA)
2. National Sanitation Foundation (NSF)
3. American Society of Mechanical Engineers (ASME)
4. National Board of Boiler and Pressure Vessel Inspectors (NBBPVI)
5. Underwriters Laboratories (UL)

D. Pool and Spa Heaters: Provide with on-site start-up operator training, and on-site warranty service, all of which shall be performed by a representative trained and authorized by the Manufacturer.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Coordinate delivery with installation time to assure minimum holding time.

B. Accept Heaters and accessories on site in original factory packaging. Immediately upon receipt of shipment, inspect and check for damage.

C. Protect Heater and accessories from physical damage including effects of weather, water, and construction debris. Provide temporary inlet and outlet caps; maintain caps in place until installation.

PART 2 - PRODUCTS

2.1 ELECTRIC WATER HEATERS

A. Acceptable Manufacturers

1. Coates Heater Company

B. Shall include the following standard features:

1. Close Differential Thermostat
2. Manual Reset High Limit
3. Flow Switch with element and flow switch "ON" lights
4. Element sequencing of single phase heaters
5. Internal protective fusing (units over 48 amps)
6. 316L Stainless Steel tank
7. UL Listed for indoor and outdoor installation
8. Incoloy 825 Heating Elements

PART 3 - EXECUTION

3.1 GENERAL

A. Supply all labor, equipment, and materials to construct, test, and put into operation complete heating system with lines, valves, heaters, and gauges in accordance with the Contract Documents and as directed by the Engineer of Record.

B. Install all piping without bending, springing, or forcing, true to line and grade, in a neat workman like manner and properly supported.

C. Install tubing in adequate lengths so equipment can be moved or adjusted in positions and locations for maintenance purposes without disconnecting tubing.

D. Inspect all equipment and remove any dirt or foreign material before attaching inlet, outlet piping or tubing.

E. Install the entire Heating system to meet applicable state and local codes, including, but not limited to National Sanitation Foundation (NSF).

F. Heaters shall be capable of fitting in to the space shown on the Contract Documents.

3.2 INSTALLATION

A. Install Heaters in accordance with the Manufacturer’s recommendations.

B. Place and level the Heater in location shown on the Contract Documents on concrete equipment pads and where there is adequate access for service and inspection on all sides.

C. Influent and Effluent supply lines connecting the Heater to the main circulation line shall be installed according to the manufacturer’s installation documentation to allow for thermal separation of the piping. Copper pipe or CPVC is acceptable depending on the temperatures required and for the minimum distance specified by the manufacturer before changing to PVC pipe.

D. Install a check valve on the Heater inlet between the filter system and the Heater.

E. Pipe pressure relief valve discharge to a floor drain.

END OF SECTION 131507

SECTION 131511

WATER FEATURE VALVES, GAUGES, AND METERS

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes the following:

1. Furnishing and Installing Valves and Flow Control Devices.
2. Furnishing and Installing Gauges and Meters.
3. Furnishing and Installing Thermometers and Temperature Probes.
4. Furnishing and Installing Valve Actuators.
5. Furnishing and Installing Accessories.

B. Related Sections:

1. SECTION 13 1401 – WATER FEATURE PIPE AND FITTINGS
2. SECTION 13 1403 – WATER FEATURE PIPE HANGERS, SUPPORTS, AND ANCHORS
3. SECTION 13 1501 – WATER FEATURE MECHANICAL IDENTIFICATION
4. SECTION 13 1502 – WATER FEATURE PUMPS AND MOTORS
5. SECTION 13 1503 – WATER FEATURE FILTERS
6. SECTION 13 1504 – WATER FEATURE CHEMICAL FEED SYSTEMS
7. SECTION 13 1505 – WATER FEATURE OZONE GENERATION AND INJECTION
8. SECTION 13 1507 – WATER FEATURE HEATERS
9. SECTION 13 1602 – WATER FEATURE CONTROLS
10. SECTION 13 1604 – WATER FEATURE FIELD INSTRUMENTS, SWITCHEDS, AND ALARMS

C. References:

1. ASTM D1784 – STANDARD SPECIFICATION FOR RIGID POLY (VINYL CHLORIDE) (PVC) COMPOUNDS AND CHLORINATED POLY (VINYL CHLORIDE) (CPVC) COMPOUNDS
2. ASTM F1030 – STANDARD PRACTICE FOR SELECTION OF VALVE OPERATORS
3. ASTM F1970 – STANDARD SPECIFICATION FOR SPECIAL ENGINEERED FITTINGS, APPURTENANCES OR VALVES FOR USE IN POLY (VINYL CHLORIDE) (PVC) OR CHLORINATED POLY (VINYL CHLORIDE) (CPVC) SYSTEMS
4. AMERICAN WATER WORKS ASSOCIATION (AWWA) C508-09 – SWING-CHECK VALVES FOR WATERWORKS SERVICE 2-IN THROUGH 24-IN (50-mm THROUGH 600-mm) NPS
5. AWWA C509-09 – RESILIENT-SEATED GATE VALVES FOR WATER SUPPLY SERVICE

1.2 SUBMITTALS FOR REVIEW

A. SECTION 01 3300 – SUBMITTAL PROCEDURES

B. Product Data: Submit Manufacturer's literature including printed recommendations, compliance with Standard and Testing agencies, dimensions and sizes for all Valves, Gauges, Meters, and accessories.

1. Indicate on each submittal which materials, models, data, ratings, and options are being selected.

C. Project Record Documents: Record actual horizontal and vertical locations of fittings, valves, and accessories on all site piping.

D. Maintenance data for Valves, Gauges, Meters, and accessories including detailed instructions on adjusting, servicing, disassembling, and repairing. The Contractor shall provide the information neatly bound with the Manufacturer's literature.

1.3 QUALITY ASSURANCE

A. Comply with referenced Standards and Manufacturer's recommendations.

PART 2 - PRODUCTS

2.1 VALVES AND FLOW CONTROL DEVICES

A. Ball Valves

1. Acceptable Manufacturers

a. Asahi/America
b. Colonial Valve
c. Hayward Industrial Plastics
d. Spears Manufacturing

2. Ball Valves 1/4-inch (6mm) and larger, body construction shall be one-piece thermoplastic PVC conforming to Cell Classification 12454.
3. Seats shall be PTFE with elastomeric backing cushions the same material as all other "O" rings.
4. Ball Valves shall be True Union or double entry type with blocking capability.
5. Ball Valves shall have bubble tight shut-off with the following pressure ratings based on ambient temperature:
   a. Sizes up to 3-inch (80mm): 230 psi (1.6 MPa)
   b. Size 4-inch (100mm): 150 psi (1.0 MPa)
6. Seals composed of Viton® or EPDM.
7. All Ball Valves shall be tested by the Manufacturer prior to shipment. Test documents shall be available upon request.

B. Butterfly Valves

1. Acceptable Manufacturers

a. Asahi/America
b. Colonial Valve
c. Hayward Industrial Plastics
d. Spears Manufacturing

2. Valve Disc shall be PVC or Polypropylene.

3. Stem shall be 316L Stainless Steel non-wetted type.
4. Metallic fasteners shall be 316L Stainless Steel.
5. External metallic trim shall be 300 series Stainless Steel epoxy or powder coated.
6. Seals: Full Seat Design, Isolating Stem from media and functioning as a gasket for mating flanges.
    a. Materials shall be Viton® or EPDM.
7. Butterfly Valve body materials for Underground or Above Ground Applications shall be as follows:
    a. Sizes up to 14-inch (350mm) – shall be one piece thermoplastic PVC conforming to Cell Classification 12454. Body type shall be wafer type conforming to ANSI B16.5 Bolt Circle.
    b. Sizes 16- to 24-inch (400 to 600mm) – shall be one piece thermoplastic PVC conforming to Cell Classification 12454 or Polypropylene Cell Classification PP0210B67272. Body type shall be wafer type conforming to ANSI B16.5 Bolt Circle.
8. Butterfly Valve body materials for Submerged conditions shall be as follows:
    a. Sizes up to 24-inch (600mm) – Valves shall meet requirements shown for Underground or Above Ground Applications with the following exceptions:
        i. Valve Stems shall be 316L Stainless Steel for Fresh Water application and Titanium for Saltwater applications.
        ii. Stem extensions or 2-inch (50mm) square operating nuts of the appropriate material and design shall be supplied, subject to review of the installation and valve Manufacturer's recommendations.
9. Butterfly Valves shall be bubble tight shut-off with the following pressure ratings based on ambient temperature:
    a. Sizes up to 10-inch (250mm): 150 psi (1.0 MPa)
    b. Sizes 12- to 14-inch (300 to 450mm): 100 psi (690 kPa)
    c. Size 16-inch (400mm): 85 psi (590 kPa)
    d. Sizes 18- to 24-inch (450 to 600mm): 75 psi (520 kPa)
10. Butterfly Valves 4-inches (100mm) and smaller shall be lever type with an internal locking device.
11. Butterfly Valves 6-inches (150mm) and larger shall be gear type. Gear operators shall be worm gear design with visual position indicator and travel stops.
12. Butterfly Valves located 7-feet (2m) or higher above finished floor elevation shall be provided with chain operators with the chain extending no more than 7-feet (2m) above the finished floor elevation.
13. All Butterfly Valves shall be tested by the Manufacturer prior to shipment. Test documents shall be available upon request.

C. Check Valves

1. Ball Check Valve
    a. Acceptable Manufacturers

i. Asahi/America
ii. Colonial Valve
iii. Hayward Industrial Plastics
iv. Spears Manufacturing

b. Ball Check Valves shall be PVC, CPVC, PP or PVDF body with EPDM, FKM, or PTFE seals for valve sizes 1/2- to 4-inch (15 to 100mm).
c. Valves body construction shall be one piece thermoplastic construction.
d. Valves shall be designed with an elastomeric uniseat/seal for tight shut-off under pressure.
e. Sizes 1/2- to 2-inch (15 to 50mm) shall be True Union and sizes 3 to 4 inch (80 to 100mm) shall be single union.
f. For sizes larger than 4-inch (100mm) material shall be epoxy or powder coated cast iron with flange connections meeting ANSI B16.5 bolt pattern.

2. Swing Check Valve

a. Acceptable Manufacturers

i. Asahi/America
ii. Colonial Valve
iii. Hayward Industrial Plastics
iv. Spears Manufacturing

b. Swing Check Valves shall be PVC, PP, or PVDF body with FKM, EPDM, or PTFE seals and shall incorporate a single disc design suitable for horizontal or vertical applications.
c. Valves shall have a top entry bonnet for maintenance purposes.
d. Valves shall be flat faced flanged end type conforming to ANSI B16.5 bolt pattern for 150 psi (1.0 MPa).
e. Swing Check Valves shall have the following pressure rating based on ambient temperature:

i. Elastomeric Seals:

1. Sizes 3/4- to 3-inch (20 to 80mm): 150 psi (1.0 MPa)
2. Sizes 4- to 6-inch (100 to 150mm): 100 psi (689 kPa)
3. Size 8-inch (200mm): 75 psi (571 kPa)

ii. PTFE Seals:

1. Sizes 3/4- to 2-1/2-inch (20 to 65mm): 90 psi (621 kPa)
2. Sizes 3- to 4-inch (80 to 100mm): 75 psi (571 kPa)
3. Size 5-inch (125mm): 60 psi (414 kPa)
4. Sizes 6- to 8-inch (150 to 200mm): 45 psi (310 kPa)

3. Wafer Check Valve

a. Metal Wafer Check Valve

i. Acceptable Manufacturers

1. Ritepro Corporation
2. DeZURIK APCO

ii. Wafer Check body construction shall be as follows:

1. Valve Class 125: Cast Iron
2. Valve Class 150: Ductile Iron
3. Valve Class 300: Steel

iii. Wafer Check Seating Material and Spacer Material:

1. Valve Class 125: Buna N and Teflon
2. Valve Class 150: EPDM and Teflon
3. Valve Class 300: Stainless Steel and Bronze

iv. Wafer Check Valve shall consist of a compact Body with a single plate disc attached to a hinge which in turn is supported by a hinge pin inside an off-center body cavity.

v. The Disc shall be mechanically biased to the closed position by a torsional spring located between two hinged lugs. The hinge pin shall be retained by two NPT Pipe Plugs inside the body.

vi. An eyebolt shall be located on the top of the Valve to aid easy installation.

vii. Wafer Check Valve shall be designed to open when a pressure of less than 1 psi (0.07 bar) is applied across the face of the Disc.

viii. Wafer Check Valve shall be provided for installation inside the bolt circle and between standard flanges, using flat faced gaskets.

ix. Wafer Check Valve shall be hydrostatically tested with zero leakage criteria in both horizontal and vertical configurations.

x. Wafer Check Valve shall be available in sizes from 1- to 24-inch (25 to 600mm).

b. Thermoplastic Wafer Check Valve

i. Acceptable Manufacturers

1. Asahi/America
2. Hayward Industrial Plastics
3. Spears Manufacturing

ii. Wafer Check Valve shall be of solid thermoplastic construction, having no metal that encounters the media. PVC shall conform to ASTM D1784 Cell Classification 12454.

iii. Valves shall incorporate a single disc design suitable for either horizontal or vertical installations.

iv. Valves shall be wafer style conforming to ASME/ANSI B16.1 face to face dimensions for Valve Class 150 flanges.

v. Valves shall be round body design with O-ring seals of either EPDM or FKM and accept as an option a SWP-B ETFE coated spring for use in vertical applications.

vi. Wafer Check Valves shall be bubble tight shut-off with the following pressure ratings based on ambient temperature:

1. Sizes 4- to 8-inch (100 to 200mm): 150 psi (1.0 MPa)
2. Sizes 10- to 12-inch (250 to 300mm): 85 psi (590 kPa)

vii. An eyebolt shall be located on the top of the Valve to aid easy installation.
viii. Wafer Check Valve shall be designed for a minimum opening pressure as follows:

1. Without Spring: 0.01 psi (69 Pa)
2. With Spring: 0.01 psi (69 Pa) Horizontal, 0.02 psi (0.14 kPa) Vertical

ix. Wafer Check Valve shall be designed for a minimum sealing pressure.

1. Without Spring: 1 psi (6.9 kPa)
2. With Spring: 1 psi (6.9 kPa)

D. Thermoplastic Globe Valves

1. Acceptable Manufacturers

a. Asahi/America
b. Hayward Industrial Plastics
c. Spears Manufacturing

2. Globe Valve body shall be one-piece thermoplastic PVC conforming with ASTM D1784.
3. Seals shall be FKM or EPDM.
4. Disc shall be PVC or Polypropylene with rising stem.
5. There shall be no metal to media contact.
6. The Valve shall have excellent flow regulating characteristics throughout the entire lift of the disc.
7. Globe Valves shall be bubble tight shut-off with the following pressure ratings based on ambient temperature:

a. Sizes 1/2- to 2-inch (40 to 200mm): 150 psi (1.0 MPa)
b. Sizes 2-1/2- to 4-inch (65 to 100mm): 110 psi (758 MPa)

8. All Valves shall be tested by the manufacturer prior to shipment. Test documents shall be available upon request.

E. Ball Cock Valves

1. Acceptable Manufacturers

a. Asahi/America
b. Hayward Industrial Plastics
c. Spears Manufacturing

2. Ball Cock Valve body shall be one-piece unibody thermoplastic PVC conforming with ASTM D1784.
3. Seals shall be EPDM.
4. Valve shall have a calibrated flow indicator lever handle.
5. End connections shall be threaded.
6. Valve shall have a pressure rating of 150 psi (1.0 MPa) for all sizes at ambient temperature.
7. All Valves shall be tested by the manufacturer prior to shipment. Test documents shall be available upon request.

F. Level Control Valves

1. Metal Float Valve

a. Acceptable Manufacturers

i. CLA-VAL Company
ii. Approved Equal

b. The Valve shall be hydraulically operated, single diaphragm-actuated, globe or angle pattern.
c. The Valve shall consist of three major components:

i. The Body with seat installed
ii. The Cover with bearing installed
iii. The Diaphragm assembly

d. The Diaphragm assembly shall be the only moving part and shall form a sealed chamber in the upper portion of the valve, separating operating pressure from line pressure.
e. Packing glands and/or stuffing boxes are not permitted and there shall be no pistons operating the main valve or pilot control. No separate chamber shall be allowed between the main valve cover and body.
f. Valve body and cover shall be of cast material. Ductile Iron is standard and other materials shall be available. No fabrication or welding shall be used in the manufacturing process.
g. The Valve shall contain a resilient, synthetic rubber disc with a rectangular cross-section contained on three and one-half sides by a disc retainer and forming a tight seal against a single removable seat insert. No O-ring type discs (circular, square, or quad type) shall be permitted as a seating surface.
h. The disc guide shall be of the contoured type to permit smooth transition of flow and shall hold the disc firmly in place. The disc retainer shall be of a sturdy one-piece design capable of withstanding opening and closing shocks. No hourglass-shaped disc retainers shall be permitted, and no V-type or slotted type disc guides shall be used.
i. The Diaphragm assembly contains a non-magnetic 303 stainless steel stem of sufficient diameter to withstand high hydraulic pressures and shall be fully guided at both ends by a bearing in the valve cover and an integral bearing in the valve seat.
j. The Seat shall be a solid, one-piece design and shall have a minimum of a five-degree taper on the seating surface for a positive, drip-tight shut off. No center guides shall be permitted. The stem shall be drilled and tapped in the cover end to receive and affix such accessories as may be deemed necessary.
k. The flexible, non-wicking, FDA approved diaphragm shall consist of nylon fabric bonded with synthetic rubber compatible with the operating fluid. The center hole for the main valve stem must be sealed by the vulcanized process or a rubber grommet sealing the center stem hole from the operating pressure.

l. The Diaphragm must withstand a Mullins Burst Test of a minimum of 600 psi (4.14 MPa) per layer of nylon fabric and shall be cycle tested 100,000 times to ensure longevity.
m. The main valve seat and the stem bearing in the valve cover shall be removable. The cover bearing and seat in 6-inch (150mm) and smaller size valves shall be threaded into the cover body. The valve seat in 8-inch (200mm) and larger size valves shall be retained by flat head machine screws for ease of maintenance.
n. The Valve Manufacturer shall warrant the valve to be free of defects in material and workmanship for a period of three (3) years from the date of shipment, provided the valve is installed and used in accordance with all applicable instruction.
o. The Float Control shall be a rotary disc, plate-type pilot. The Pilot shall direct supply pressure into the cover of the main valve to close it. Then vent the cover of the main valve to atmosphere to open the main valve.
p. The Valve shall open wide when the float is at a low liquid level and close drip tight when the float is at a high liquid level. Once the pilot signals the main valve to open or close, the valve shall travel through its entire stroke without additional movement of the pilot control.
q. Float shall be constructed of stainless steel with KFM or EPDM seals.

2. Thermoplastic Float Valve

a. Approved Manufacturers

i. Hudson Valve Company, Incorporated
ii. Approved Equal

b. The Float Valve shall use fluid pressure, as opposed to a lever arm and ball, as the force to close the valve.
c. The Valve shall be of a self-contained design. The valve body shall be constructed of glass-filled nylon 6/6. Internal parts shall be of ABS plastic, silicone, and stainless steel
d. The Valve shall have threaded female connection.
e. Valve shall have the following operating pressure:

i. Size 1/2-inch (15mm): 8 to 65 psi (55 to 448 kPa)
ii. Size 1-inch (25mm): 8 to 100 psi (55 to 689 kPa)

f. The maximum fluid temperature shall be 90 °F (32 °C), with a high temperature model with a maximum fluid temperature of 150 °F (65 °C).

G. Combination Air and Vacuum Valves

1. Metal Valve Components

a. Acceptable Manufacturers

i. DeZurik APCO
ii. Crispin
iii. Valmatic

b. Cast iron body, cover, and baffle.
c. Stainless steel floats, stem, and bushing.

d. Seats shall be KFM or EPDM.
e. Valve shall allow unrestricted venting or re-entry of air.
f. Fittings shall be threaded.

2. Thermoplastic Valve Components

a. Acceptable Manufacturers

i. Jain Irrigation
ii. Plast-o-matic

b. Thermoplastic body with a non-corrosive slam resistant ball.
c. Removable top for seal maintenance.
d. Seats shall be KFM or EPDM.
e. Valve shall allow unrestricted venting or re-entry of air.
f. Fittings shall be threaded.

H. Backflow Prevention Device

1. Acceptable Manufacturers

a. DeZurik
b. Watts FEBCO
c. Zurn Industries, LLC

2. Reduced Pressure type.
3. Epoxy coated cast iron body.
4. Standard ANSI flanged end connections.
5. 316L Stainless Steel strainer.
6. Fasteners shall be 316L Stainless Steel.
7. Assembled with four (4) test cocks.
8. Non-Treaded vent outlet.
9. ASSE Listed 1013, CSA Certified, UL Classified 2, FM Approved 32; IAPMO® Listed.

2.2 GAUGES AND METERS

A. Pressure Gauges

1. Acceptable Manufacturers

a. Dwyer Instruments
b. WIKA Instrument Corporation
c. Marshall Town

2. Gauge shall be easy to read oversized 4-inch (100mm) diameter face. The Contractor may substitute a 2.5-inch (65mm) diameter face only with the approval of the Engineer of Record
3. Gauge shall be liquid filled with glycerin,
4. Gauge shall have a 304 stainless steel case with 316 stainless steel wetted parts and polycarbonate lens,
5. Gauge shall have a white aluminum dial with a black aluminum pointer,
6. Connections shall be lower or back mount,
7. Gauge shall have the following accuracy:

a. 4-inch (100mm) +/- 1.0-percent of span ASME B40.100 Grade A.
b. 2.5-inch (65mm) +/- 2.5-percent of span ASME B40.100 Grade 1A.

8. Gauge shall have the following range:

a. 0 to 60 psi (0 to 420 kPa) for pumps with a TDH of 60-feet (18m) or higher.
b. 0 to 30 psi (0 to 210 kPa) for pumps with a TDH less than 60-feet (18m).

B. Thermometer (Temperature Indicator)

1. Acceptable Manufacturers

a. H.O. Trerice Company
b. WIKA Instrument Corporation

2. Type:

a. 7-inch (180mm) Adjustable Angle Industrial.
b. 3.5-inch (89mm) Direct Mount Adjustable Angle Dial.

3. Stainless Steel stem with acrylic window.
4. Use with 316 stainless steel thermowell.
5. Accuracy within +/- one (1) scale division.
6. Liquid Actuated with Aluminum white background with black graduations and markings.
7. Range from 30 to 180 °F (0 to 82 °C).

C. Temperature Probe

1. Acceptable Manufacturers

a. H.O. Trerice Company
b. Dwyer Instruments

2. Type:

a. RTD sensor with remote cable to PLC or Filter Control Panel.
b. Visual display at probe location.
c. 9-inch (230mm) scale with adjustable angle probe.

3. Range from 30 to 180 °F (0 to 82 °C).
4. Stem shall be 316 stainless steel, 1/4-inch (15mm) diameter.
5. Insulation shall be Ceramic.
6. Head shall be stainless steel.
7. Use with 316 stainless steel thermowell.

D. Flow Meters

1. Magnetic Flow Meters

a. Acceptable Manufacturers

i. George Fischer Signet
ii. Seametrics
iii. Badger Meter
iv. FlowVis

b. The electromagnetic insertion flow sensor shall generate an electrical signal proportional flow velocity from a range of 0.15-33 feet per second. The output signals shall be optional 4-20 mA analog, or digital S^3L / open-collector pulse with maximum pull-up voltage of 30 vdc, and a maximum current sink of 50 mA.
c. Sensor shall operate with a power input of 5 – 26.4 vdc, with a maximum current draw of 15 mA.
d. The microprocessor-based sensor shall include Empty Pipe Detection, LED-assisted troubleshooting, and Bi-Directional span capability (in 4-20 mA models). An optional USB to Digital (S^3L) Configuration/Diagnostic Tool shall be used to span (in 4-20 mA models), and/or customize performance features including Noise Rejection Filter, Low Flow Cutoff, Averaging Time, and Sensitivity.
e. The sensor shall utilize an Installation Fitting that is factory set to control proper flow sensor insertion depth and orientate sensor to be parallel with fluid flow.
f. The sensor shall not create a pressure drop of >1 psi at any flow rate.
g. With a fully developed flow profile the sensor output shall be linear to ±1-percent of full range, with a repeatability of ±0.5-percent of full range, and supplied with a certificate traceable to N.I.S.T.
h. Three optional sensor lengths shall allow the flow sensor to install into pipes from 0.5- to 36-inches.
i. The sensor body shall be 316L Polypropylene with stainless steel electrodes and grounding ring: Optional PVDF/Titanium, PVDF/Hastelloy-C, or PVDF/316LSS.
j. The flow sensor shall be equipped with dual O-ring seals. The elastomeric seals shall be FPM-Viton® (standard) with optional EPDM or FFPM-Kalrez*.

2. Pitot Tube Flow Meter

a. Acceptable Manufacturers

i. Blue-White Industries, LTD
ii. Approved Equal

b. Meter body shall be constructed of one-piece cast acrylic and float shall be 316 stainless steel on standard range models.
c. Meter shall be dual scale (gpm/lpm) printed on both sides of the meter.
d. Meter shall mount to existing pipe, with no unions or adapters required.
e. Meter shall be available with models for horizontal and vertical installations.
f. 300 series stainless steel clamps and neoprene gasket shall be included.
g. Meter shall be sized to pipe and flow rate.

2.3 Valve Actuators

A. Electric Actuator

1. Actuator shall be provided by the same Manufacturer as the valve.
2. Electric Actuator shall be reversing type capacitor run motor design, thermally protected with a permanently lubricated gear train.
3. Actuator shall be provided at the voltage specified in the Contract Document.
4. Enclosure shall meet NEMA 4X, 7 and 9.

5. Actuator to have heat-treated solid metal gearing in a die cast aluminum housing and shall be powder coated with stainless steel trim for corrosion resistance.
6. Actuator shall have a beacon position indicator, manual override, and ISO bolt pattern for valve mounting.
7. Manual override is used for declutching motor for manual operation.
8. Two (2) limit switches shall be supplied as a standard for setting open and closed limits.
9. Actuators to have two (2) 1/2-inch (15mm) NPT conduit entry for ON-OFF units and modulating units.

B. Pneumatic Actuator

1. Actuator shall be provided by the same Manufacturer as the valve.
2. Actuator shall be double piston, rack and pinion design double acting air-to-air operation.
3. Actuator shall have ISO mounting pattern for valve with NAMUR mounting pattern for solenoids and accessories.
4. Valves 4-inch (100mm) and smaller to include flats on actuator shaft for manual override
5. Valves larger than 4-inch (100mm) shall include de-clutchable gear operated manual override
6. Actuator body shall be of highly corrosion resistant glass filled polyamide or aluminum with Rilsan coating.
7. Solenoid valve to be NEMA 4, with manual override and speed controls, NAMUR mount design
8. Actuators shall incorporate adjustable travel stop 0 – 90-degrees.
9. Stops shall allow independent adjustment of opening or closing direction.
10. Actuators shall incorporate valve position limit switches coupled to the valve shaft and indicating to the PLC the fully OPEN or CLOSED position of the valve.
11. Supply air working pressure range 80 to 120 psi (550 to 830 kPa).
12. Actuator seals shall be Buna N.
13. Actuator shall have integral thermal overload protection with auto-reset.
14. Actuator shall have a permanently lubricated gear train.
15. Actuator shall have adjustable travel-stop limit switches.
16. Actuator shall be capable of being operated by a 24-volt signal from filter control center and separate HAND-OFF-AUTO switch.
17. Fully field adjustable closure stops to limit the percent of valve closure to assure proper system flow rate.

2.4 ACCESSORIES

A. Wye Strainers

1. Approved Manufacturers
    a. ASAHI/America
    b. Hayward Industrial Plastics
    c. Spears Manufacturing
2. Transparent PVC body with minimum 150 psi (1.0 MPa) working pressure rating.
3. True union end connections.
4. EPDM or KFM seals and O-rings.

5. Stainless steel strainer screen.

B. Valve Boxes

1. FRP Valve Box

a. Approved Manufacturers

i. A.S.A. Manufacturing, Incorporated
ii. Approved Equal

b. Box shall be constructed of premium fiberglass and resin for maximum structural strength
c. Provide durable smooth gelcoat interior finish.
d. Box shall be custom sized for the number of valves and dimensions as shown on the Contract Documents.
e. Provide open bottom for drainage and hinged, lockable landscape lid with handle.

PART 3 - EXECUTION

3.1 GENERAL

A. All Valves, Gauges, Meters, and accessories shall be installed in strict accordance with Manufacturer's instructions and recommendations.

B. Position all Valves, Gauges, Meters, and accessories to result in good appearance, easily read, and easy access to all components for maintenance and repairs.

3.2 EXAMINATION

A. Examine surfaces, substrates, and conditions for compliance with requirements of other sections that related work is specified, and determine if surfaces, substrates, and conditions affecting performance of the Work of this section are satisfactory. Do not proceed with the Work of this section until unsatisfactory conditions have been corrected in a manner acceptable to the installer. Starting installation constitutes acceptance of surfaces, substrates, and conditions.

3.3 PREPARATION

A. Determine depth, size, and alignment of existing utilities before beginning excavation.

B. Hot dip galvanize all metallic items that are not factory furnished.

3.4 INSTALLATION

A. Buried Valves

1. Locate shut-off valves as close to main lines as possible while maintaining easy valve access.
2. Valves shall be the same size as the connecting pipe. Where pipe reduces near the valve, size the valve to the large diameter pipe.
3. Valves less than 3-inch (80mm) located in landscape areas shall have a standard 2-inch (50mm) irrigation valve box, PVC riser, and cover. Riser shall extend up to a level of 6-inches (150mm) above finish ground surface.
4. Valves 3-inch (80mm) and larger located in landscape areas shall have an 8-inch (200mm) Schedule 40 PVC pipe that extends from a level of 6-inches (150mm)

above finish ground surface down to a point that is 4-inches (100mm) below the top of the operating lug nut that fully encloses the operating lug nut/handle. The pipe shall act as a valve key box and be fitted with removable, tight fitting PVC cap.

5. Buried valves located in walkways or vehicular traffic areas shall have a cast iron valve box with cover, mounted flush with the finished surface and fully enclose the operating nut or handle.
6. Provide three (3) valve keys for each 5-foot (1.5m) increment of depth from 5 feet (1.5m) to the depth of the deepest valve.
7. Valves installed in valve boxes shall have wheel or lever operators, with valves installed so flow through the valve is horizontal and the riser and operator on the top of the valve.
8. Buried Valves 6-inch (150mm) and larger shall be supported and anchored with concrete blocks to support the valve weight and provide resistance to thrust.

B. Above Ground Valves

1. Locate equipment shut-off valves and check valves as close to equipment as possible, while maintaining Manufacturer's recommendations and easy valve access.
2. Valves shall be the same size as the connecting pipe. Where pipe reduces near the valve, size the valve to the large diameter pipe.
3. Overhead valves should be in accessible areas next to equipment, not directly above equipment.
4. Butterfly Valves installed above 7-feet (2.1m) from the finish floor elevation shall be provided with chain operators. The chain shall be in a manner that they do not hang down in walkways or become tangled with equipment and piping.
5. Ball Valves installed overhead shall be located so access to the valve can be easily accomplished with a step ladder.
6. Install overhead valves with operators (handles, levers, or wheels) at 90 degrees from vertical, do not install valves with valve operator upside down.
7. Install Valves larger than 3-inch (80mm) with flanges or between flanges. Valves 3-inch (80mm) and smaller shall be installed with socket welded union type connections.
8. Do not use Valves to straighten misaligned pipes. Do not install valves between misaligned pipes.
9. Provide supports, hangers, and anchors for valves to adequately support valve weight and to resist thrust.
10. Support Valves adequately at both flanges if in a horizontal position and by the top flange if in a vertical position.

C. Submerged Valves

1. Locate submerged valves within 12-inches (300mm) of walls. Anchor valves to walls.
2. Valves shall be the same size as the connecting pipe. Where pipe reduces near the valve, size the valve to the large diameter pipe.
3. Valves located in lagoons, waterfalls, or inlet/outlet boxes shall have a 2-inch (50mm) operating nut for valves 6-inch (150mm) and larger, and lever operator for valves less than -6-inch (150mm)

4. Valves located in balance tanks or surge chambers shall have a 2-inch (50mm) operating nut on a riser stem which shall extend 2-inches (50mm) below the finished surface of the tank lid. Place a removable cast iron cover over operating nut. Cast iron cover shall be flush with the finished surface of the tank lid. Located valve gear boxes above water level.

D. Level Control Valves

1. Install Float Valves in a cast-in-place or pre-cast concrete or FRP box with access hatch, or in a balance tank as indicated on the Contract Documents.
2. Install Float Valve with Isolating Ball Valve and a bypass with a normally closed, locking handle Ball Valve.
3. Install valve float in a 12-inch (300mm) diameter PVC pipe as a stilling well.
4. Stilling well shall be connected to the main water body with a minimum 6-inch (150mm) equalizer line for remote fill box applications.
5. Adjust valve float to maintain water level within 1-inch (25mm) of planned water level.

E. Combination Air and Vacuum Valves

1. Install Air/Vacuum Valves in all high points in above ground and below ground pressure pipelines and in locations indicated on the Contract Documents or as directed by the Engineer of Record.
2. Air/Vacuum Valves installed on below grade site piping shall be installed in pre-cast concrete or FRP boxes with removable lids. Provide a drain in the box that is piped to a sump or storm drain system.
3. Valves installed above ground shall be piped with PVC pipe to the nearest floor drain. Size drainpipe to the Air/Vacuum Valve.
4. Air/Vacuum Valves shall be sized per the Manufacturer’s recommendations for size of pipe, pressure, and conditions where valve is to be installed.

F. Backflow Preventer

1. Install backflow preventer as per local code requirements on all potable water fill lines, hose bibs, and emergency eyewash/showers. Combine potable fill lines in a suitable manner to minimize the number of backflow devices.
2. Install gate valves before and after backflow prevention devices.
3. Size backflow prevention devices to match inflow pipe size.
4. Pipe relief from backflow preventer to nearest drain or into a sump. Provide a minimum 6-inch (150mm) air gap between device and drainpipe.

G. Pressure Gauges

1. Install Pressure Gauges as indicated on Contract Documents and in locations where they are easily read. Install in a vertical to 15-degrees of vertical position.
2. Pressure Gauge should not be installed more than 6-feet (1.8m) above the finished floor.
3. Install Pressure Gauge with pulsation dampers. Provide a gauge cock to isolate each gauge.
4. Adjust Pressure Gauge to final angle, clean windows, and lenses, and calibrate to zero.

H. Flow Meters

1. Install flow sensor at locations as indicated on the Contract Documents. Install per Manufacturer's recommendations for preceding and following pipe lengths clearances and orientations.
2. Flow sensors for paddle wheel Flow Meters shall be installed in the pipe using as saddle or other means as recommended by the Manufacturer.
3. Install Flow Meters or Display Units in a location that is near the sensor with ready access and visibility.
4. Mount Display Units 5-feet (1.5m) above the finish floor.
5. Provide a service outlet at a location near the Display Unit.
6. Calibrate Flow Meter display as per Manufacturer's recommendations.

I. Wye Strainers

1. Install Wye Strainers as indication on the Contract Documents and in locations where they are easily accessible.
2. Install Wye Strainers in pipes where flow is horizontal or vertically down. For horizontal flow, install with the strainer vertically down.
3. Install a shut-off valve immediately next to the Wye Strainer on the upstream side for isolation.

J. Dielectric Connections

1. Isolate copper pipe from steel supports with suitable insulator.
2. Dielectric connections shall be installed in vertical sections of piping only.
3. Copper system shall have brass fittings, including connections to equipment.

END OF SECTION 131511

SECTION 131601

WATER FEATURE GENERAL ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes the following:

1. Provide labor, materials, and equipment necessary for completion of the Work in the Water Feature Electrical Specification and as described in the Contract Documents

B. Related Sections:

1. SECTION 13 1502 – WATER FEATURE PUMPS AND MOTORS
2. SECTION 13 1503 – WATER FEATURE FILTERS
3. SECTION 13 1504 – WATER FEATURE CHEMICAL FEED SYSTEMS
4. SECTION 13 1505 – WATER FEATURE OZONE GENERATION AND INJECTION
5. SECTION 13 1507 – WATER FEATURE HEATERS
6. SECTION 13 1511 – VALVES, GAUGES, AND METERS
7. SECTION 13 1602 – WATER FEATURE CONTROLS
8. SECTION 13 1605 – WATER FEATURE CONTROL PANELS
9. SECTION 13 1609 – WATER FEATURE DISCONNECTS, MCC, AND STARTERS
10. SECTION 13 1610 – WATER FEATURE ELECTRICAL ACCESSORIES
11. DIVISION 26 – ELECTRICAL

1.2 SUBMITTALS FOR REVIEW

A. SECTION 01 3300 – SUBMITTAL PROCEDURES

B. Product Data:

1. Submit Manufacturer literature for the following:

a. Wiring Devices
b. Disconnect Switches
c. Panel Boards
d. MCC
e. Transformers
f. Motor Starters & VFDs
g. System Field Switches

2. Provide the following information for each item of equipment:

a. Catalog Sheet
b. Assembly Details of Dimension Drawings
c. Installation Instructions
d. Manufacturer’s Name and Catalog Number

e. Name of Local Supplier
f. Name of Electrical Contractor

3. Do not purchase equipment before approval of Product Data.

C. Shop Drawings: Submit Shop Drawings for MCC, Panel Boards, and Control Panels.

D. As-Built Drawings: Provide the following:

1. Complete set with all changes made to original drawings.
2. Provide CAD files as well as prints. Hand-drawn changes are not acceptable.

E. Operation & Maintenance Manual

1. Provide two (2) copies of Operation and Maintenance Manuals.

a. Binder – Loose-leaf type with hard cover. Title on outside of front cover and on spine shall be as follows:

***** WATER FEATURE FACILITY *****
OPERATION & MAINTENANCE MANUAL
ELECTRICAL

b. Title Page: List the following information:

i. Name of Project.
ii. Project Completion Date.
iii. Name and Address of Architect, Electrical Engineer, General Contractor, Electrical Contractor, and Suppliers.

c. Table of Contents

i. List equipment in order that it appears in the Binder.

d. Dividers:

i. Provide one (1) divider tab for each type of equipment listed in the Table of Contents. Properly label tabs.

e. Equipment Information: Provide the following information for each item of equipment

i. Catalog Sheets
ii. Assembly Details or Dimension Drawings
iii. Installation, Operation, and Maintenance Instructions
iv. Manufacturer’s Name and Catalog Number
v. Name of Local Supplier

f. Furnish such information for the following equipment and arrange as listed:

i. Wiring Devices
ii. Disconnect Switches
iii. Panel Boards
iv. MCC
v. Transformers
vi. Motor Starters & VFDs
vii. System Field Switches

1.3 REQUIREMENTS OF REGULATORY AGENCIES:

A. Furnish UL listed equipment where such label is available. Install in conformance with UL Standards where applicable.

B. Install electrical Work in accordance with Contract Documents, edition of NEC in effect at the project location, recommendations of NFPA, state and local electrical and building codes, and special codes having jurisdiction over specific portions of the Work. This includes, but is not limited to the following:

1. NFPA 70 – National Electrical Code (NEC) with applicable local amendments.
2. International Building Code (IBC).

C. In the event of a conflict between the Contract Documents and such codes, notify the Architect/Engineer in writing prior to bid. A ruling will then be made by Architect/Engineer in writing

D. Obtain permits and certificates of approval from all authorizes having jurisdiction over installation and pay all fees required for scope of Work being done including connection fees, impact fees, power company installation cost, etc.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS:

A. Where Manufacturer names appear, other Manufacturers may be substituted upon obtaining written approval from the Architect/Engineer at least ten (10) days prior to opening of bids.

B. Any prior approval of alternate equipment does not automatically exempt the supplier from meeting the intent of these specifications. Failure to comply with the operational and functional intent of these specifications may result in the total removal of the alternate system at the expense of the Contractor.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Confirm dimension, ratings, and specification of equipment to be installed and coordinate these with site dimensions and with other Sections. Coordinate electrical equipment location with other trades to maintain required working clearances and prevent encroachment into such working spaces.

B. Electrical Drawings are diagrammatic. Do not scale for exact sizes or locations. Drawings are not intended to disclose absolute or unconditional knowledge of actual field conditions. Some equipment may need to be relocated from the locations indicated on the drawings to maintain working spaces around equipment. Any such coordination and relocation shall be the responsibility of the Electrical Contractor.

C. Confirm and verify electrical power specification (i.e., voltage, phase, amperage, etc.) and electrical equipment and material requirements for all water feature equipment provided by others, before beginning rough-in. All coordination shall be done with the approved shop drawings or submittals.

D. Be prepared to relocate any outlet or device 6-feet (1.8m) in any direction without additional charge to the Owner.

E. Install equipment in accordance with the Manufacturer's recommendations.

F. In the event of a conflict between specifications and drawings or between various areas on the Contract Documents the most stringent requirements shall govern.

3.2 FIELD QUALITY CONTROL

A. Test systems and demonstrate equipment as working and operating properly. Rectify defects at no additional cost to the Owner.

B. All Work under this section shall be executed in a thorough workmanlike manner, as determined by the Engineer, by competent and experienced journeyman electricians.

C. All Work shall be installed in strict conformance with all Manufacturer's requirements and recommendations.

3.3 IDENTIFICATIONS

A. Provide for each Panel Board, Terminal Cabinet, Motor Starter, Motor Controller, Pushbutton, Control Switch, etc, furnished and/or installed under this section of the specifications, with identification as to its designation or specific function.

1. Identification shall be laminated, white core, black plastic nameplate with beveled edges. Lettering shall be machine engraved, not less than 3/16 inch (5mm) high, cut through the black surface to the white core.
2. Secure nameplate to the identified item by the use of stainless steel self-tapping screws.
3. Impressed plastic shall not be used to satisfy this requirement.

B. Panel schedules shall be typed and easily legible.

3.4 GUARANTEE-WARRANTY

A. Guarantee Work to be free from defects of materials and workmanship for a period of two (2) years from date of final acceptance of building by authorities having jurisdiction.

B. Furnish Owner with three (3) written copies of Guarantee-Warranty.

END OF SECTION 131601

SECTION 131602

WATER FEATURE CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes the following:

1. Pump Control
2. Sand Filter Backwash Control
3. Chemical Control
4. Secondary Disinfection (Ozone) System Control
5. Temperature Control
6. System Alarms and Shutdown Trips

B. Related Sections:

1. SECTION 13 1502 – WATER FEATURE PUMPS AND MOTORS
2. SECTION 13 1503 – WATER FEATURE FILTERS
3. SECTION 13 1504 – WATER FEATURE CHEMICAL FEED SYSTEMS
4. SECTION 13 1505 – WATER FEATURE OZONE GENERATION AND INJECTION
5. SECTION 13 1507 – WATER FEATURE HEATERS
6. SECTION 13 1511 – WATER FEATURE VALVES, GAUGES, AND METERS
7. SECTION 13 1601 – WATER FEATURE GENERAL ELECTRICAL REQUIREMENTS
8. SECTION 13 1604 – WATER FEATURE FIELD INSTRUMENTS, SWITCHES, AND ALARMS
9. SECTION 13 1605 – WATER FEATURE CONTROL PANELS
10. SECTION 13 1606 – WATER FEATURE INSTRUMENT POWER SYSTEMS
11. SECTION 13 1609 – WATER FEATURE DISCONNECTS, MCC, AND STARTERS
12. SECTION 13 1610 – WATER FEATURE ELECTRICAL ACCESSORIES
13. SECTION 13 1611 – WATER FEATURE GROUNDING

PART 2 - PRODUCTS

2.1 NOT APPLICABLE

PART 3 - EXECUTION

3.1 FUNCTIONAL REQUIREMENTS

A. The System shall provide all the functions described herein for each system. Major equipment items are specified for each loop; however, all items of equipment, whether indicated or not, which are necessary to affect the required performance shall be provided.

B. Water Feature Control Systems (WFC): The WFC includes controlling and monitoring of pumps, water filtration, chemical feed systems, secondary disinfection systems, temperature control, and lighting. These systems shall be controlled via a Control Panel (CP-X) and/or a Motor Control Panel (MP-X). Refer to Contract Documents for panel designations.

3.2 PUMP CONTROL

A. All pump controls shall include the following:

1. Integrated program control buttons as well as external control connections. The pump keypad can be programmed for external control only and will light up the “External Control Only” LED. Manual controls can be programmed through the pump keypad. Each keypad will have a Start/Stop button with an LED to signal when the pump is in a “start state”. The Start/Stop button is used to start or stop the pump. When the LED is illuminated the pump can be started with both external and manual inputs. When the pump is stopped and the LED is not illuminated, the pump is not able to run from any type of input.

    a. When the pump is in manual mode, the pump shall operate unless inhibited by controller’s safety interlock.
    b. When the pump is running and the start/stop button is pressed and the pump stopped and the LED is not illuminated, the pump shall stop.
    c. Press and hold the Start/Stop button for 10 seconds to enable/disable External Control Only mode.
    d. When the pump is in the External Control Only mode, pump control shall be determined by the controller output relay in the controller.

2. Each direct suction connected pump shall have a Vacuum Limit Switch (VLS) interlock as indicated on the drawings. The VLS will operate as follows:

    a. The VLS shall be preset on site prior to commissioning to meet each pump’s vacuum limit when pump suction is excessively restricted.
    b. When the VLS is activated the controller shall shut down the associated pump. The Human Machine Interface (HMI) will indicate that the pump has been shut down due to high vacuum condition.
    c. Filtration Pump(s), (typically identified as Treatment Pump P-X01, …), shall include the following addition controls when the pump is turned off either with manual start/stop button or through controller interlock in the External Control Only mode:

        i. All associated Feature Pumps, Chemical Feed Pumps, Secondary Disinfection Systems, and temperature control operations will cease to operate regardless of their modes of operation.
        ii. HMI on the controller indicates that each of the Feature Pump(s) and other ancillary systems operations are suspended while the Treatment Pump is not operational.

3. All feature pumps not associated with the filtration and chemical treatment of the water shall include a control timer within the spray controller that may turn the pumps ON and OFF based on and operator adjustable set points adjustable through the spray controller HMI.

3.3 SAND FILTER BACKWASH CONTROL

A. Function: To monitor and control the Water Treatment Pumps (WTP), Filter Control Panel (FCP), and control the position of the Motorized Backwash Control Valve (MBCV).

B. Components:

1. WTP
2. FCP
3. MBCV
4. MBCV – AUTO-OFF-OPEN-CLOSE selector switch
5. PLC I/O in CP

C. Operation:

1. General:

a. The FCP controls the operation of the Filtration System and should be provided by the Filter Manufacturer.
b. When operated in MANUAL, filter backwashing may be accomplished manually.
c. When operated in AUTO, the FCP determines when a backwash is necessary, and when it may be allowed.
d. The normal mode of operation of the System shall be when the WTP is in AUTO and circulating water through the Filters to the features.
e. Normal mode of the FCP will be AUTO.

2. Manual Backwash:

a. For multiple filter tank operation each filter tank shall be backwashed separately. Only one filter shall backwash at a time throughout all systems in the mechanical room.
b. Operator shall manually change position of the valves located at the inlet and outlet of each filter element and position the MBCV (if so equipped). If inlet and outlet valves are not linked, then the Operator shall turn OFF the WTP while valve position is changed, then turn the WTP back ON.
c. The valve change allows the water to reverse flow through the filter and direct the backwash water to the Backwash Tank or sewer connection.
d. Backwash shall continue for sufficient time to fluidize the sand bed and flush the filtrate. Backwash progress may be monitored visually with the backwash sight glass. When water stream in the sight glass appears clear back wash may be stopped – valves returned to normal filtering position.
e. Repeat process sequentially for each filter in each system. Once all filters in each system have been backwashed the filter pressure drop is verified. If the differential pressure is not down to “Clean” filter conditions the backwash sequence should be repeated.

3. Automatic Backwash:

a. Automatic Backwash operation differs from Manual operation by automating the valve change sequence and allowing the FCP to configure and position the valves based on either an operator-initiated command to

start the sequence or automatically due to measured pressure differential or elapsed time.

b. For multiple filters on a single system the FCP shall backwash each filter tank sequentially inhibiting multiple filters from backwashing simultaneously.

c. For the AUTO operation to occur, the following modes shall be assumed:

i. The WTP(s) operation HOA switch is in the AUTO position
ii. The FCP is in AUTO mode
iii. The BWCV local control switch is in the AUTO position

d. Backwash Sequence:

i. STEP 1: The PLC in the CP shall monitor the FCP “Stop Pump” output. When the FCP signals the PLC the corresponding WTP(s) shall be stopped.
ii. STEP 2: When the FCP signals the PLC for a backwash cycle to begin the PLC causes the MBCV to partially close (this position should be set during start-up with limit positioners on the MBCV actuator). The partially CLOSED MBCV provides a flow restriction in the outlet piping resulting in an increase flow through the filter element being backwashed. The MBCV shall remain in this partially closed position until all the elements in the filter bank have been backwashed sequentially.
iii. STEP 3: The FCP then repositions the inlet and outlet valves of filter #1 to Backwash position.
iv. STEP 4: FCP receives confirmation that valves are repositioned and signals the PLC to re-start the WTP(s).
v. STEP 5: When one filter element has been backwashed for a predetermined time, the FCP shall stop the WTP, reposition the backwashed filter element valves back to normal operating position, and re-position the valves on the next element to be backwashed to backwash position.
vi. STEP 6: Steps 4 and 5 are repeated sequentially for each filter element in turn until all filter elements have been backwashed.
vii. STEP 7: Once all the filter elements have been backwashed, the FCP shall signal the WTP to STOP, return the filter element valves to normal operating position, reposition the MBCV to full OPEN, and then allow the WTP to restart.

3.4 REGENERATIVE FILTER CONTROL

A. Function: To monitor and display the function of the Regenerative Filter System Controller (FCP) and coordinate control of WTP operation during regeneration and rinse cycles.

B. Components:

1. Water Treatment Pump(s) WTP
2. Regenerative Filter FCP
3. PLC I/O in CP

C. Operation:

1. General:

a. The FCP provided by the Filter Manufacturer controls the operation of the regenerative filter including regeneration cycles, Rinse and Pre-coat cycles and vacuum transfer of media into the filter.
b. Filter regeneration and rinse cycles may be manually or automatically initiated.
c. When operated in AUTO, the FCP determines when a regeneration cycle is necessary, and when it may be allowed.
d. The normal mode of operation of the System shall be when the WTP is in AUTO and circulating water through the Filters to the features.
e. Normal mode of the FCP will be AUTO.

2. Operation

a. During media transfer the WTP is turned “OFF”.
b. FCP will initiate regeneration as needed or when manually initiated signaling CP to stop the WTP. FCP will then set all necessary pneumatic actuated valves and process the cycle signaling the CP to re-start WTP for pre-coat and will return the system to normal operation when cycle is complete.

3.5 CHEMICAL CONTROL

A. Function: To monitor and control the water pH and ORP of the closed loop water systems.

B. Components:

1. Chemical Controller (CC).
2. Chlorine Chemical Feeder (CCF).
3. pH Chemical Feeder (PCF).
4. PLC I/O in CP.

C. Operation:

1. General: The CC shall sample and monitor the chemical properties of the system water. The CC shall control the CCF and the PCF via switching relays in the CC.
2. The PLC shall monitor the WTP for the system and shall inhibit any chemical injection or feed unless the WTP is ON. If the WTP is ON, the PLC relay shall energize the CC to adjust the chemistry of the water.

3.6 SECONDARY DISINFECTION (OZONE) SYSTEM CONTROL

A. Function: To monitor and control the Ozone Generation and Injection, which provide additional water disinfection in association with the Chlorine Feed System.

B. Components:

1. Ozone Booster Pump (OBP)
2. Ozone Generator (OZ)
3. Ozone Air Preparation System (OAP), when required
4. ORP Controller (ORPC)

5. Ozone Destruct Unit (DU)

C. Operation:

1. General: The OBP provides flow through the ozone side stream loop, which includes a venturi injector that injects the Ozone gas provided the OZ. The ozonated water flows into a pressurized vessel, Ozone Contact Tank, where the ozone is allowed to react with the water and any undissolved ozone gas is collected and off gassed through the DU. The water in the Ozone Contact tank discharged back into the main system water line. In the main line the ORP is monitored by the ORPC and provides feed back to the OZ, the ORP Probe should be located after the Ozone loop reconnects to the main line, but prior to the injection of the Chlorine Feed System.
2. The OBP shall be interlocked to the operation of the WTP. The OBP shall not operate when the WTP is OFF.
3. The PLC shall monitor the OZ and provide a display of the operation of the OZ, including the ORP reading from the ORPC.
4. Ozone destruct is a passive system wherein a catalyst converts undissolved ozone to oxygen. No control is required but the unit does require power to run a small heater to prevent condensation within the catalyst bed.

3.7 TEMPERATURE CONTROL (ADD/ALTERNATE)

A. Function: To monitor the temperature of the system water leaving the mechanical room and insure that temperature is never more than 104 °F (40 °C).

B. Components:

1. Temperature Probe (TP) – located on the main outlet pipe after the Heater connections.
2. Temperature display at the location of the TP.
3. Controller I/O in CC-X.
4. Heater (H).

C. Operation:

1. General: The TP shall monitor the temperature of the water going out of the mechanical room and back to the water feature. If the temperature of the water every exceeds 104 °F (40 °C) the controller will de-energize the Heater.
2. The temperature set point will be adjustable on the controller HMI.

3.8 BACKWASH TANK MANAGEMENT

A. Function: To monitor the water level in the backwash holding tank and permit backwashing operations only when the backwash holding tank has sufficient storage capacity to contain new backwash effluent.

B. Components:

1. Backwash Tank Level Monitoring System (LMS).
2. Backwash Drain Valve (BDV) or Pump (BDP), when specified.
3. All associated WTP Systems that contribute backwash water to the tank.
4. PLC I/O in CP-X.

C. Operation:

1. General: The LMS shall monitor the level of the water in the backwash holding tank. If a BDP is used the pump will turn OFF and ON based on levels with the tank to meter water out to the sewer system. If a BDV is used the valve position will be set at start-up to ensure that the maximum flow out of the backwash holding tank is not greater than the site capacity. The position of the BDV shall be constant.
    a. If the water level in the tank is below the low-level setpoint (LLS), the BDP shall not operate. If BDV is used there is no LLS.
    b. While backwash water is being discharged into the holding tank the PLC shall monitor the water level. When the level reaches the LLS (to be determined at start-up) the BDP shall automatically start, sending water to the site sewer. The BDP shall continue to operate, until the water level reaches the Low-Level Shutdown (LLD), which shall be determined at start-up.
    c. Should the water level rise to the High-Level Alarm (HLA), approximately 6-inches (150mm) below the top of the tank, all WTP System associated with the backwash holding tank shall be stopped and an alarm relayed to the HMI. WTP operation shall not be allowed until the water level in the backwash holding tank decreases to an acceptable level.

3.9 SYSTEM ALARMS AND SHUTDOWN TRIPS

A. Mechanical Room High Water Trip

1. Function: To monitor high water levels on the mechanical room floor and shut down electrical power.
2. Components:
    a. Floor Water Level Switch (FLS)
    b. Shunt Trip on MCC Main Circuit Breaker
    c. Alarm Notification in the door of CP-X
3. Operation:
    a. The FLS shall be installed near the floor as shown in the Contract Documents.
    b. Should the FLS actuate, the Main Breaker shall trip, de-energizing all water feature equipment in the mechanical room. An audible alarm and Operator notifications shall be initiated.
    c. Resetting the alarm shall occur when the MCC circuit breaker is reset.
4. Pump Restart Time Delay
    a. Function: To delay restarting all motors and allow a staggered starting after Utility Power Failure.
    b. Components: Timing Relays in CP-X.
    c. Operation: When CP-X is energized, several timing relays shall begin timing, each relay shall be set for a five (5) minute cascaded delay. Various large pump loads shall not be allowed to start until the time delay for that pump is complete. The relays shall reset on loss of control power at CP-X.

B. Motor Control Center – Phase Failure Trip

1. Function: To monitor the incoming AC power to the 3-phase MCC and trip all motors on loss of any phase.
2. Components:
    a. Phase Failure Sensing Relay in the MCC.
    b. Shunt Trip on the MCC Main Circuit Breaker.
    c. Operation:
        i. The relay shall be installed in the MCC.
        ii. The relay shall monitor incoming AC power.
        iii. Should the incoming AC power feeder have a low voltage condition occur on any one of the three phases, the MCC main circuit breaker shall trip, de-energizing the MCC
        iv. There is no indicator or horns for this alarm. Resetting the alarm shall occur when the MCC main circuit breaker is reset.

C. Ambient Ozone Alarm

1. Function: To monitor the status of the Ambient Ozone monitor and shut down ozone generation in event of a high limit alarm condition.
2. Components:
    a. Ambient Ozone Monitor [AOM]
    b. Ozone Generator(s) [OG]
    c. Ozone Booster Pump(s) [OBP]
    d. Ambient Ozone Alarm Indicator Strobe Light (SL)
    e. CP HMI
    f. Control Logic and I/O of the CP
3. Operation
    a. The “Alarm Output” relay in the AOM signals the CP that an alarm condition exists.
    b. CP shuts down all OG within the mechanical space monitored by the AOM but leaves OBP and other water treatment equipment operating.
    c. CP activates the SL and signals operator of the alarm condition and that OG(s) are shut down via the HMI.
    d. Operator acknowledges the Alarm condition on the AOM and takes steps necessary to correct the issue causing the fault.
    e. CP deactivates the SL and enables operation of the OG when the Operator resets the Fault condition on the CP through the HMI .

END OF SECTION 131602

SECTION 131604

WATER FEATURE FIELD INSTRUMENTS, SWITCHES, AND ALARMS

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes the following:

1. Field Instruments:

   a. Ultrasonic Level Indicators
   b. Pressure Sensors
   c. Temperature Sensor and Transmitter
   d. Flow Sensor and Transmitter
   e. ORP Sensor and Controller

2. Field Switches:

   a. Vacuum Limit Switch
   b. Pressure Switch
   c. Flow Switch
   d. Liquid Level Switch
   e. Floor High Level Switch
   f. Selector Switches
   g. Time Delay Switches

3. Field Alarms

B. Related Sections:

1. SECTION 13 1502 – WATER FEATURE PUMPS AND MOTORS
2. SECTION 13 1503 – WATER FEATURE FILTERS
3. SECTION 13 1504 – WATER FEATURE CHEMICAL FEED SYSTEMS
4. SECTION 13 1505 – WATER FEATURE OZONE GENERATION AND INJECTION
5. SECTION 13 1507 – WATER FEATURE HEATERS
6. SECTION 13 1511 – WATER FEATURE VALVES, GAUGES, AND METERS
7. SECTION 13 1602 – WATER FEATURE CONTROLS
8. SECTION 13 1605 – WATER FEATURE CONTROL PANELS
9. SECTION 13 1609 – WATER FEATURE DISCONNECTS, MCC, AND STARTERS
10. SECTION 13 1610 – WATER FEATURE ELECTRICAL ACCESSORIES
11. SECTION 26 0000 – ELECTRICAL

C. References:

1. NEMA Enclosure Types
2. NFPA 70 – National Electrical Code
3. Underwriters Laboratories (UL)

1.2 SUBMITTALS FOR REVIEW

A. SECTION 01 3300 – SUBMITTAL PROCEDURES

B. Product Data: Submit Manufacturer's literature, cut sheets indicating mounting instructions, sensor dimensions, materials, electrical requirements, and operational parameters.

C. Shop Drawings: Submit Shop Drawings indicating location of all Field Switches, Sensors, and Meters, including the following:

1. Connection Diagrams
2. Loop Diagrams

D. Operation and Maintenance Data: Provide Manufacturer's instructions for installation, calibration, start-up, troubleshooting, and schedule maintenance recommendations.

E. Certifications: Provide Factory and Field Calibration Sheets for each instrument and device that requires setup and calibration. Provide Certification certifying each instrument and device has been setup and calibrated by a qualified individual.

F. Warranty: Submit Manufacturer's warranty and ensure forms have been completed in the owner's name and registered with the Manufacturer, where applicable.

PART 2 - PRODUCTS

2.1 ULTRASONIC LEVEL SENSOR / TRANSMITTER

A. Acceptable Manufacturers

1. Flowline – EchoSonic Level Sensor/Transmitter
2. IMO Industries, Incorporated – GEMS Sensors, ULS-60
3. Approved Equal

B. Sensor and transmitter shall be one integral unit.

C. Output signal shall be 4-20-mA two wire with 500-ohm loop resistance (at 24 VDC).

D. Sensor shall have a minimum resolution of 1/8-inch (3mm).

E. Configuration adjustment, test and calibration shall be accomplished by means of software connection with a USB interface.

F. Enclosure shall be type 6P encapsulated and submersible rated.

G. Transducer shall be PVDF material.

H. Sensor shall have a minimum range of 6-inches (150mm) to 9.8-feet (3m) with a 4-inch (100mm) maximum deadband.

2.2 PRESSURE SENSOR

A. Acceptable Manufacturers

1. IMO Industries, Incorporated
2. Approved Equal

B. Range: Vacuum to 100 psi (690 kPa)

C. Operating Temperature: Water (Fresh or Salt) to 140 °F (60 °C)

D. Operating Pressure (max): 150 psi (1.0 MPa)

E. Output: 4-20 mA

F. Electrical connection to be NEMA 4X or IP66 rated.

2.3 TEMPERATURE SENSOR AND TRANSMITTER

A. RTD Sensor

1. Acceptable Manufacturers
    a. Trerice
    b. Approved Equal
2. Stem: 316L Stainless Steel
3. Head: Polypropylene
4. Connection: 1/2-inch (15mm) NPT spring loaded
5. Conduit Connection: 3/4-inch (20mm) NPT female
6. Use with 316L Stainless Steel thermowell provided by the same Manufacturer.

B. Transmitter

1. Acceptable Manufacturers
    a. Trerice
    b. Approved Equal
2. Transmitter shall be fully compatible with sensor.
3. Transmitter to have 4-20 mA output.

2.4 FLOW SENSOR AND TRANSMITTER

A. Insertion Type Magnetic Flowmeter flow sensor

1. Acceptable Manufacturers
    a. Georg Fischer Signet: Model 2551
    b. Approved Equal
2. The electromagnetic insertion flow sensor shall generate an electrical signal proportional flow velocity from a range of 0.15-33 feet per second. The output signals shall be optional 4-20 mA analog, or digital S3L / open-collector pulse with maximum pull-up voltage of 30 vdc, and a maximum current sink of 50 mA.
3. Sensor shall operate with a power input of 5 – 26.4 vdc, with a maximum current draw of 15 mA.
4. The microprocessor-based sensor shall include Empty Pipe Detection, LED-assisted troubleshooting, and Bi-Directional span capability (in 4-20 mA models). An optional USB to Digital (S3L) Configuration/Diagnostic Tool shall be used to span (in 4-20 mA models), and/or customize performance features including Noise Rejection Filter, Low Flow Cutoff, Averaging Time, and Sensitivity.
5. The sensor shall utilize an Installation Fitting that is factory set to control proper flow sensor insertion depth and orientate sensor to be parallel with fluid flow.
6. The sensor shall not create a pressure drop of >1 psi at any flow rate.

7. With a fully developed flow profile the sensor output shall be linear to ±1-percent of full range, with a repeatability of ±0.5-percent of full range, and supplied with a certificate traceable to N.I.S.T.
8. Three optional sensor lengths shall allow the flow sensor to install into pipes from 0.5 to 36 inches.
9. The sensor body shall be 316L Polypropylene with stainless steel electrodes and grounding ring: Optional PVDF/Titanium, PVDF/Hastelloy-C, or PVDF/316LSS.
10. The flow sensor shall be equipped with dual O-ring seals. The elastomeric seals shall be FPM-Viton® (standard) with optional EPDM or FFPM-Kalrez®.

B. Flow Transmitter

1. Acceptable Manufacturers

   a. Georg Fischer Signet model 9900
   b. Approved equal

2. General:

   a. Transmitter shall be modular design with a functional base unit and optional field replaceable output modules.
   b. Printed circuit boards shall be conformally coated or potted with an epoxy solution.
   c. Transmitter shall offer field, integral, and panel mounting options with NEMA 4X, CE, and UL approvals/ratings and removable terminal blocks for filed wiring interface.

3. Inputs

   a. Transmitter shall be used for, and not limited to, Georg Fischer Signet Flow, pH, ORP, Conductivity / Resistivity, Salinity, Temperature, and Level measurements able to accept Signet's Digital (S3L) signals as well as open collector and AC frequency inputs.
   b. Transmitter shall operate on loop power or 12 to 32 VDC from a DC power supply.
   c. Transmitter shall provide over-voltage protection for 1.5 times the max voltage rating for this device as well as reverse-voltage protection.

4. Outputs

   a. Open Collector shall operate up to 30 VDC and have a maximum current rating of 50 mA allowing for the NPN open collector output that can be used in a NPN or PNP configuration.
   b. 2 SPDT, Form C relays shall accept up to 30 VDC or 250 VAC and a maximum current of 5A for any measurement, such as primary or secondary, as a relay output source.
   c. Relay outputs hall allow for the following relay modes: Off, Low, High, Window (Inside/Outside), Volumetric Pulse, Totalizer Volume, Cyc High, Cyc Low, Proportional Pulse, PWM, and USP.
   d. Relays shall allow for a hysteresis value, relay time delay, and relay test mode.
   e. Relays shall be replaceable without having to replace the transmitter.

f. 4-20 mA current loop outputs shall comply with the ANSI-ISA 50.00.01 Class H Standard. 4-20 mA outputs shall be isolated and offer forward or reversible scaling.
g. User confirmation and adjustment of current outputs.
h. Provide user-selectable current output value in case of error conditions.

5. Calibration

a. Transmitter shall provide a method for single or dual point calibration by user.
b. Transmitter shall provide a method for the device to auto buffer recognition.
c. Shall allow for users to reset the measurement(‘s) calibration.
d. Shall provide a menu to allow the user to enter the last cal date.
e. Shall provide the means to hold outputs during calibration.

6. Security to be provided via standard or enhance password/code.
7. Signal Conditioning to be provided via user-selectable times for averaging the processed input signal including a sensitivity function that can override the averaging function if the user-specified set point is reached.

2.5 ORP SENSOR AND CONTROLLER

A. ORP Sensor

1. Acceptable Manufacturers

a. DEL Ozone
b. Sensorex
c. GF Signet Company
d. Approved Equal

2. 1/2-inch (15mm) MPT insertion mount with 1/2-inch (15mm) conduit threads on opposite end
3. Flat-tip sensor design.
4. Compatible with insertion dry tap mounting to allow for cleaning of the probe without system shutdown.

B. ORP Meter/Controller

1. Acceptable Manufacturers

a. Hanna Instruments
b. GF Signet Company, 3-8350 Series
c. Approved Equal

2. Controller shall be fully compatible with sensor.
3. Device shall meet NEMA 4X and IP65 Standards.
4. ORP reading shall be in millivolts (mV) and setpoint shall be displayed.
5. Setpoint shall be adjustable by front panel controls.
6. Transmitter to have an isolated 4-20 mA output with an open collector output.
7. Transmitter to have Hold and Simulate functions selectable by the Operator.

2.6 GENERAL SWITCH REQUIREMENTS

A. Switches shall provide ON-OFF control action in response to changes in a measured variable.

B. Unless otherwise scheduled, provide switches with Form C (SPDT) electrical contacts.

C. Switch contacts in 120 VAC circuits will be rated NEMA B150, and switch contacts in 24 VDC circuits will be NEMA P150, unless otherwise noted.

D. Electrical contacts will be hermetically sealed and either mercury or snap action type.

E. Switched to be automatic reset type.

2.7 FIELD SWITCHES

A. Vacuum Limit Switch

1. Acceptable Manufacturers

   a. Static-O-Ring, No. 54NN-K117-N4-B1A
   b. Square D Company, Class 9016, Type GAW2
   c. Approved Equal

2. Range: Must have an adjustable setpoint from atmospheric pressure down to a minimum of 15-inch Hg (-50 kPa vacuum).
3. Process connection: 1/4-inch (8mm) NPT
4. Conduit Connection: 3/4-inch (20mm) NPT conduit fitting
5. Over-range Rating: 100 psi (690 kPa)
6. Housing: NEMA 4X
7. DPDT N.O. & N.C. contacts rated for a minimum 1 amp at 250-VAC.

B. Pressure Switch

1. Acceptable Manufacturers

   a. IMO Industries, Incorporated – GEMS Sensors, 2200 Series
   b. Approved Equal

2. Range: Vacuum to 100 psi (690 kPa)
3. Over-range Rating: 200 psi (1.4 MPa)
4. Process Connection: 1/4-inch (8mm) NPT minimum
5. Electrical connection to be shielded PVC cable
6. Housing: NEMA 4X
7. Output: 4-20 mA

C. Flow Switches

1. Acceptable Manufacturers

   a. IMO Industries, Incorporated – GEMS Sensors, FS-550 Series
   b. Approved Equal

2. Wetted Materials: Housing, Paddle, and Spring to be 316L S. S., Teflon, Or Ceramic
3. Operating Pressure: 2,000 psig (14 MPa) maximum
4. Pressure Drop: 3 psig (20 kPa) maximum
5. Operating Temperature: -30 to 300 °F (-35 to 150 °C)
6. Setpoint Accuracy: +/- 25%

7. Switch Rating: SPDT, 20 VA
8. Repeatability: +/- 5%

D. Liquid Level Switches

1. Small Tank Float Type Switches

a. Acceptable Manufacturers

i. IMO Industries, Incorporated – GEMS Sensors, LS-3 (Vertical Mount)
ii. IMO Industries, Incorporated – GEMS Sensors, LS-6 or LS-7 (Horizontal Mount)
iii. Approved Equal

b. Wetted Parts to be 316 Stainless Steel, Polypropylene, Teflon, or Kynar (PVDF).
c. Operating Temperature: Water (Fresh or Salt) to 140 °F (60 °C)
d. Minimum Liquid Specific Gravity: 0.65
e. Operating Pressure: 150 psi (1.0 MPa) maximum
f. Switch Rating: 20 VA
g. Electrical Termination: No. 22 AWG, minimum of 12 inches (300mm) long, Polymeric Lead Wires.
h. Selectable Normally Open (NO) or Normally Closed (NC) operation by inverting float on unit stem.

2. Electro-Optic Switches

a. Acceptable Manufacturers

i. IMO Industries, Incorporated – GEMS Sensors, ELS-1100
ii. Approved Equal

b. Housing and Prism: Polysulfone
c. Operating Pressure: 0 to 150 psi (1.0 MPa)
d. Operating Temperature: 0 to 176 °F (-17.8 to 80 °C)
e. Input Power: 10-28 VDC
f. Mounting Type: 1/4-inch (8mm) NPT and 3/8-inch (10mm) NPT Conduit.
g. Repeatability: +/- 1 mm
h. Electrical Termination: No. 22 AWG, minimum 12 inches (300mm) long lead wires with PVC jacket.

3. Ultrasonic Type Switches

a. Acceptable Manufacturers

i. IMO Industries, Incorporated – GEMS Sensors, ULS-60
ii. Flowline Liquid Intelligence, LU12-5061
iii. Approved Equal

b. Enclosure: Engineered Plastic NEMA 4X with 1/2-inch (15mm) NPT Conduit fitting.
c. Sensor Material: Kynar (PVDF)
d. Deadband: 3.6-inch (91mm) maximum
e. Output:

i. 4-20 mA.
ii. Two (2) relay channels for control and alarm with potentiometer calibration. Relays to have a minimum 20-VA rating.

E. Floor High Level Switch

1. Acceptable Manufacturers

a. IMO Industries, Incorporated – GEMS Sensors, LS-1700
b. Approved Equal

2. Stem Material: 316 Stainless Steel
3. Float Material: Buna
4. Operating Temperature: Water (Fresh or Salt) to 300 °F (149 °C)
5. Switch Operation: Normally Open (Reversible)
6. Actuation Level: 9/16-inch (14.28mm)
7. Switch Type: SPST (20 VA)
8. Electrical Termination: No. 22 AWG, minimum of 24-inches (600mm) long, Polymeric Lead Wires.
9. Provide a junction box with the Floor High Level Switch.

a. Acceptable Manufacturers

i. Hoffman AS404SC
ii. Approved Equal

b. Meets NEMA Type 12
c. 16-gauge Steel with seams continuously welded and ground smooth
d. Oil-resistant gasket
e. ANSI 61 Gray polyester powder paint inside and out
f. Flat Cover Plate

F. Selector Switches

1. Acceptable Manufacturers

a. Square D, Type K
b. Allen-Bradley, Bulleting 800T
c. Micro Switch Division of Honeywell, Type PT
d. Eaton Corporation
e. Culter-Hammer Products, Type T
f. General Electric Company, Type CR
g. Approved Equal

2. General: Heavy Duty oil-tight with operators as specified. Engrave position legends on switch faceplate. Switches for electrical circuits shall have silver butting or sliding contacts, rated 10 amperes continuous at 120-VAC.
3. Motorized Backwash Control Valve – Black knob operator switch, four position, maintained contact.

G. Time Delay Switches

1. Acceptable Manufacturers

a. Tork, A500 Series

b. Approved Equal

2. General: Switch shall be a spring wound, interval time switch.
3. Ratings:
    a. Single-pole, single throw.
    b. 20 amp at 125-VAC.
    c. 0-to-30-minute time duration.
    d. Color: Ivory or as specified by Architect/Landscape Architect.
    e. Install in standard 2- by 4-inch (50 by 100mm) electrical box with decorative cover plate.

2.8 FIELD ALARMS

A. Emergency Shutdown Alarm Horn

1. Acceptable Manufacturers
    a. Cooper Wheelock
    b. Approved Equal
2. Alarm shall be an audible and strobe type.
3. Audible tone shall be a selectable choice of either continuous horn or temporal pattern.
4. Each tone shall have 3 dBa settings (99, 95, and 90 dBa) to choose from.
5. Shall be available with a weatherproof model for outdoor use.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install components as per the Manufacturer’s recommendation.

3.2 GENERAL

A. Erect and install all instruments, control systems, and equipment furnished and required by the Contract Documents.

B. Furnish and install all tubing, piping, fittings, and valves required to install, connect, and complete the instrumentation and control systems as specified and indicated.

C. Connect tube, pipe, and support all equipment erected and installed as specified.

D. Calibrate all instruments furnished by this section.

E. Perform loop checking and functional testing as specified.

F. Provide all testing instruments, calibration standards, and devices required to perform calibration and testing procedures.

G. Provide skilled labor and technical assistance to the Manufacturer’s Service Representative for the calibration and start-up of control systems and equipment.

H. Coordinate and consult with the control systems service representative as required.

I. Place instruments and controls into successful operation.

J. Install all prefabricated cable as required in this section.

K. Wire all instrumentation and control devices as required in this section.

3.3 FLOW SWITCH

A. Switch shall be installed in a 1-inch (25mm) NPT pipe tap or saddle fitting.

B. The Contractor shall cut paddle length to suit pipe diameter in accordance with the Manufacturer's recommendations.

3.4 LIQUID LEVEL SWITCHES

1. Float: Install as shown on Contract Documents and in accordance with Manufacturer's Installation Instructions.

3.5 FLOOR HIGH LEVEL SWITCHES

A. Install switches in lowest area of the mechanical room with electrical equipment, such as pump pits.

B. Provide one switch for each separate area.

C. Mount switch junction box a maximum of 3-inches (75mm) from the floor.

D. Adjust the location of the float to be within the manufacturer specified actuation distance.

E. Provide necessary electrical connections and controls to trip the shunt trip for main circuit breaker for the equipment room upon actuation of the switch.

3.6 HYDROTHERAPY JET PUMP AND/OR BLOWER TIME SWITCH

A. Switch shall be installed in a plastic 2- by 4-inch (50 by 100mm) or 4- by 4-inch (100 by 100mm) electrical box with a plastic cover plate. Provide and in-service weatherproof cover if located outside.

B. Install switch in a secure and accessible manner to the spa/hot tub.

3.7 EMERGENCY SHUTDOWN ALARM HORN

A. Alarm Horn shall provide an audible warning of an emergency switch actuation.

B. Alarm Horn shall remain on continuous until the emergency switch is reset.

END OF SECTION 131604

SECTION 131605

WATER FEATURE CONTROL PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes the following:

1. Panel Enclosures
2. Panel Instruments and Devices
3. Panel Accessories
4. Panel Wiring

B. Related Sections:

1. SECTION 13 1502 – WATER FEATURE PUMPS AND MOTORS
2. SECTION 13 1503 – WATER FEATURE FILTERS
3. SECTION 13 1504 – WATER FEATURE CHEMICAL FEED SYSTEMS
4. SECTION 13 1505 – WATER FEATURE OZONE GENERATION AND INJECTION
5. SECTION 13 1507 – WATER FEATURE HEATERS
6. SECTION 13 1511 – WATER FEATURE VALVES, GAUGES, AND METERS
7. SECTION 13 1602 – WATER FEATURE CONTROLS
8. SECTION 13 1609 – WATER FEATURE DISCONNECTS, MCC, AND STARTERS
9. SECTION 13 1610 – WATER FEATURE ELECTRICAL ACCESSORIES
10. SECTION 26 0000 – ELECTRICAL

C. References:

1. Instrument Society of America (ISA) – ANSI/ISA-S5.4 Instrument Loop Diagrams
2. NEMA 250 – Enclosures for Electrical Equipment (1,000 Volts Maximum
3. NFPA 70 – National Electrical Code (NEC) – Article 250 Grounding
4. Underwriters Laboratories (UL)

1.2 SUBMITTALS FOR REVIEW

A. SECTION 01 3300 – SUBMITTAL PROCEDURES

B. Product Data: Submit Manufacturer’s literature for all components indicating component dimensions, weights, colors, and materials.

C. Shop Drawings: Submit the following Shop Drawings, drawn to scale. Scale shall not be less than 1-inch equals 1-foot 0-inches (1” = 1’-0”) for Imperial Units or 1:10 for Metric Units. Drawings shall identify all equipment, dimensions, materials, and colors.

1. Panel Front View – showing equipment arrangement and dimensional information.
2. Panel Floor Plan and Side View – showing dimensions, doors, and equipment layout inside the Panel.

3. Drawings showing structural details of fabricated Panels and Mounting requirements.
4. Internal Interconnecting Wiring Diagrams – showing Terminal Strips and all external devices connected to the Panel as required in SECTION 13 1602 – WATER FEATURE CONTROLS, design submittal for Loop and Schematic Diagrams.
5. Complete Schematic and Diagrams – including terminal block and wire identification number and device location symbols consistent with the Contract Documents.
6. Panel Bill of Materials – with detailed description of components and equipment data sheets.
7. Field Cable Number/ID and Terminations.
8. Factory Data Sheets for Instrumentation.

D. Operation and Maintenance Data: Provide Manufacturer's instructions for installation, general assembly instructions, and maintenance and care recommendations for all components.

E. Factory Test Certifications: Provide certification from the Panel Manufacturer indicating the Panel has been tested and is fully operational prior to shipping.

F. Warranty: Provide a written warranty for assembled Panels and Components for a minimum of two (2) years from the date of installation.

1.3 QUALITY ASSURANCE

A. Panel Builder Qualifications: Panel Builder shall have a minimum of five (5) years' experience in building Panels and performing all Work related to this section.

B. The Contract Documents show the general arrangement of each Panel. The Panel Builder shall design the Panel layouts within the guidelines set forth and submit these layouts in accordance with the Submittals Section.

C. Panels shall be built in accordance with the approved shop drawings. All components and operations shall be tested and working prior to shipping.

D. Panels shall be shipped with one (1) complete copy of Schematic Diagrams including Terminal Block and Wire Identification Numbers.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver Panels to the job site in the Manufacturer's original, unopened packaging, clearly marked with Supplier's Name, Address, and Panel information.

B. Storage and Handling: Store Panels in a well-ventilated, clean, dry covered area. Do not store in direct sunlight or where Panels can be damaged from water or moisture.

PART 2 - PRODUCTS

2.1 PANEL ENCLOSURES

A. Acceptable Manufacturers

1. Rittal Corporation
2. Hoffman
3. Approved Equal

B. General Enclosure Requirements

1. Use NEMA 12 rated Panels for Indoor installation. Use NEMA 4X rated Panels for Outdoor installation. Specific requirements as specified herein or as indicated on the Contract Documents
2. Size Panels in accordance with limitations indicated on the Contract Documents. Panel size is the specific requirement of the Panel Manufacturer.
3. Cabinets less than 60-inches (1.5m) high shall be provided with floor stands to raise the top of the Panel to 60-inches (1.5m) above the floor or work platform, or if the Panel weighs less than 100 lbs (45 kg) and wall space is available, wall mounting may be used in lieu of a floor stand
4. Structures and equipment shall be braced to prevent damage from seismic forces. Equipment shall not be required to function properly during periods of seismic disturbance but shall be capable of manual restart following a disturbance.
5. Cutouts for future equipment shall be blanked off with suitable covers.
6. Instrument tag numbers, if used, shall be identified on the Panel rear. Name Plates shall identify face-mounted instruments. Instruments shall be mounted in a manner that allows ease of access to components and ease of removal.
7. Face-mounted instruments that are more than 6-inches (150mm) deep, weigh more than 10 lbs (4.5kg), or exert more than 4.0 ft-lbs (0.6kg-m) moment force on the face of the Panel shall be supported underneath at the rear.
8. Face-mounted equipment shall be flush or semi-flush with black escutcheons
9. Name Plates on internal and external instruments and devices:

    a. Materials approximate dimensions and legends as indicated on the Contract Documents made of laminated phenolic material having engraved letters approximately 3/16-inch (5mm) high extending through the black face into the white layer; firmly secured to Panels.

10. Fabricated Custom Metal Panels:

    a. Thoroughly clean, sand, and apply a minimum two (2) coats of rust inhibiting primer both inside and outside of Panels. Apply a minimum of two (2) coats of white enamel or lacquer on Panel interior surfaces. Smooth exterior surfaces and apply a minimum of two (2) coats of enamel, polyurethane, or lacquer finish. Furnish 2 quarts (1.9 liters) of finish color paint with the Panels to cover future scratches.

11. Provide Panels with an inside pocket to hold Panel Drawings. Ship Panels with one (1) copy of accepted Submittal Drawings in a sealed plastic bag stored in the Panel drawing pocket.

C. Freestanding Custom Metal Panels:

1. Panel Custom Fabrication: Dust tight, completely enclosed cubicle formed from steel structural members and steel plates. Form base of heavy channel iron, with flanges up, and with 1/2-inch (12mm) holes drilled at 12-inch (300mm) spacing so that the Panel shall be bolted to the floor. Grind smooth welds, seams, and edges on exposed surfaces. Provide lifting facilities for handling and shipment.

2. Panel Bracing: Suitably brace Panel structure for sufficient strength to support equipment mounted on or within, to withstand handling and shipment, to maintain alignment, and to be rigid and freestanding.
3. Fabricate tops, sides, and rear from minimum 12-gauge (2.7mm) steel plates with stationary rear suitable for back-to-wall installation.
4. Front Doors: use 12-gauge (2.7mm) steel plate, with turned-back edges suitably braced and supported to maintain alignment and rigidity without sagging; of sufficient width to permit door opening without interference with rear projection on flush mounted instruments, essentially fully height, with strong continuous piano type hinges.
5. Positive Latches: Acting from a common door handle that shall hold doors securely compressed at top, side, and bottom against gaskets.
6. Doors shall have padlock locking provisions. All Panels shall be keyed alike.
7. Top and bottom with nominal 1 sq. foot (929 sq. cm) per section removable access plates that shall be drilled to accommodate external wiring and conduit. Arrange Panel internal components for external conduit and piping to enter the Panel either from above or below.
8. Arrange Panel instruments and control devices in a logical configuration from an Operator’s standpoint and as indicated on the Contract Documents.
9. Locate Control Switches and Indicators within 60-inches (1.5m) and 36-inches (0.9m) above the base of the Panel.
10. Provide duplex, grounded GFI receptacles for service and maintenance tools within the panel at spacing not greater than 5-feet (1.5m) throughout the length of the Panel. Provide lighting and receptacle circuit from a separate power source and fuse separately from the instrument systems.

D. Wall-Mounted Panels

1. Panels: Fabricate the enclosures from not less than 14-gauge (2mm) steel complete with full size gasketed doors with stainless steel three-point latch and hinges.
2. Construct instrument sub-panels from minimum 1/8-inch (3mm) thick steel, reinforced and braced as required to form a rigid assembly.
3. Mount components on easily removable steel sub-panels painted white.

2.2 PANEL INSTRUMENTS AND DEVICES

A. General

1. Instruments shall have matching or compatible fascia such as height, finish, color, and display color with a logically grouped panel display.
2. Electronic Panel instruments shall be able to operate from 120-VAC plus or minus 10-percent, 60 Hertz (220 VAC +/- 10%, 50 Hz), and 24-VDC plus or minus 10-percent power supply. Instruments in the same panel shall be powered from the same power supply.
3. Panel Instruments shall be capable of providing loop power (nominally 24 VDC) for all analog inputs and outputs. Signal circuits and power supply circuits shall be galvanically isolated from each other and the instrument case.
4. Operating temperature range shall be from 40 to 120 °F (4.4 to 50 °C) and relative humidity to 90 percent non-condensing.

B. Switches

1. Acceptable Manufacturers

a. Micro Switch Division of Honeywell, Type PT
b. Eaton Corporation
c. Culter Hammer Products, Type T
d. General Electrical Company, Type CR
e. Square D Company, Type K
f. Allen-Bradley, Bulletin 800T

2. Selector Switches: Heavy duty oil-type with gloved-hand or wind lever operator. Engrave position legends on switch faceplate. Switches for electrical circuits shall have silver butting or sliding contacts, rate 10-amperes continuous at 120-VAC.
3. Contact Configuration: Switches used in electronic circuits shall have contacts with a minimum rating of 2-amperes.

C. Indicator Lights

1. Acceptable Manufacturers

a. Micro Switch Division of Honeywell, Type PT
b. Eaton Corporation
c. Culter Hammer Products, Type T
d. General Electrical Company, Type CR
e. Square D Company, Type K
f. Allen-Bradley, Bulletin 800T

2. Heavy-duty, oil-tight type, which utilizes a 6 VDC lamp and built-in transformer. Engrave legends on the lens or on a legend faceplate. Lamps shall be easily replaceable from the front of the indicating light.
3. Integrate a push-to-test feature with each indicating light, or a common test of all Panel Indicating Lights.

D. Operator Panels

1. Acceptable Manufacturers

a. Optimation, Incorporated, OP-620 Series
b. Approved Equal

2. Operator Panel shall connect to the PLC, and shall offer two (2) lines of 20 digital characters, plus user definable pushbuttons. Each pushbutton shall have LED indicators.
3. The Unit shall display up to 160 user definable status or variable messages.
4. The Operator Panel shall operate on 8-30 VDC.
5. Communications between the Operator Panel and the PLC shall be via RS232/RS422 4800 to 19200 baud.
6. The Unit shall be fully compatible with Allen-Bradley SLC 5-03 products.

E. Control Relays

1. Acceptable Manufacturers

a. Potter and Brumfield, Series KRP
b. Eagle Signal Controls, Series 22 or 80
c. Manufacturers of Struthers-Dunn, Incorporated, Series A3 or A4
d. IDEC, RH Series

2. Provide Control Relays indicated in Instrument and Control Panels and Enclosures with plug-in socket base type with dustproof plastic enclosures.
3. Relays: Relays shall function as indicated on the Contract Documents, in accordance with design requirement, and with not less than the number of poles shown on the Contract Documents. Provide form “C” double-throw contacts.
4. Control circuits relays shall have silver-cadmium oxide contacts rated for 10-amperes at 120-VAC
5. Electronic switch-duty relays shall have gold-plated or gold alloy contacts suitable for use with low level signals.
6. Relays utilized for computer input, alarm input, or indicating light service shall have contacts rated not less than 5-amperes.
7. Time delay relays shall have dials or switch settings engraved in seconds, with timing. repeatability of plus or minus 2.0-percent of setting.
8. Provide latching and special purpose relays as indicated for the specific application.
9. Relays shall have a built-in lamp, LED, or neon, to indicate an energized relay.

F. 7-Day Electronic Digital Time Switch

1. Acceptable Manufacturers

a. Tork, DIN 200
b. Paragon

2. Unit shall program in AM/PM or 24-hour format and shall provide one (1) minute resolution
3. The Unit shall have an LCD display.
4. It shall be capable of a minimum of 48 event per channel per week and allow separate schedules for each day of the week.
5. The Unit shall have 365 holiday capabilities with 16 single dates and 5 holiday blocks of unlimited duration.
6. The Unit shall be selectable between Standard and Daylight Savings Time.
7. Controller shall have automatic Leap Year correction.
8. Controller shall have a 72-hour memory backup with rechargeable battery.
9. The Unit shall be capable of manual override ON or OOF to the next scheduled event using one (1) button for each channel.
10. Technical Specification:

a. Switching Interval: 1 minute
b. Manual Override
c. Input Voltage: 120 VAC, 50/60 Hz
d. Power Consumption: 5 VA maximum
e. Battery Backup: 150 hours
f. Operating Temperature: 14 to 140 °F (-10 to 55 °C)
g. Accuracy at 68 °F (20 °C): +/- 2.5 seconds per day
h. Weight: 5.2 oz (147g)

i. Mounting: DIN Rail (35mm)
j. Dimensions:
  i. Width: 1-7/8-inch (48mm)
  ii. Depth: 2-7/8-inch (73mm)
  iii. Height: 3-1/4-inch (83mm)
k. Output:
  i. Switch Configuration: SPDT
  ii. Switch Contact Rating: 16 A Resistive

2.3 PANEL ACCESSORIES

A. Terminal Strips

1. Acceptable Manufacturers
   a. Allen-Bradley, 1492-W Line
   b. Entrelec M4/6 Series
   c. Weidmuller SAKS
   d. Phoenix Contact
   e. Wago
2. Voltage Rating: 600 V AC/DC
3. Maximum Current: 30 Amperes
4. Wire Range: No. 22 – No. 8 AWG
5. Density: 38 pieces per foot (125 per meter)
6. Insulation Temperature Range: -40 to 221 °F (-40 to 150 °C)
7. Color: Gray

B. Plastic Wireway

1. Acceptable Manufacturers
   a. IBOCO Corporation, T1 Duct Series
   b. Approved Equal
2. Material: Rigid PVC, Self-extinguishing
3. Color: Light Grey or White
4. Standard Length: 6-feet 6-3/4-inches (6’-3.75”) (2.0m)

C. DIN Mounting Rail

1. Acceptable Manufacturers
   a. IBOCO Corporation
   b. Approved Equal
2. Material: RoHS Compliant, treated with galvanic zinc plating
3. Minimum Thickness: 6-microns
4. Standard Length: 6-feet 6-3/4-inches (6’-3.75”) (2.0m)

2.4 PANEL WIRING

A. Interconnecting wiring and wiring to terminals for external connection shall be MTW or SIS 16 AWG, stranded copper wire, insulated for not less than 600 volts, with a moisture-resistant and flame-retardant covering rated for not less than 194 °F (90 °C)

except circuits and special instrument interconnecting wiring that shall be in accordance with Manufacturer requirements.

B. Panel Wiring Size:

1. Power Distribution Wiring on the line side of pane fuses: Minimum 12 AWG.
2. Secondary Power Distribution Wiring and Wiring for Control Circuits: Minimum 14 AWG.
3. Annunciation and Indicating Light Circuits: Minimum 16 AWG.
4. Electronic Analog Circuits within Instrument and Control Panels: Minimum 14 AWG, Twisted and shielded pairs or triads rated not less than 600 volts.

C. Analog Circuits and AC Power Circuits: Separated

D. Internal Panel Wire Colors:

1. AC Power Distribution: Red
2. DC Power Distribution: Blue
3. Instrument: Black and White shielded pair

E. Other and in agreement with Manufacturer's wiring diagrams as stated on manufactured drawing legend.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install gasket and sealing material under panels with floor slab cutouts for conduit. Undercoat floor mounted panels.

B. Install signal grounding conductor and grounding electrode as required by the Panel Manufacturer.

C. Connect Panel equipment grounding (safety) terminal to the building or facility grounding grid with 6 AWG green insulated conductor.

3.2 CLEANING

A. Clean the interior and exterior of the Panel prior to applying power and energizing.

3.3 DEMONSTRATION

A. Demonstrate operation of equipment in accordance with the intent of the Contract Documents.

3.4 PROTECTION

A. Protect products until acceptance by the Owner.

END OF SECTION 131605

SECTION 131606

WATER FEATURE INSTRUMENT POWER SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes the following:

1. Surge Protectors
2. Control Power Transformer
3. DC Power Supplies

B. Related Sections:

1. SECTION 13 1502 – WATER FEATURE PUMPS AND MOTORS
2. SECTION 13 1602 – WATER FEATURE CONTROLS
3. SECTION 13 1604 – WATER FEATURE FIELD INSTRUMENTS, SWITCHES, AND ALARMS
4. SECTION 13 1605 – WATER FEATURE CONTROL PANELS
5. SECTION 13 1609 – WATER FEATURE DISCONNECTS, MCC, AND STARTERS
6. SECTION 13 1610 – WATER FEATURE ELECTRICAL ACCESSORIES
7. SECTION 26 0000 – ELECTRICAL

1.2 SUBMITTALS FOR REVIEW

A. SECTION 01 3300 – SUBMITTAL PROCEDURES

B. Product Data: Submit Manufacturer’s literature, cut sheets indicating materials, dimensions, mounting instructions, electrical requirements, and operational parameters.

C. Warranty: Submit manufacturer’s warranty and ensure forms have been completed in the owner’s name and registered with the manufacturer, as appropriate.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Solid State electronic instrumentation loads shall be supplied with AC power that has been conditioned to suit the instrumentation Manufacturer’s specified requirements. Power supplies to panel housing electronic instrumentation shall include a noise isolation transformer.

B. This provision is not necessary where the electronic instrumentation includes an integral isolation transformer or equivalent noise isolation is provide by an alternative UPS power supply conditioning device.

2.2 SURGE PROTECTORS

A. Acceptable Manufacturers

1. Tanstector ACP-100 BW
2. Power Integrity Corporation ZTAS
3. Entrelec
4. Weidmuller
5. Phoenix Contact
6. Approved Equal

B. Size Surge Protector to line voltage the device is servicing.

C. Shall have illuminated status indication, Fuse outputs, line and load bidirectional protection, and silicon diode technology.

2.3 CONTROL POWER TRANSFORMERS

A. Acceptable Manufacturers

1. Square D Company, Class 9070, Type K
2. Cutler-Hammer
3. Approved Equal

B. Top mounted fuse block for Primary (2) and Secondary (1).

C. Integral mounting plate.

D. Temperature Rise:

1. 50 VA to 250 VA: 55 °C
2. 300 VA to 350 VA: 80 °C
3. 500 VA to 5,000 VA: 115 °C

E. Rated for 50/60 Hertz operation

2.4 DIRECT CURRENT (DC) POWER SUPPLIES

A. Acceptable Manufacturers

1. AGM Electronics, Incorporated
2. Lambda Electronics, Incorporated
3. Approved Equal

B. Direct Current Power Supply units shall be switching type.

1. Line regulation shall not exceed plus or minus 0.4-percent for 95- to 132-VAC input variation
2. Load regulation shall not exceed plus or minus 0.2-percent for 0- to 100-percent load variation
3. Ripple shall not exceed 150-mV peak to peak
4. Temperature Coefficient shall not exceed 0.03-percent per degree Celsius

C. Automatic adjustable over voltage shutdown and over temperature protection shall be included. An integral or external under voltage relay shall provide and alarm on under voltage, over voltage, or over temperature.

D. Transient voltage response to a 50-percent step change in load shall not exceed 0.25-volts or plus or minus 0.1-percent after 20-milliseconds.

E. Hold-up time shall be 16.7-milliseconds or greater.

F. Efficiency shall be 75-percent or greater.

G. Conduct electro-magnetic interference (EMI) shall conform to FCC Docket 20780, Class A. Radiated EMI shall be minimized with suitably designed screened enclosures.

PART 3 - EXECUTION

3.1 SURGE PROTECTION

A. Provide surge protection on all incoming power to the Control Panels.

3.2 CONTROL POWER TRANSFORMERS

A. Install according to the Manufacturer’s requirements.

END OF SECTION 131606

SECTION 131609

WATER FEATURE DISCONNECTS, MCC, AND STARTERS

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes the following:

1. Disconnect Switches

B. Related Sections:

1. SECTION 13 1502 – WATER FEATURE PUMPS AND MOTORS
2. SECTION 13 1504 – WATER FEATURE CHEMICAL FEED SYSTEMS
3. SECTION 13 1505 – WATER FEATURE OZONE GENERATION AND INJECTION
4. SECTION 13 1507 – WATER FEATURE HEATERS
5. SECTION 13 1511 – WATER FEATURE VALVES, GAUGES, AND METERS
6. SECTION 13 1602 – WATER FEATURE CONTROLS
7. SECTION 13 1605 – WATER FEATURE CONTROL PANELS
8. SECTION 13 1610 – WATER FEATURE ELECTRICAL ACCESSORIES
9. SECTION 26 0000 – ELECTRICAL

C. References:

1. NEMA 250 – Enclosures for Electrical Equipment
2. NEMA ICS 18 – Industrial Control and Systems: Motor Control Centers
3. NEMA KS 1 – Enclosed Switches
4. NFPA 70 – National Electrical Code (NEC)
5. Underwriters Laboratories (UL) 98 – Enclosed and Dead Front Switches
6. UL 845 – UL Standard for Safety of Motor Control Centers

1.2 SUBMITTALS FOR REVIEW

A. SECTION 01 3300 – SUBMITTAL PROCEDURES

B. Product Data: Submit Manufacturer’s literature for all major components including but not limited to the following: Overload relays, circuit breaker and fuse information, control power transformers, pilot devices, relays, and etc.

C. Shop Drawings: Submit Manufacturer drawing showing the following:

1. Structure descriptions showing: Bus rating, enclosure rating, short-circuit withstand rating, and other information requiring approval.
2. Conduit Locations.
3. Required Bus Splices.
4. Unit Descriptions including starter sizes, circuit breaker frame sizes, circuit breaker continuous amperage rating, pilot devices, etc.
5. Nameplate information.
6. Schematic Wiring Diagrams.

D. Provide a copy of the Manufacturer's installation instructions that include the following: Delivery and storage instructions, general description for reading nameplate data and other markings, installation procedures, conduit and cable installation, installing and removing plug-in units, operation of operator handles and unit interlocks, checklist before energizing, procedure for energizing equipment, and maintenance procedures.

E. Warranty: Submit manufacturer's warranty and ensure forms have been completed in the owner's name and registered with the manufacturer.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Equipment shall be handled and stored in accordance with the Manufacturer's instructions.

B. One (1) copy of the Manufacturer's instructions shall be included with the equipment at time of shipment.

1.4 REGULATORY REQUIREMENTS

A. The Manufacturer shall provide certified copies of production test reports demonstrating compliance when requested by the Engineer.

PART 2 - PRODUCTS

2.1 DISCONNECT SWITCHES

A. Approved Manufacturers

1. Schneider Electric – Square D Company
2. Eaton
3. Approved Equal

B. Switch Interior

1. All switches shall have switch blades that are visible when the switch is OFF, and the cover is open.
2. Lugs shall be UL Listed and sized for the temperature and amperage ratings as recommended by the Manufacturer, aluminum, or copper.
3. All current carrying parts shall be plated to resist corrosion.

C. Switch Mechanism

1. The Switch operating mechanism shall be quick-make, quick-break such that, during normal operation of the switch, the operation of the contacts shall not be capable of being restrained by the operating handle after the closing or opening action of the contacts has started.
2. The operating handle shall be an integral part of the box, on the cover.
3. Provisions shall be provided for padlocking the switch in the OFF position.

D. Switch Enclosures

1. The enclosure shall be NEMA Type 1 for dry indoor use and NEMA Type 3R for outdoor or high humidity environments.
2. Tangential knockouts shall be provided to facilitate ease of conduit entry on switches through 200-ampere.

3. Enclosures for Type 3R switches through 200-ampere shall have provisions for interchangeable bolt-on hubs in the top endwall. Hubs shall be provided by a common manufacturer.

E. Switch Ratings

1. Switches shall be horsepower rated for 240-VAC as indicated on the Contract Documents.
2. The UL Listed short circuit rating shall be as per the Manufacturer's recommendation and specification.

PART 3 - EXECUTION

3.1 DISCONNECT SWITCH INSTALLATION

A. Clearly label Disconnects with the equipment served. Use 1/16-inch (2mm) thick laminated plastic composition material with contrasting color core. Engraved lettering shall be 1/4-inch (6mm) high. Attach tags with screws.

B. Install Disconnect Switch when motors are not in sight of the pump circuit breaker.

END OF SECTION 131609

SECTION 131610

WATER FEATURE ELECTRICAL ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes the following:

1. Raceways
2. Wires and Cables
3. Boxes
4. Wiring Devices
5. Supporting Devices and Hangers

B. Related Sections:

1. SECTION 13 1601 – WATER FEATURE GENERAL ELECTRICAL REQUIREMENTS
2. SECTION 13 1602 – WATER FEATURE CONTROLS
3. SECTION 13 1604 – WATER FEATURE FIELD INSTRUMENTS, SWITCHES, AND ALARMS
4. SECTION 13 1605 – WATER FEATURE CONTROL PANELS
5. SECTION 13 1609 – WATER FEATURE DISCONNECTS, MCC, AND STARTERS
6. SECTION 13 1611 – WATER FEATURE GROUNDING
7. SECTION 26 0000 – ELECTRICAL

C. References:

1. NFPA 70 – National Electrical Code (NEC)
2. Underwriters Laboratories (UL)

1.2 SUBMITTALS FOR REVIEW

A. SECTION 01 3300 – SUBMITTAL PROCEDURES

B. Product Data: Submit Manufacturer’s literature, cut sheets indicating mounting instructions, sensor dimensions, materials, electrical requirements, and operational parameters.

C. Warranty: Submit manufacturer’s warranty and ensure forms have been completed in the owner’s name and registered with the manufacturer.

PART 2 - PRODUCTS

2.1 RACEWAYS

A. Conduit

1. 1/2-inch (15mm) minimum diameter unless indicated otherwise and used strictly as indicated by product. If not indicated on the Contract Documents, size conduit for conductor type and quantity installed.

2. Galvanized Rigid Steel or Galvanized Intermediate Metallic Conduit (IMC).
    a. May be used in all areas
3. Galvanized Electrical Metallic Tubing (EMT)
    a. May be used in indoor dry locations where it is:
        i. Not subject to damage
        ii. Not in contact with earth
        iii. Not in concrete
4. Schedule 40 Polyvinyl Chloride (PVC)
    a. May only be used
        i. Underground
        ii. In or below concrete
    b. Use Galvanized Rigid Steel elbows and risers wrapped with approved protection tape.
5. Flexible Steel Conduit
    a. 3/4-inch (20mm) minimum.
    b. Required for final connections to indoor mechanical equipment, length not to exceed 36 inches (1m).
6. Listed, Liquid-Tight Flexible Metallic Conduit
    a. Use in outdoor final connections to mechanical equipment, not to exceed 36 inches (1m) with ground conductor.

B. Fittings
1. Compression type or set-screw type with steel housing for EMT conduits.
2. Screw-in type for flexible metal conduit.
3. Seal-Tite type for liquid-tight flexible metal conduit.
4. PVC Conduit
    a. PVC fittings shall be PVC type. Use PVC adapters at all boxes.
    b. Brush applied PVC Cement.
    c. All PVC components (conduit, fittings, cement) shall be from the same Manufacturer.
5. Rigid and IMC conduit fittings shall be threaded and designed for conduit use.

C. Prohibited Materials
1. Aluminum Conduit
2. Crimp-on, tap-on, indenter type fittings
3. Malleable iron or cast set-screw fittings for EMT
4. Spray (aerosol) PVC cement
5. Type MC or AC Cable
6. ENT Conduit

2.2 WIRES AND CABLES

A. Conductors

1. Feeders in conduit and ducts shall be copper-type THW, THHN, or XHHW.
2. Branch circuits in conduit in dry locations shall be copper, minimum #12 AWG – Type THHN.

B. Connectors

1. Type 512, 3M tapeless steel spring wire connectors or pressure type terminal lugs as specified in the Contract Documents.

2.3 BOXES

A. Outlet Boxes

1. Galvanized steel and correct size and shape.
2. Provide metal supports and other accessories for installation of each box.
3. Equip ceiling and bracket fixture boxes with fixture studs, where required.
4. No outlet box shall be smaller than 4-inches (100mm); for 1-inch (25mm) diameter conduit, boxes shall be 4-11/16-inch (120mm) minimum.

2.4 WIRING DEVICES

A. Switches and Receptacles

1. Switches are 20 ampere. Where higher ampere devices are required they shall be of the same series as those listed. Devices of single type shall be of the same Manufacturer.
2. Approved Manufacturers
    a. Switches
        i. Hubbell – CS1221 Series
        ii. Approved Equal

B. Receptacles

1. Receptacles are to be 15 amperes. Where higher ampere devices are required they shall be of the same series as those listed. Devices of single type shall be of the same Manufacturer.
2. Approve Manufacturers
    a. Receptacles
        i. Hubbell – CR5252 Series
        ii. Approved Equal
    b. Ground Fault Receptacles
        i. Hubbell – GF5352I
        ii. Leviton – 6899-I
        iii. Pass & Seymour – 2091-S-I
        iv. Approved Equal

C. Weatherproof Receptacles

1. Complete with corrosion resistant plate, spring lid cover, and weatherproof mats.
2. Approved Manufacturers.
    a. Pass & Seymour – WP-8

b. Approved Equal

D. Plates

1. Metal covers shall be used for all surface-mounted boxes.

2.5 SUPPORTING DEVICES AND HANGERS

A. Approved Manufacturers

1. Erico Products, Incorporated
2. Steel City
3. Minerallac
4. Approved Equal

B. Provide the appropriate supporting devices and hangers for electrical equipment from the following:

1. Beam Clamps

a. Set-Screw Type
b. Universal Clamps
c. Vertical Flange Clamps (Beam Clamps)

2. Clips

a. Conduit Clips
b. Combination Push-in Conduit Clips
c. Flexible Conduit Clips
d. Special Combination Conduit Clips
e. “Z” Purlin Clips

3. Combination Conduit Hanger Clamps
4. One Hole Steel Strap
5. Minerallac Conduit Hangers
6. Other Hangers or Supports per the discretion of the Engineer

PART 3 - EXECUTION

3.1 RACEWAY INSTALLATION

A. Keep all raceway runs a minimum of 6-inches (150mm) from hot water or vent lines.

B. Conduit in concrete slabs shall not exceed 3/4-inch (20mm) I.P. size and shall be spaced no closer than 8-inches (200mm) on center except at panel and junction boxes where they are to be spread as widely as possible; special framing may be required where conduits enter a panel board.

C. Support conduit and boxes in an appropriate manner by:

1. Expansion shields in concrete or solid masonry
2. Toggle bolts on hollow masonry units
3. Wood screws on wood
4. Metal screw on metal

D. Secure conduit with approved supports within 3-feet (1m) of every outlet box, junction box, gutter, panel, fitting, etc. Do not space support further apart than 10-feet (3m). Do not support conduit on suspended ceiling grid (tile or sheet rock).

E. Cap conduit ends during construction.

F. Clean or replace conduit in which water or foreign matter has accumulated.

G. Install insulated bushings on each end of conduit 1-1/4-inch (32mm) in diameter and larger.

H. Install grounding conductor in PVC conduit.

I. Bending of PVC shall be by hot box.

J. Route exposed conduit at right angles or parallel to walls of buildings and not “as the crow flies”. Neatly rack parallel conduits together and make bends uniform to one another. Where installation is made inferior utilizing poor practice contrary to these methods as determined by the Engineer, said installation will be removed and reinstalled at the Contractor’s expense.

K. Coat buried Rigid or IMC Conduit with approved asphaltic compound or wrap with two layers of approved corrosion protection tape.

L. Leave one (1) #10 or equivalent nylon pull wire in empty conduits.

M. When PVC conduit is used, turn up with Rigid Galvanized elbows and risers to provide equipment grounding conductor in accordance with NEC, Article 250.

N. Cut and thread conduit so ends will butt in couplings. Make threads no longer than necessary and ream pipe free of burrs.

O. Prohibited Procedures

1. Use of wooden plugs inserted in concrete or masonry units as base for fastening conduits, tubing, boxes, cabinets, or other equipment.
2. Installation of conduit or tubing that has been crushed or deformed.
3. Torches for bending PVC Conduit.

3.2 WIRES AND CABLES INSTALLATION

A. Install Conductors in Raceway.

B. Pulling Conductors

1. Do not pull Conductors into conduit until raceway system is complete and cabinets and outlet boxes are free of foreign matter and moisture.
2. Do not use heavy mechanical means for pulling conductors.
3. Only wire pulling lubricant may be used.

C. Conductors shall be continuous from outlet to outlet.

D. Making splices for Conductors #8 AWG and smaller with steel spring wire connections. Splice larger conductors with Lock-Tite type silicon bronze type connectors. Insulated connections of #8 AWG wire and larger with 3M #33 tape.

E. Run Conductors of different voltage systems in separate conduits.

F. Leave sufficient slack at terminations to make proper connections.

G. Conductor size #10 AWG and smaller shall be colored throughout. Color code Conductors as follows:

1. 120/240 volts
    a. Black – Phase A
    b. Red – Phase B
    c. Green – Ground
    d. White – Neutral
2. Approved color tape is acceptable for feeders only.

3.3 BOXES INSTALLATION

A. Boxes shall be accessible and installed with appropriate cover.

B. Sectional boxes shall not be used in concrete.

C. Locate boxes so outlets are not obstructed by pipes, ducts, or other items.

D. Label all circuits and source panels on exterior of each junction box.

3.4 WIRING DEVICES INSTALLATION

A. Provide properly sized outlet boxes for all wiring devices of types specified for outlets and junction boxes in the Contract Documents.

B. Properly wire all convenience outlets so that the hot wire, the neutral wire, and the ground wire connect to the proper terminal on all receptacles.

C. Label source panel and circuit number on the back of all device cover plates.

D. Provide grounding jumper from device grounding terminal to metal back box.

E. Provide GFI receptacles in areas as required by the NEC whether indicated on the Contract Documents or not.

3.5 SUPPORTING DEVICES AND HANGERS INSTALLATION

A. Secure conduits to within 3-feet (1m) of each outlet box, junction box, cabinet, fitting, etc and at intervals not exceeding 10-feet (3m).

B. Install clamps secured to structure for feeder and other conduit routed against the structure. Use drop rods and hangers to support conduits run apart from the structure.

C. Paint all supporting metal not otherwise protected, with rust inhibiting primer and then with a finish coat, if appropriate to match the surrounding metal surfaces.

D. Use of chains, perforated iron, baling wire, rope, or tie wire for supporting conduit runs will not be permitted.

END OF SECTION 131610

SECTION 131611

WATER FEATURE GROUNDING

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes the following:

1. Furnish and install for entire electrical installation as specified below and described in the Contract Documents:

   a. Separately Derived Systems.
   b. Conduits and other conductor enclosures.
   c. Neutral or identified conductor of interior wiring system.
   d. Panel Boards and Control Panels.
   e. Non-current-carrying metal parts of fixed equipment such as motors, starters and controller cabinets, light fixtures, and other metal water feature accessories.

B. Related Sections:

1. SECTION 13 1202 – WATER FEATURE STEEL REINFORCEMENT
2. SECTION 13 1305 – WATER FEATURE ACCESSORIES
3. SECTION 13 1502 – WATER FEATURE PUMPS AND MOTORS
4. SECTION 13 1504 – WATER FEATURE CHEMICAL FEED SYSTEMS
5. SECTION 13 1505 – WATER FEATURE OZONE GENERATION AND INJECTION
6. SECTION 13 1507 – WATER FEATURE HEATERS
7. SECTION 13 1511 – WATER FEATURE VALVES, GAUGES, AND METERS
8. SECTION 13 1602 – WATER FEATURE CONTROLS
9. SECTION 13 1605 – WATER FEATURE CONTROL PANELS
10. SECTION 13 1609 – WATER FEATURE MOTOR DISCONNECTS AND STARTERS
11. SECTION 13 1610 – WATER FEATURE ELECTRICAL ACCESSORIES
12. SECTION 26 0000 – ELECTRICAL

C. References:

1. NFPA 70 – National Electrical Code (NEC) – Article 250 Grounding
2. Underwriters Laboratories (UL)

PART 2 - PRODUCTS

2.1 COMPONENTS

A. Size materials as shown on the Contract Documents and in accordance with all applicable codes.

B. Grounding Conductors shall be bare copper or copper with green insulation.

C. Make grounding conductor connections to grounding electrodes and water pipes using approved bolted clamps of bronze or brass designed for such use.

D. Concrete encases grounding electrode (UFER Ground): # 2/0 AWG bare copper conductor.

E. Insulated grounding bushings: Plated malleable iron body with 150 °C molded plastic insulting throat, lay-in grounding lug with hardened stainless-steel fasteners.

F. Grounding Rods: Steel with copper welded exterior 3/4-inch (20mm) diameter by 10-inches (250mm) long.

G. Connections to structural steel, grounding rods, or splices: for splicing and/or connecting conductors, use exothermic welds or high pressure compression type connectors. Provide exothermic weld kits manufactured by Cadweld.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Pull ground conductors in all non-metallic raceways, flexible conduit, and liquid tight flexible conduit. Use same size ground as phase conductors up through #10 AWG. Using NEC Table 250-66 for all others unless otherwise stated on Contract Documents.

B. Provide bonding jumpers across expansion and deflection couplings in conduit runs, across pipe connections at water meters, and across dielectric couplings in metallic cold water piping systems.

C. Provide bonding jumpers from all wiring devices grounding terminals to metal back box.

D. Provide grounding for water feature steel reinforcement and metal accessories and equal potential grid for water feature decks as per NEC.

END OF SECTION 131611

SECTION 220500

GENERAL PLUMBING REQUIREMENTS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This Section pertains to general requirements for furnishing and installing plumbing systems.

B. Furnish all labor, materials, equipment, and incidentals to provide a complete plumbing system as shown on the Drawings and specified herein.

C. This Section includes:
   1. Coordination
   2. Permits
   3. Calculations
   4. Installation Services

D. Connections of electrical, control and instrumentation components shall be provided in accordance with Division 26.

1.2 INTERPRETATION OF DRAWINGS

A. Dimensions shown on the Drawings that are related to equipment are based on one manufacturer's equipment. Coordinate the dimensions of the equipment proposed to be furnished with the space allocated for that equipment.

B. The Drawings show the principal elements of the plumbing installation.

C. The Drawings are not intended as detailed working drawings for the plumbing Work but as a complement to the Specifications to clarify the principal features of the plumbing systems.

D. It is the intent of this Section that all equipment, piping, and devices, furnished and installed under this and other Sections, be properly connected and interconnected with other equipment or pipes so as to render the installations complete for successful operation, regardless of whether all the connections and interconnections are specifically mentioned in the Contract Documents or shown on the Drawings.

1.3 QUALITY ASSURANCE

A. Reference Standards: Comply with all Federal, State and Local laws or ordinances, as well as all applicable codes, standards, regulations and/or regulatory agency requirements including the partial listing below:
   1. ANSI, American National Standards Institute.
   2. ASTM, American Society for Testing and Materials.
   3. AWWA, American Water Works Association.
   4. PDI, Plumbing and Drainage Institute.
   5. CISPI, Cast Iron Soil Pipe Institute.
   6. NEMA, Standards of National Electrical Manufacturers.
   7. OSHA, Occupational Safety and Health Act.

B. Regulatory Requirements:
   1. Baltimore County Code and County modifications of the following adopted codes:
      a. International Building Code
      b. Maryland Building Performance Standards
      c. National Electrical Code
      d. International Mechanical Code
      e. International Plumbing Code
      f. International Fire Code
      g. International Energy Conservation Code
   2. It is the intention of the Contract Documents that the work described therein is in compliance with codes. Should the Contractor or System Installer discover work shown or noted which is not in code compliance, he shall immediately notify the Engineer. He shall not install the work in contravention of any code provision.
   3. All packaged equipment shall be independently third party labeled as a system for its intended use by a Nationally Recognized Testing Laboratory (NRTL) in accordance with OSHA Federal Regulations 29 CFR 1910.303 and 1910.399, NFPA 70, and National Electric Code (NEC), Article 90-7.
   4. Code provisions supersede the Contract Documents.
   5. Notify the Owner of conflicts between code provisions and the Contract Documents prior to Shop Drawing submittals.
   6. Permits:
      a. The plumbing Contractor shall apply for and obtain plumbing permits for all plumbing work.
      b. The plumbing Contractor will be the applicant and shall pay all associated permit fees.

c. No plumbing work is to be started prior to issuance of a permit for such work.

d. No plumbing work shall be started prior to furnishing to the Owner, a copy of such Plumbing Permit.

e. The Contractor shall arrange for all inspections required by the Plumbing Inspector and shall inform the Owner of all pending inspection schedules.

C. Plumbing System Installer Qualifications - Installer shall:
1. Be a licensed plumbing contractor in the Local Authority Having Jurisdiction.
2. Have ten years, minimum, of experience in the installation and maintenance of industrial and heavy commercial plumbing systems.
3. Maintain a full-time, local, staff of engineers, technicians, and service/maintenance personnel.

1.4 SUBMITTALS

A. Shop drawings shall be submitted for all items specified herein in accordance with Section 01 33 00 “Submittal Procedures”. Shop drawings shall include, but not be limited to, physical characteristics, parts and materials lists, electrical characteristics, operating data, dimensional drawings, wiring diagrams, weights, and installation requirements.

B. Shop Drawings:
1. Submit Manufacturer's literature, specifications, installation diagrams, including isometrics and engineering data.
2. Detailed 1/4-inch scale drawings showing materials and dimensions of the complete piping systems, in plan and in section showing location and size of all fixtures, sleeves and pipes.

C. Record Drawings:
1. Prepare and submit comprehensive record drawings for the principal plumbing work performed under this Section in compliance with Section 01 78 39 “Project Record Documents.”

D. Product Data:
1. Submit data on new or replacement equipment and parts.

1.5 GENERAL REQUIREMENTS

A. Unless otherwise specified hereinafter, starters, pushbuttons, H-O-A switches, and other electrical items for the equipment shall be as specified and provided under the electrical sections of the specifications

1.6 WARRANTY AND GUARANTEE

B. Warranty and guarantee shall be for a minimum period of two (2) year as specified in Section 01 60 00 “Product Requirements.”

1.7 OPERATION AND MAINTENANCE MANUALS

C. Submit Operation and Maintenance Manuals for the equipment as specified in Section 01 78 23 “Operational and Maintenance Data.”

PART 2 - PRODUCTS

2.1 RESERVED

PART 3 - EXECUTION

3.1 EXAMINATION AND VERIFICATION

A. Verification of Site Conditions: Contractor shall examine the site(s) and existing facilities and compare them with the Contract Documents with respect to the conditions of the premises, location of or connection of existing facilities and any obstructions which may be encountered and conduct his work to minimize disruption to existing conditions. The costs for making changes to adjust to existing conditions are the responsibility of the Contractor.

3.2 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery and Handling:
1. Obtain the physical sizes of equipment from Manufacturer to ensure that all items will fit in the spaces assigned and instruct the Manufacturers as to the maximum shipping sizes of equipment that can be accommodated at the site.
2. Inspect all equipment and materials against approved Shop Drawings at time of delivery.

B. Storage and Protection:
1. Carefully prepare for storage and label all equipment and materials after they have been inspected.
2. Store all equipment and materials in a dry, covered, ventilated location and protect from harm according to the Manufacturer’s instructions.

3.3 INSTALLATION

A. Coordination: Review installation procedures under other Sections and coordinate the installation of items that must be installed with the form work, walls, partitions, ceilings, and those items required to avoid interference with other trade work.

3.4 FIELD QUALITY CONTROL

A. Performance: All Work shall be done by a firm experienced and properly manned and tooled in the Work specified.

3.5 MAINTENANCE

B. The Contractor shall maintain the plumbing system in operating condition until Conditional Acceptance.

3.6 INSTRUCTION PERIOD

A. The Contractor shall furnish the services of the equipment manufacturer's qualified field representative for a period of not less than four hours to instruct plant personnel in the operation and maintenance of the equipment specified hereinbefore, and as specified in Section 01 79 00 "Demonstration and Training".

END OF SECTION 22050

SECTION 220517

SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Sleeves without waterstop.
   2. Sleeves with waterstop.
   3. Sleeve-seal systems.
   4. Grout.
   5. Silicone sealants.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

PART 2 - PRODUCTS

2.1 SLEEVES WITHOUT WATERSTOP

A. Cast-Iron Pipe Sleeves: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends.

B. Steel Pipe Sleeves: ASTM A53/A53M, Type E, Grade B, Schedule 40, hot-dip galvanized, with plain ends.

C. Steel Sheet Sleeves: ASTM A653/A653M, 0.0239-inch minimum thickness; hot-dip galvanized, round tube closed with welded longitudinal joint.

2.2 SLEEVES WITH WATERSTOP

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Advance Products & Systems, LLC.
   2. CALPICO, Inc.
   3. GPT; a division of EnPRO Industries.
   4. Metraflex Company (The).

B. Description: Manufactured galvanized steel, sleeve-type, waterstop assembly made for imbedding in concrete slab or wall.

C. Description: Manufactured, galvanized cast-iron sleeve with integral clamping flange for use in waterproof floors and roofs. Include clamping ring, bolts, and nuts for membrane flashing.
   1. Underdeck Clamp: Clamping ring with setscrews.

2.3 SLEEVE-SEAL SYSTEMS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Advance Products & Systems, LLC.
   2. CALPICO, Inc.
   3. GPT; a division of EnPRO Industries.
   4. Metraflex Company (The).

B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
   1. Designed to form a hydrostatic seal of 20 psig minimum.
   2. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
   3. Pressure Plates: Stainless steel, Type 316.
   4. Connecting Bolts and Nuts: Stainless steel, Type 316 of length required to secure pressure plates to sealing elements.

2.4 GROUT

A. Description: Nonshrink, for interior and exterior sealing openings in non-fire-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.

2.5 SILICONE SEALANTS

A. Silicone, S, NS, 25, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Sika Corporation.
      b. The Dow Chemical Company.
      c. Tremco Incorporated.
   2. Standard: ASTM C920, Type S, Grade NS, Class 25, Use NT.

B. Silicone, S, P, T, NT: Single-component, 100/50, pourable, plus 100 percent and minus 50 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Sika Corporation.
   b. The Dow Chemical Company.
   c. Tremco Incorporated.
2. Standard: ASTM C920, Type S, Grade P, Class 100/50, Uses T and NT.

PART 3 - EXECUTION

3.1 INSTALLATION OF SLEEVES - GENERAL

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.
   1. Sleeves are not required for core-drilled holes.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
   1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
   2. Cut sleeves to length for mounting flush with both surfaces.
      a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.
   3. Using grout or silicone sealant, seal the space outside of sleeves in slabs and walls without sleeve-seal system.

D. Install sleeves for pipes passing through interior partitions.
   1. Cut sleeves to length for mounting flush with both surfaces.
   2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
   3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint.

E. Fire-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke Barrier Penetrations: Maintain indicated fire or smoke rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with fire- and smoke-stop materials. Comply with requirements for firestopping and fill materials specified in Section 07 8413 "Penetration Firestopping."

3.2 INSTALLATION OF SLEEVES WITH WATERSTOP

A. Install sleeve with waterstop as new walls and slabs are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.

C. Secure nailing flanges to concrete forms.

D. Using grout or silicone sealant, seal the space around outside of sleeves.

3.3 INSTALLATION OF SLEEVE-SEAL SYSTEMS

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building, and passing through exterior walls.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:
   1. Leak Test: After allowing for a full cure, test sleeves and sleeve seals for leaks. Repair leaks and retest until no leaks exist.
   2. Sleeves and sleeve seals will be considered defective if they do not pass tests and inspections.

B. Prepare test and inspection reports.

3.5 SLEEVE SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:
   1. Exterior Concrete Walls above and below Grade:
      a. Sleeves with waterstops.
         1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
   2. Concrete Slabs-on-Grade:
      a. Sleeves with waterstops.
         1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
   3. Concrete Slabs above Grade:
      a. Sleeves with waterstops.
   4. Interior Partitions:
      a. Sleeves without waterstops.

END OF SECTION 220517

SECTION 22 0523.12

BALL VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Bronze ball valves.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of valve.
   1. Certification that products comply with NSF 61 Annex G and NSF 372.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:
   1. ASME B1.20.1 for threads for threaded end valves.
   2. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
   3. ASME B16.18 for solder-joint connections.
   4. ASME B31.9 for building services piping valves.

C. NSF Compliance: NSF 61 Annex G and NSF 372 for valve materials for potable-water service.

D. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.

E. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

F. Valve Sizes: Same as upstream piping unless otherwise indicated.

G. Valve Actuator Types:
   1. Hand lever: For quarter-turn valves smaller than NPS 4.

H. Valves in Insulated Piping:
   1. Include 2-inch stem extensions.
   2. Extended operating handles of nonthermal-conductive material and protective sleeves that allow operation of valves without breaking vapor seals or disturbing insulation.
   3. Memory stops that are fully adjustable after insulation is applied.

2.2 BRONZE BALL VALVES

A. Bronze Ball Valves, Two-Piece with Regular Port and Bronze or Stainless Steel Trim:
   1. Description:
      a. Standard: MSS SP-110.
      b. CWP Rating: 600 psig.
      c. Body Design: Two piece.
      d. Body Material: Bronze.
      e. Ends: Threaded.
      f. Seats: PTFE.
      g. Stem: Bronze or stainless steel.
      h. Ball: Chrome-plated brass or stainless steel.
      i. Port: Regular.

PART 3 - EXECUTION

3.1 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

3.2 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valves with specified CWP ratings are unavailable, the same types of valves with higher CWP ratings may be substituted.

B. Select valves with the following end connections:

1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
2. For Steel Piping, NPS 2 and Smaller: Threaded ends.

3.3 DOMESTIC HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:
   1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.
   2. Brass ball valves, two-piece with full port and brass trim.
   3. Bronze ball valves, two-piece with full port and bronze or brass trim.

END OF SECTION 220523.12

SECTION 220529

HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Metal pipe hangers and supports.
   2. Trapeze pipe hangers.
   3. Thermal hanger-shield inserts.
   4. Fastener systems.
   5. Pipe-positioning systems.
   6. Equipment supports.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show fabrication and installation details and include calculations.

C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.3 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.4 QUALITY ASSURANCE

A. Structural-Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M.

B. Pipe Welding Qualifications: Qualify procedures and operators according to "2015 ASME Boiler and Pressure Vessel Code, Section IX."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 4000 "Quality Requirements," to design trapeze pipe hangers and equipment supports.

B. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
   1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
   2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

2.2 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:
   1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
   2. Galvanized Metallic Coatings: Pregalvanized, 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.

B. Copper Pipe and Tube Hangers:
   1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
   2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

2.3 TRAPEZE PIPE HANGERS

A. Description: MSS SP-58, Type 59, shop- or field-fabricated pipe-support assembly, made from structural-carbon-steel shapes, with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.4 THERMAL HANGER-SHIELD INSERTS

A. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig minimum compressive strength and vapor barrier.

B. Insulation-Insert Material for Hot Piping: Water-repellent-treated, ASTM C 533, Type I calcium silicate with 100-psig or ASTM C 552, Type II cellular glass 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.

2.5 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: Insert-wedge-type anchors, for use in hardened portland cement concrete, with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
   1. Indoor Applications: Zinc-coated or stainless steel.
   2. Outdoor Applications: Stainless steel.

C. Adhesive Anchoring Systems: Threaded-zinc-coated or Type 316 stainless steel anchor rod, nut, washer, and adhesive capsule, for use in hardened Portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.6 PIPE-POSITIONING SYSTEMS

A. Description: IAPMO PS 42 positioning system composed of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

2.7 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural-carbon-steel shapes.

2.8 MATERIALS

A. Aluminum: ASTM B 221.

B. Carbon Steel: ASTM A 1011/A 1011M.

C. Structural Steel: ASTM A 36/A 36M carbon-steel plates, shapes, and bars; black and galvanized.

D. Stainless Steel: ASTM A 240/A 240M.

E. Grout: ASTM C 1107/C 1107M, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
   1. Properties: Nonstaining, noncorrosive, and nongaseous.
   2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with requirements in Section 07 8413 "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.

3.2 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 so as to reduce pipe deflection to within allowable tolerances.

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 so as to reduce pipe deflection to within allowable tolerances.
   2. Field fabricate from ASTM A 36/A 36M carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Thermal Hanger-Shield Installation: Install in pipe hanger or shield for insulated piping.

D. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs/walls less than 4 inches thick in concrete, after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
2. Install mechanical-expansion anchors in concrete, after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
3. Install adhesive anchoring systems in existing concrete. Select anchor based on load carried and embedment depth. Clean all holes per manufacturer instructions to remove loose material and drilling dust prior to installation of adhesive. Remove excess adhesive from the surface. Shim anchors with suitable device to center the anchor in the hole. Do not disturb or load anchors before manufacturer specified cure time has elapsed. Install anchoring systems according to manufacturer’s written instructions.
4. Remove and replace misplaced or malfunctioning anchors. Fill empty anchor holes and patch failed anchor locations with high-strength non-shrink, nonmetallic grout. Anchors that fail to meet proof load or installation torque requirements shall be regarded as malfunctioning.

E. Pipe-Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture.

F. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories. Use lock nuts or vibration resistant nuts where potential vibration may cause failure. Install hangers plumb.

G. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

H. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

I. Install lateral bracing with pipe hangers and supports to prevent swaying.

J. Install building attachments within walls or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms, and install reinforcing bars through openings at top of inserts. Do not attach supports to metal decking.

K. Load Distribution: Install hangers and supports, so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

L. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

M. Insulated Piping:
1. Attach clamps and spacers to piping.
a. Piping Operating Above Ambient Air Temperature: Clamp may project through insulation.
b. Piping Operating Below Ambient Air Temperature: Use thermal hanger-shield insert with clamp sized to match OD of insert.
c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
2. Install MSS SP-58, Type 39 protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
a. Option: Thermal hanger-shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
3. Install MSS SP-58, Type 40 protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
a. Option: Thermal hanger-shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
4. Shield Dimensions for Pipe: Not less than the following:
a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
b. NPS 4: 12 inches long and 0.06 inch thick.
5. Thermal Hanger Shields: Install with insulation of same thickness as piping insulation.

3.3 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor. Calculate support loads for installed conditions and for operating or live-loaded conditions, and design supports for the higher load.

B. Grouting: Place grout under supports for equipment, and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.4 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work.

3.5 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.6 PAINTING

A. Touchup: 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.

B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded, shop-painted areas on miscellaneous metal are specified in Section 09 9123 "Interior Painting."

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas, and apply galvanizing-repair paint to comply with ASTM A 780/A 780M.

3.7 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-58 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finishes.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports and metal trapeze pipe hangers and attachments for general service applications.

F. Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.

G. Use padded hangers for piping that is subject to scratching.

H. Use thermal hanger-shield inserts for insulated piping and tubing.

I. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 4.
   2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
   3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
   4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
   5. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8.
   6. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
   7. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
   8. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
   9. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.
   10. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30. Use only on trapeze hanger systems or on fabricated frames.
   11. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
   12. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
   13. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
   14. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
   15. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction occurs.
   16. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24, from single rod if horizontal movement caused by expansion and contraction occurs.
   17. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction occurs but vertical adjustment is unnecessary.
   18. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 if small horizontal movement caused by expansion and contraction occurs and vertical adjustment is unnecessary.

19. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 if vertical and lateral adjustment during installation, in addition to expansion and contraction, is required.

J. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 4 if longer ends are required for riser clamps.

K. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment of up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11 split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

L. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel or Malleable-Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from **wall**.
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. Both locknuts and retaining devices furnished by the manufacturer. Field-fabricated C-clamp bodies or retaining devices are not acceptable.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles. Provide with an added malleable-iron heel plate or adapter.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes. Both locknuts and retaining devices furnished by the manufacturer. Field-fabricated C-clamp bodies or retaining devices are not acceptable.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.

11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
    a. Light (MSS Type 31): 750 lb.
    b. Medium (MSS Type 32): 1500 lb.
    c. Heavy (MSS Type 33): 3000 lb.
13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

M. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation. For insulated pipes NPS 4 to NPS 42 when the temperature of the medium is 60 deg F or higher.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal Hanger-Shield Inserts: For supporting insulated pipe.

N. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load, and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load, and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load, and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
    a. Horizontal (MSS Type 54): Mounted horizontally.
    b. Vertical (MSS Type 55): Mounted vertically.

c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

O. Comply with MSS SP-58 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

P. Use powder-actuated fasteners or mechanical-expansion anchors or adhesive anchoring systems 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.

R. Do not weld hangers/support with structural beams.

END OF SECTION 22 05 29

SECTION 220533
HEAT TRACING FOR PLUMBING PIPING

PART 1 - GENERAL

1.01 DESCRIPTION

A. Section includes plumbing piping heat tracing for freeze prevention, domestic hot-water-temperature maintenance, and snow and ice melting on roofs and in gutters and downspouts with the following electric heating cables:

1. Self-regulating, parallel resistance.

1.02 SUBMITTALS

A. Shop drawings shall be submitted for all items specified herein in accordance with Section 01 33 00 SUBMITTAL PROCEDURES. Shop drawings shall include, but not be limited to, physical characteristics, parts and materials lists, electrical characteristics, operating data, dimensional drawings, wiring diagrams, weights, and installation requirements, such as, but not limited to:

B. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, and furnished specialties and accessories.

2. Schedule heating capacity, length of cable, spacing, and electrical power requirement for each electric heating cable required.

C. Shop Drawings: For electric heating cable.

1. Include plans, elevations, sections, and attachment details.

2. Include diagrams for power, signal, and control wiring.

D. Field quality-control reports.

E. Sample Warranty: For special warranty.

1.03 OPERATION AND MAINTENANCE MANUALS

A. Submit Operation and Maintenance Manuals for the electric heating cables as specified in Section 01 78 23, entitled OPERATION AND MAINTENANCE DATA .

1.04 WARRANTY AND GUARANTEE

A. Warranty and guarantee shall be as specified in Section 01 78 36 with the exception that the warranty period shall be as mentioned below:

B. Special Warranty: Manufacturer agrees to repair or replace electric heating cable that fails in materials or workmanship within specified warranty period.

1. Warranty Period: Three years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 SELF-REGULATING, PARALLEL-RESISTANCE HEATING CABLES

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

1. Chromalox, Inc.

2. nVent (Pyrotenax).

3. nVent (Raychem).

4. Thermon Americas Inc.

B. Comply with IEEE 515.1.

C. Heating Element: Pair of parallel No. 16 AWG, nickel-coated, stranded copper bus wires embedded in self-regulating conductive core, polyolefin inner jacket and copper sheath which varies heat output in response to temperature along its length. Basis of design is HBTV heat tracing cable and accessories manufactured by nVent; Raychem. Terminate with waterproof, factory-assembled, nonheating leads with connectors at one end, and seal the opposite end watertight. Cable shall be capable of crossing over itself once without overheating.

D. Electrical Insulating Jacket: Polyolefin inner jacket.

E. Cable Cover: Tinned-copper sheath and fluoropolymer outer jacket with ultraviolet inhibitor.

F. Maximum Operating Temperature (Power On): 150 deg F.

G. Maximum Exposure Temperature (Power Off): 185 deg F.

H. Electrical Components, Devices, and Accessories:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2. Approved for NEMA 500, Class I, Division 1, Group D, Hazardous location classification as designated in Room & Area Classification Schedule, contract drawing G-17.

I. Capacities and Characteristics:

1. Maximum Heat Output: 5 W/ft.

2. Piping Diameter: As shown on plans.

3. Number of Parallel Cables: two.

4. Spiral Wrap Pitch: 24 inches

5. Electrical Characteristics for Single-Circuit Connection: As Shown.

2.02 CONTROLS

A. Pipe-Mounted Thermostats for Freeze Protection:

1. Remote bulb unit with adjustable temperature range from 30 to 50 deg F.

2. Snap action; open-on-rise, single-pole switch with minimum current rating adequate for connected cable.

3. Remote bulb on capillary, resistance temperature device, or thermistor for directly sensing pipe-wall temperature.

4. Corrosion-resistant waterproof control enclosure.

5. Approved for installation in Non-Hazardous location.

2.03 ACCESSORIES

A. Cable Installation Accessories: Fiberglass tape, heat-conductive putty, cable ties, silicone end seals and splice kits, and installation clips all furnished by manufacturer, or as recommended in writing by manufacturer.

B. Warning Labels: Refer to Section 22 05 53 "Identification for Plumbing Piping and Equipment."

C. Warning Tape: Continuously printed "Electrical Tracing"; vinyl, at least 3 mils thick, and with pressure-sensitive, permanent, waterproof, self-adhesive back.

1. Width for Markers on Pipes with OD, Including Insulation, Less Than 6 Inches: 3/4 inch minimum.

2. Width for Markers on Pipes with OD, Including Insulation, 6 Inches or Larger: 1-1/2 inches minimum.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine surfaces and substrates to receive electric heating cables for compliance with requirements for installation tolerances and other conditions affecting performance.

1. Ensure surfaces and pipes in contact with electric heating cables are free of burrs and sharp protrusions.

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

3.02 APPLICATIONS

A. Install the following types of electric heating cable for the applications described:

1. Freeze Protection for Plumbing/non potable water/flushing water located in Classified, Hazardous rooms and spaces: Self-regulating, parallel-resistance heating cable.

3.03 INSTALLATION

A. Install electric heating cable across expansion, construction, and control joints according to manufacturer's written instructions; use cable-protection conduit and slack cable to allow movement without damage to cable.

B. Electric Heating-Cable Installation for Freeze Protection for Piping:

1. Install electric heating cables after piping has been tested and before insulation is installed.

2. Install electric heating cables according to IEEE 515.1.

3. Install electric heating cables, wiring accessories and temperature sensing devices are approved for hazardous location classification.

4. Install insulation over piping with electric cables according to Section 22 07 19 "Plumbing Piping Insulation."

5. Install warning tape on piping insulation where piping is equipped with electric heating cables.

C. Set field-adjustable switches and circuit-breaker trip ranges.

3.04 CONNECTIONS

A. Install controllers approved for non-hazardous locations outside of classified areas.

B. Ground equipment according to Section 26 05 26 "Grounding and Bonding for Electrical Systems."

C. Connect wiring according to Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

3.05 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

1. Perform tests after cable installation but before application of coverings such as insulation, wall or ceiling construction, or concrete.

2. Test cables for electrical continuity and insulation integrity before energizing.

3. Test cables to verify rating and power input. Energize and measure voltage and current simultaneously.

B. Repeat tests for continuity, insulation resistance, and input power after applying thermal insulation on pipe-mounted cables.

C. Cables will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.06 PROTECTION

A. Protect installed heating cables, including nonheating leads, from damage during construction.

B. Remove and replace damaged heat-tracing cables.

END OF SECTION 220533

SECTION 22 05 53

IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Warning signs and labels.
2. Pipe labels.
3. Valve tags.

1.2 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.1 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.

B. Letter Color: Black.

C. Background Color: Yellow.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.

G. Fasteners: Stainless-steel rivets or self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Label Content: Include caution and warning information plus emergency notification instructions.

2.2 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

C. 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.
2. Lettering Size: At least 1/2 inch for viewing distances up to 72 inches and proportionately larger lettering for greater viewing distances.

2.3 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.

1. Tag Material: Brass, 0.032-inch or anodized aluminum, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Fasteners: Brass wire-link chain or beaded chain or S-hook.

B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-tag schedule shall be included in operation and maintenance data.

PART 3 - EXECUTION

3.1 PIPE LABEL INSTALLATION

A. Piping Color Coding: Painting of piping is specified in Section 09 9123 "Interior Painting."

B. 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 on 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 20 feet along each run. Reduce intervals to 10 feet in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

C. Pipe Label Color Schedule:

1. Domestic Cold Water Piping

   a. Background: Safety green.
   b. Letter Colors: White.

2. Domestic Hot Water Piping:

   a. Background Color: Yellow.
   b. Letter Color: Black.

3. Domestic Hot Water Return and Tempered Water Piping:

   a. Background Color: Yellow.
   b. Letter Color: Black.

4. Sanitary Waste and Storm Drainage Piping:

   a. Background Color: Safety black.

b. Letter Color: White.

5. Sanitary Vent Piping:

a. Background Color: Yellow.
b. Letter Color: Black.

3.2 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves, valves within factory-fabricated equipment units, shutoff valves, faucets, convenience and lawn-watering hose connections, and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:

1. Valve-Tag Size and Shape:

a. Cold Water: 1-1/2 inches, round.
b. Hot Water: 1-1/2 inches, round.

2. Valve-Tag Colors:

a. Cold Water: Safety green.
b. Hot Water: Safety green.

3. Letter Colors:

a. Cold Water: White.
b. Hot Water: White.

END OF SECTION 22 05 53

SECTION 22 0719

PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes insulating the following plumbing piping services:
   1. Domestic hot/cold-water piping.
   2. Supplies and drains for handicap-accessible lavatories and sinks.

1.2 ACTION SUBMITTALS

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

1.3 QUALITY ASSURANCE

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, wi

B. th appropriate markings of applicable testing agency.
   1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

C. Comply with the following applicable standards and other requirements specified for miscellaneous components:
   1. Supply and Drain Protective Shielding Guards: ICC A117.1.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in the “Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule" article for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.

F. Mineral-Fiber, Preformed Pipe Insulation:
1. Type I, 850 Deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ-SSL. Factory-applied jacket requirements are specified in the “Factory-Applied Jackets" Article.

2.2 INSULATING CEMENTS

A. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.

2.3 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.
1. Adhesive: As recommended by flexible elastomeric manufacturer and with a VOC content of 80 g/L or less.
2. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
1. Adhesive: As recommended by mineral fiber manufacturer and with a VOC content of 80 g/L or less.
2. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

D. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
1. Adhesives shall have a VOC content of 80 g/L or less.

2. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

E. PVC Jacket Adhesive: Compatible with PVC jacket.
1. Adhesive: As recommended by Adhesive - PVC Jacket manufacturer and with a VOC content of 50 g/L or less.
2. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.4 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
1. Mastics: As recommended by an insulation manufacturer and with a VOC content of 50 g/L or less.
2. Mastics shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.
1. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
2. Service Temperature Range: Minus 20 to plus 180 deg F.
3. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
4. Color: White.

C. Breather Mastic: Water based; suitable for indoor use on above-ambient services.
1. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
2. Service Temperature Range: Minus 20 to 180 deg F.
3. Solids Content: 60 percent by volume and 66 percent by weight.
4. Color: White.

2.5 SEALANTS

A. FSK and Metal Jacket Flashing Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F.
4. Color: Aluminum.
5. Sealant shall have a VOC content of 420 g/L or less.
6. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

B. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:
1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F.
4. Color: White.
5. Sealant shall have a VOC content of 420 g/L or less.
6. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.6 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.7 FIELD-APPLIED FABRIC-REINFORCING MESH

A. Woven Polyester Fabric: Approximately 1 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in., in a Leno weave, for pipe.

2.8 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
   1. Adhesive: As recommended by jacket material manufacturer.
   2. Color: Color-code jackets based on system. Color as selected by Architect.
   3. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
      a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

C. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.
   1. Sheet and roll stock ready for shop or field sizing.
   2. Finish and thickness are indicated in field-applied jacket schedules.
   3. Moisture Barrier for Indoor Applications: 3-mil-thick, heat-bonded polyethylene and kraft paper OR 2.5-mil-thick polysurlyn.
   4. Factory-Fabricated Fitting Covers:
      a. Same material, finish, and thickness as jacket.
      b. Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
      c. Tee covers.
      d. Flange and union covers.
      e. End caps.
      f. Beveled collars.
      g. Valve covers.
      h. Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

2.9 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
   1. Width: 3 inches.
   2. Thickness: 11.5 mils.
   3. Adhesion: 90 ounces force/inch in width.
   4. Elongation: 2 percent.
   5. Tensile Strength: 40 lbf/inch in width.
   6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
   1. Width: 3 inches.
   2. Thickness: 6.5 mils.
   3. Adhesion: 90 ounces force/inch in width.
   4. Elongation: 2 percent.
   5. Tensile Strength: 40 lbf/inch in width.
   6. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor applications.
   1. Width: 2 inches.
   2. Thickness: 6 mils.
   3. Adhesion: 64 ounces force/inch in width.
   4. Elongation: 500 percent.
   5. Tensile Strength: 18 lbf/inch in width.

D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
   1. Width: 2 inches.
   2. Thickness: 3.7 mils.
   3. Adhesion: 100 ounces force/inch in width.
   4. Elongation: 5 percent.
   5. Tensile Strength: 34 lbf/inch in width.

2.10 SECUREMENTS

A. Aluminum Bands: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 3/4 inch wide with closed seal.

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch-wide, stainless steel or Monel.

C. Wire: 0.080-inch nickel-copper alloy OR 0.062-inch soft-annealed, stainless steel.

2.11 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers, Accessible Sinks & Lavatories:
   1. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

B. Protective Shielding Piping Enclosures, Accessible Sinks & Lavatories:

1. Description: Manufactured plastic enclosure for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with ADA requirements.

PART 3 - EXECUTION

3.1 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. 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 insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive are recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:
1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.
    a. For below-ambient services, apply vapor-barrier mastic over staples.
4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. For above-ambient services, do not install insulation to the following:
1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Cleanouts.

3.3 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
   1. Seal penetrations with flashing sealant.
   2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.

B. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

C. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
   1. Comply with requirements in Section 07 8413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

D. Insulation Installation at Floor Penetrations:
   1. Pipe: Install insulation continuously through floor penetrations.
   2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 07 8413 "Penetration Firestopping."

3.4 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
   1. Install insulation over fittings, valves, strainers, flanges, unions, heat tracing cable 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
   3. contour that is uniform with adjoining pipe insulation.
   4. 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.
   5. 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.

6. 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
7. 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 reu
8. sable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
9. 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.
10. 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.
11. For services not specified to receive a field-applied jacket except for flexible elastomeric, 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.
12. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.

4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.5 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. 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.

B. Insulation Installation on Pipe Flanges:
   1. Install pipe insulation to outer diameter of pipe flange.
   2. Make the width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
   3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
   4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:
   1. Install mitered sections of pipe insulation.
   2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:
   1. Install preformed valve covers manufactured of same material as pipe insulation when available.
   2. When performed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
   3. Install insulation to flanges as specified for flange insulation application.
   4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.6 INSTALLATION OF MINERAL-FIBER PREFORMED PIPE INSULATION

A. Insulation Installation on Straight Pipes and Tubes:
   1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
   2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
   3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
   4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:
   1. Install preformed pipe insulation to outer diameter of pipe flange.
   2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
   3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
   4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:
   1. Install preformed sections of same material as straight segments of pipe insulation when available.
   2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:
   1. Install preformed sections of same material as straight segments of pipe insulation when available.
   2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
   3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
   4. Install insulation to flanges as specified for flange insulation application.

3.7 FIELD-APPLIED JACKET INSTALLATION

A. Where FSK jackets are indicated, install as follows:
   1. Draw jacket material smooth and tight.
   2. Install lap or joint strips with same material as jacket.
   3. Secure jacket to insulation with manufacturer's recommended adhesive.

4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch-wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

B. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.
1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

C. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.8 FINISHES

A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 09 9123 "Interior Painting."
1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

D. Do not field paint aluminum or stainless-steel jackets.

3.9 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:
1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe ser

2. vice defined in the "Pi
3. ping Insulation Schedule, General" Article.

C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.10 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
1. Drainage piping located in crawl spaces.
2. Underground piping.
3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.11 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Cold, Hot and Recirculated Hot Water: Insulation shall be one of the following:
1. Flexible Elastomeric: 1 inch thick.
2. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

B. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities: Insulation shall be the following:
1. Protective shielding guards.

3.12 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Concealed:
1. None.

D. Piping, Exposed in utility room:
1. PVC, Color-Coded by System: 30 mils thick.

END OF SECTION 220719

SECTION 221116

DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Copper tube and fittings.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Pipe and tube.
2. Fittings.
3. Joining materials.
4. Transition fittings.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Piping layout, or BIM model, drawn to scale, showing the items described in this Section, and coordinated with all building trades.

B. System purging and disinfecting activities report.

C. Field quality-control reports.

D. As-built Drawings: For domestic water installation to be provided as part of close-out.

1.5 FIELD CONDITIONS

A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:

1. Notify Owner no fewer than seven days in advance of proposed interruption of water service.
2. Do not interrupt water service without Owner's written permission.

1.6 WARRANTY

A. Polypropylene Piping (PP-R) Manufacturer's Warranty: Manufacturer agrees to repair or replace PP-R pipe and fittings that fail in materials or workmanship within 10 years from date of Substantial Completion.

1. Warranty is to cover labor and material costs of repairing and/or replacing defective materials and repairing any incidental damage caused by failure of the piping system due to defects in materials or manufacturing.
2. Warranty is to be in effect only upon submission by the Contractor to the manufacturer of valid pressure/leak documentation indicating that the system was tested and passed the manufacturer's pressure/leak test.

PART 2 - PRODUCTS

Refer to Baltimore County Standard Specifications for Construction and Materials, Section 905 – Pipe

PART 3 - EXECUTION

Refer to Baltimore County Standard Specifications for Construction and Materials, Section 353 – Water House Services, Water Meter Settings, and Vaults

END OF SECTION 221116

SECTION 221116

DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Copper tube and fittings.
2. Piping joining materials.
3. Transition fittings.
4. Dielectric fittings.

1.2 ACTION SUBMITTALS

A. Product Data: For transition fittings and dielectric fittings.

1.3 INFORMATIONAL SUBMITTALS

A. System purging and disinfecting activities report.

B. Field quality-control reports.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in the “Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

B. Potable-water piping and components shall comply with NSF 14 and NSF 61 Annex G. Plastic piping components shall be marked with "NSF-pw."

C. Comply with NSF 372 for low lead.

2.2 COPPER TUBE AND FITTINGS

A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.

B. Soft Copper Tube: ASTM B 88, Type K and ASTM B 88, Type L water tube, annealed temper.

C. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.

D. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.

E. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.

F. Copper Unions:

1. MSS SP-123.
2. Cast-copper-alloy, hexagonal-stock body.
3. Ball-and-socket, metal-to-metal seating surfaces.
4. Solder-joint or threaded ends.

G. Copper Pressure-Seal-Joint Fittings:

1. Fittings for NPS 2 and Smaller: Wrought-copper fitting with EPDM-rubber, O-ring seal in each end.
2. Fittings for NPS 2-1/2 to NPS 4: Cast-bronze or wrought-copper fitting with EPDM-rubber, O-ring seal in each end.

2.3 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials:

1. AWWA C110/A21.10, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free unless otherwise indicated.
2. Full-face or ring type unless otherwise indicated.

B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

C. Solder Filler Metals: ASTM B 32, lead-free alloys.

D. Flux: ASTM B 813, water flushable.

E. Brazing Filler Metals: AWS A5.8M/A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

2.4 TRANSITION FITTINGS

A. General Requirements:

1. Same size as pipes to be joined.
2. Pressure rating at least equal to pipes to be joined.
3. End connections compatible with pipes to be joined.

B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

2.5 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Nipples:

1. Standard: IAPMO PS 66.
2. Electroplated steel nipple complying with ASTM F 1545.
3. Pressure Rating and Temperature: 300 psig at 225 deg F.
4. End Connections: Male threaded or grooved.
5. Lining: Inert and noncorrosive, propylene.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."

C. Install shutoff valve immediately upstream of each dielectric fitting.

D. Install domestic water piping level with 0.25 percent slope downward toward drain and plumb.

E. Rough-in domestic water piping for water-meter installation according to utility company's requirements.

F. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

G. 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.

H. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

I. Install piping to permit valve servicing.

J. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.

K. Install piping free of sags and bends.

L. Install fittings for changes in direction and branch connections.

M. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

N. Install sleeves for piping penetrations of walls, ceilings, and floors.

O. Install escutcheons for piping penetrations of walls, ceilings, and floors.

3.2 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

D. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Brazed Joints" chapter.

E. Soldered Joints for Copper Tubing: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."

F. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

3.3 TRANSITION FITTING INSTALLATION

A. Install transition couplings at joints of dissimilar piping.

3.4 DIELECTRIC FITTING INSTALLATION

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric nipples.

C. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric nipples.

3.5 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for pipe hanger, support products, and installation in Section 22 0529 "Hangers and Supports for Plumbing Piping and Equipment."

1. Vertical Piping: MSS Type 8 or 42, clamps.
2. Individual, Straight, Horizontal Piping Runs:
    a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
    c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.
3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
4. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Support vertical piping and tubing at base and at each floor.

C. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.

D. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
4. NPS 2-1/2: 108 inches with 1/2-inch rod.

E. Install supports for vertical copper tubing every 10 feet.

F. Support piping and tubing not listed in this article according to MSS SP-58 and manufacturer's written instructions.

3.6 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.

C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.

D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:

1. Domestic Water Booster Pumps: Cold-water suction and discharge piping.
2. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
3. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.
4. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

3.7 IDENTIFICATION

A. Identify system components. Comply with requirements for identification materials and installation in Section 22 0553 "Identification for Plumbing Piping and Equipment."

B. Label pressure piping with system operating pressure.

3.8 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Piping Inspections:

    a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
    b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:

        1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.
        2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.

    c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
    d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

2. Piping Tests:

    a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
    b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
    c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
    d. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
    e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
    f. Prepare reports for tests and for corrective action required.

B. Domestic water piping will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.9 ADJUSTING

A. Perform the following adjustments before operation:

1. Close drain valves, hydrants, and hose bibbs.
2. Open shutoff valves to fully open position.
3. Open throttling valves to proper setting.
4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.

    a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.
    b. Adjust calibrated balancing valves to flows indicated.

5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.10 CLEANING

A. 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. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
d. Repeat procedures if biological examination shows contamination.
e. Submit water samples in sterile bottles to authorities having jurisdiction.

B. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.

C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.11 PIPING SCHEDULE

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.

C. Aboveground domestic water piping, NPS 3 and smaller, shall be the following:

1. Hard copper tube, ASTM B 88, Type L; cast- or wrought-copper, solder-joint fittings; and soldered joints.

END OF SECTION 221116

SECTION 221119

DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Vacuum breakers.
2. Balancing valves.
3. Strainers.
4. Outlet boxes.
5. Drain valves.
6. Water-hammer arresters.
7. Air vents.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES

A. Potable-water piping and components shall comply with NSF 61 Annex G and NSF 14.

2.2 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig unless otherwise indicated.

2.3 VACUUM BREAKERS

A. Pipe-Applied, Atmospheric-Type Vacuum Breakers:
   1. Standard: ASSE 1001.
   2. Size: NPS 1/4 to NPS 3, as required to match connected piping.
   3. Body: Bronze.
   4. Inlet and Outlet Connections: Threaded.
   5. Finish: Chrome plated.

B. Hose-Connection Vacuum Breakers:
   1. Standard: ASSE 1011.
   2. Body: Bronze, nonremovable, with manual drain.
   3. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
   4. Finish: Chrome plated.

2.4 BALANCING VALVES

A. Memory-Stop Balancing Valves:
   1. Standard: MSS SP-110 for two-piece, copper-alloy ball valves.
   2. Pressure Rating: 400-psig minimum CWP.
   3. Size: NPS 2 or smaller.
   4. Body: Copper alloy.
   5. Port: Standard or full port.
   6. Ball: Chrome-plated brass.
   7. Seats and Seals: Replaceable.
   8. End Connections: Solder joint or threaded.
   9. Handle: Vinyl-covered steel with memory-setting device.

2.5 STRAINERS FOR DOMESTIC WATER PIPING

A. Y-Pattern Strainers:
   1. Pressure Rating: 125 psig minimum unless otherwise indicated.
   2. Body: Bronze for NPS 2 and smaller; cast iron with interior lining that complies with AWWA C550 or that is FDA approved, epoxy coated and for NPS 2-1/2 and larger.
   3. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
   4. Screen: Stainless steel with round perforations unless otherwise indicated.

5. Perforation Size:
   a. Strainers NPS 2 and Smaller: 0.020 inch.
   b. Strainers NPS 2-1/2 to NPS 4: 0.045 inch.
6. Drain: Factory-installed, hose-end drain valve.

2.6 OUTLET BOXES

A. Clothes Washer/Extractactor Outlet Boxes:
1. Mounting: Recessed.
2. Material and Finish: Enameled-steel or epoxy-painted-steel or Stainless-steel box and faceplate.
3. Faucet: Combination of valved fitting or separate hot- and cold-water valved fittings complying with ASME A112.18.1. Include garden-hose thread complying with ASME B1.20.7 on outlets.
4. Supply Shutoff Fittings: NPS 1/2 gate, globe, or ball valves and NPS 1/2 copper, water tubing.
5. Drain: NPS 2 standpipe and P-trap for direct waste connection to drainage piping.
6. Inlet Hoses: Two 60-inch- long, heavy duty PVC hose sealed with rigid corrugated outer wall in red-blue and built-in auto shut-off valve and universal 90 degree elbow connection washer inlet hoses with female, garden-hose-thread couplings. Include rubber washers.
7. Drain Hose: 72-inch- long, heavy duty, industrial grade polypropylene corrugated washer drain hoses with hooked end and clamps.

2.7 DRAIN VALVES

A. Ball-Valve-Type, Hose-End Drain Valves:
1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
2. Pressure Rating: 400-psig minimum CWP.
3. Size: NPS 3/4.
4. Body: Copper alloy.
5. Ball: Chrome-plated brass.
6. Seats and Seals: Replaceable.
7. Handle: Vinyl-covered steel.
8. Inlet: Threaded or solder joint.
9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

2.8 WATER-HAMMER ARRESTERS

A. Water-Hammer Arresters:
1. Standard: ASSE 1010 or PDI-WH 201.
2. Type: Copper tube with piston.

3. Size: ASSE 1010, Sizes AA and A through F, or PDI-WH 201, Sizes A through F.

2.9 AIR VENTS

A. Bolted-Construction Automatic Air Vents:
   1. Body: Bronze.
   2. Pressure Rating and Temperature: 125-psig minimum pressure rating at 140 deg F.
   3. Float: Replaceable, corrosion-resistant metal.
   4. Mechanism and Seat: Stainless steel.
   5. Size: NPS 1/2 minimum inlet.
   6. Inlet and Vent Outlet End Connections: Threaded.

B. Welded-Construction Automatic Air Vents:
   1. Body: Stainless steel.
   2. Pressure Rating: 150-psig minimum pressure rating.
   3. Float: Replaceable, corrosion-resistant metal.
   4. Mechanism and Seat: Stainless steel.
   5. Size: NPS 3/8 minimum inlet.
   6. Inlet and Vent Outlet End Connections: Threaded.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install balancing valves in locations where they can easily be adjusted.

B. Install Y-pattern strainers for water on supply side of each control valve.

C. Install outlet boxes recessed in wall or surface mounted on wall. Install 2-by-4-inch fire-retardant-treated-wood blocking, wall reinforcement between studs.

D. Install water-hammer arresters in water piping according to PDI-WH 201.

E. Install air vents at high points of water piping. Install drain piping and discharge onto floor drain.

3.2 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:
   1. Test each pressure vacuum breaker according to authorities having jurisdiction and the device's reference standard.

B. Domestic water piping specialties will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.3 ADJUSTING

A. Set field-adjustable flow set points of balancing valves.

END OF SECTION 221119

SECTION 221313

FACILITY SANITARY SEWERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Baltimore County Department of Public Works and Transportation Standard Specifications for Construction Materials, Latest Edition.

1.2 SUMMARY

A. Section Includes:
1. PVC pipe and fittings.
2. Cleanouts.
3. Manholes.
4. Concrete.

1.3 ACTION SUBMITTALS

A. Product Data: For the following:

1. Pipe and fittings.
2. Non-pressure couplings
3. Expansion joints and deflection fittings.
4. Cleanouts.

B. Shop Drawings: For manholes. Include plans, elevations, sections, details, and frames and covers.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings:

1. Show pipe sizes, locations, and elevations. Show other piping in same trench and clearances from sewer system piping. Indicate interface and spatial relationship between manholes, piping, and proximate structures.

B. Product Certificates: For each type of pipe and fitting.

C. Field quality-control reports.

1.5 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 according to manufacturer's written rigging instructions.

1.6 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 ten days in advance of proposed interruption of service.
2. Do not proceed with interruption of service without Owner's written permission.

PART 2 - PRODUCTS

2.1 PVC PIPE AND FITTINGS

A. PVC Piping:

1. Pipe: Per Baltimore County Department of Public Works and Transportation Section 905.
2. Fittings: Per Baltimore County Department of Public Works and Transportation Section 905.

2.2 CLEANOUTS

A. PVC Cleanouts:

1. Description: PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping.

2.3 MANHOLES

A. Standard Precast Concrete Manholes:

1. Per Baltimore County Department of Public Works and Transportation Standard Details as called out on the Contract Drawings.

B. Manhole Frames and Covers:
   1. Baltimore County Standard Sanitary Sewer Frame and Cover

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Section 312000 "Earth Moving."

3.2 PIPING INSTALLATION

A. Per Baltimore County Standard Specifications Section 361.

3.3 PIPE JOINT CONSTRUCTION

A. Join gravity-flow, nonpressure, drainage piping according to the following:
   1. Join PVC profile sewer piping according to ASTM D2321 for elastomeric-seal joints or ASTM F794 for gasketed joints.

3.4 MANHOLE INSTALLATION

A. Per Baltimore County Standard Specifications Section 362.

3.5 CONCRETE PLACEMENT

A. Place cast-in-place concrete according to ACI 318.

3.6 CLEANOUT INSTALLATION

A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. 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.

B. Set cleanout frames and covers in earth in cast-in-place-concrete block, 18 by 18 by 12 inches deep. Set with tops 1 inch above surrounding grade.

C. Set cleanout frames and covers in concrete pavement and roads with tops flush with pavement surface.

3.7 IDENTIFICATION

A. Comply with requirements in Section 312000 "Earth Moving" for underground utility identification devices. Arrange for installation of green warning tapes directly over piping and at outside edges of underground manholes.
   1. Use detectable warning tape over nonferrous piping and over edges of underground manholes.

3.8 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.

   1. Submit separate report for each system inspection.
   2. Defects requiring correction include the following:

      a. Alignment: Less than full diameter of inside of pipe is visible between structures.
      b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
      c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
      d. Infiltration: Water leakage into piping.
      e. Exfiltration: Water leakage from or around piping.

   3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
   4. 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. Test plastic gravity sewer piping according to ASTM F1417.
b. Test concrete gravity sewer piping according toASTM C1628.

7. Manholes: Perform hydraulic test according to ASTM C969.

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.

3.9 CLEANING

A. Clean dirt and superfluous material from interior of piping. Flush with potable water.

END OF SECTION 221313

SECTION 221316

SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Hub-and-spigot, cast-iron soil pipe and fittings.
2. Hubless, cast-iron soil pipe and fittings.
3. Copper tube and fittings.
4. Specialty pipe fittings.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:

1. Soil, Waste, and Vent Piping: 10-foot head of water.

2.2 PIPING MATERIALS

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.3 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 74, Service class.

B. Gaskets: ASTM C 564, rubber.

C. Calking Materials: ASTM B 29, pure lead and oakum or hemp fiber.

2.4 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 888 or CISPI 301.

B. Heavy-Duty, Hubless-Piping Couplings:

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

   a. ANACO-Husky.
   b. Charlotte Pipe and Foundry Company.
   c. Clamp-All Corp.
   d. MIFAB, Inc.
   e. Mission Rubber Company, LLC; a division of MCP Industries.
   f. NewAge Casting.
   g. Tyler Pipe; a subsidiary of McWane Inc.

2. Standards: ASTM C 1277 and ASTM C 1540.

3. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

2.5 COPPER TUBE AND FITTINGS

A. Copper Type DWV Tube: ASTM B 306, drainage tube, drawn temper.

B. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.

C. Copper Pressure Fittings:

1. Copper Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
2. Copper Unions: MSS SP-123, copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

D. Copper Flanges: ASME B16.24, Class 150, cast copper with solder-joint end.

1. Flange Gasket Materials: ASME B16.21, full-face, flat, nonmetallic, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
2. Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

E. Solder: ASTM B 32, lead free with ASTM B 813, water-flushable flux.

2.6 SPECIALTY PIPE FITTINGS

A. Transition Couplings:

1. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
2. Unshielded, Nonpressure Transition Couplings:

a. Standard: ASTM C 1173.
b. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
c. End Connections: Same size as and compatible with pipes to be joined.
d. Sleeve Materials:

1) For Cast-Iron Soil Pipes: ASTM C 564, rubber.
2) For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
3) For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

3. Shielded, Nonpressure Transition Couplings:

a. Standard: ASTM C 1460.
b. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
c. End Connections: Same size as and compatible with pipes to be joined.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems.

1. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations.
2. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

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 above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping to permit valve servicing.

F. Install piping at indicated slopes.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Install piping to allow application of insulation.

J. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends.

1. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical.
2. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe.

    a. Straight tees, elbows, and crosses may be used on vent lines.

3. Do not change direction of flow more than 90 degrees.
4. Use proper size of standard increasers and reducers if pipes of different sizes are connected.

a. Reducing size of waste piping in direction of flow is prohibited.

K. Lay buried building waste piping beginning at low point of each system.

1. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream.
2. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
3. Maintain swab in piping and pull past each joint as completed.

L. Install soil and waste and vent piping at the following minimum slopes unless otherwise indicated:

1. Building Sanitary Waste: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
2. Horizontal Sanitary Waste Piping: 2 percent downward in direction of flow.
3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.

M. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

N. Install aboveground copper tubing according to CDA's "Copper Tube Handbook."

O. Plumbing Specialties:

1. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary waste gravity-flow piping.

a. Comply with requirements for cleanouts specified in Section 22 1319 "Sanitary Waste Piping Specialties."

2. Install drains in sanitary waste gravity-flow piping.

a. Comply with requirements for drains specified in Section 22 1319 "Sanitary Waste Piping Specialties."

P. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

Q. Install sleeves for piping penetrations of walls, ceilings, and floors.

R. Install escutcheons for piping penetrations of walls, ceilings, and floors.

3.2 JOINT CONSTRUCTION

A. 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.

B. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.

C. Join copper tube and fittings with soldered joints according to ASTM B 828. Use ASTM B 813, water-flushable, lead-free flux and ASTM B 32, lead-free-alloy solder.

3.3 SPECIALTY PIPE FITTING INSTALLATION

A. Transition Couplings:

1. Install transition couplings at joints of piping with small differences in ODs.
2. In Waste Drainage Piping: Shielded, nonpressure transition couplings.

3.4 VALVE INSTALLATION

A. Comply with requirements in Section 22 0523.12 "Ball Valves for Plumbing Piping," for general-duty valve installation requirements.

B. Backwater Valves: Install backwater valves in piping subject to backflow.

1. Horizontal Piping: Horizontal backwater valves. Use normally closed type unless otherwise indicated.
2. Floor Drains: Drain outlet backwater valves unless drain has integral backwater valve.
3. Install backwater valves in accessible locations.
4. Comply with requirements for backwater valve specified in Section 22 1319 "Sanitary Waste Piping Specialties."

3.5 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for pipe hanger and support devices and installation specified in Section 22 0529 "Hangers and Supports for Plumbing Piping and Equipment."

1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
2. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.

3. Vertical Piping: MSS Type 8 or Type 42, clamps.
4. Install individual, straight, horizontal piping runs:

    a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
    c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.

5. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
6. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Support horizontal piping and tubing within 12 inches of each fitting, valve, and coupling.

C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.

E. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
2. NPS 3: 60 inches with 1/2-inch rod.
3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
4. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.

F. Install supports for vertical cast-iron soil piping every 15 feet.

G. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4: 72 inches with 3/8-inch rod.
2. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
3. NPS 2-1/2: 108 inches with 1/2-inch rod.
4. NPS 3 and NPS 5: 10 feet with 1/2-inch rod.
5. NPS 6: 10 feet with 5/8-inch rod.
6. NPS 8: 10 feet with 3/4-inch rod.

H. Install supports for vertical copper tubing every 10 feet.

I. Support piping and tubing not listed above according to MSS SP-58 and manufacturer's written instructions.

3.6 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

C. Connect waste and vent piping to the following:

1. Plumbing Fixtures: Connect waste piping in sizes indicated, but not smaller than required by plumbing code.
2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
3. Plumbing Specialties: Connect waste and vent piping in sizes indicated, but not smaller than required by plumbing code.
4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
5. Install horizontal backwater valves with cleanout cover flush with floor.
6. Comply with requirements for backwater valves, cleanouts and drains specified in Section 22 1319 "Sanitary Waste Piping Specialties."
7. Equipment: Connect waste piping as indicated.

    a. Provide shutoff valve if indicated and union for each connection.
    b. Use flanges instead of unions for connections NPS 2-1/2 and larger.

D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

E. 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.

3.7 IDENTIFICATION

A. Identify exposed sanitary waste and vent piping.

B. Comply with requirements for identification specified in Section 22 0553 "Identification for Plumbing Piping and Equipment."

3.8 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test sanitary waste and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired.

    a. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.

2. Leave uncovered and unconcealed new, altered, extended, or replaced waste and vent piping until it has been tested and approved.

    a. Expose work that was covered or concealed before it was tested.

3. Roughing-in Plumbing Test Procedure: Test waste and vent piping except outside leaders on completion of roughing-in.

    a. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water.
    b. From 15 minutes before inspection starts to completion of inspection, water level must not drop.
    c. Inspect joints for leaks.

4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight.

    a. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg.

b. Use U-tube or manometer inserted in trap of water closet to measure this pressure.
c. Air pressure must remain constant without introducing additional air throughout period of inspection.
d. Inspect plumbing fixture connections for gas and water leaks.

5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

3.9 CLEANING AND PROTECTION

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect sanitary waste and vent piping during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

D. Repair damage to adjacent materials caused by waste and vent piping installation.

3.10 PIPING SCHEDULE

A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.

B. Aboveground, soil and waste piping NPS 4 and smaller shall be any of the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; heavy-duty hubless-piping couplings; and coupled joints.
3. Copper Type DWV tube, copper drainage fittings, and soldered joints.
4. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

C. Aboveground, vent piping NPS 4 and smaller shall be any of the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; heavy-duty hubless-piping couplings; and coupled joints.

3. Copper Type DWV tube, copper drainage fittings, and soldered joints.

    a. Option for Vent Piping, NPS 2-1/2 and NPS 3-1/2: Hard copper tube, Type M; copper pressure fittings; and soldered joints.

4. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

D. Underground, soil, waste, and vent piping NPS 6 and smaller shall be the following:

1. Service class, cast-iron soil piping; gaskets; and gasketed joints.
2. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

END OF SECTION 221316

SECTION 221319

SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 DISCRIPTION

A. Section Includes:

1. Backwater valves
2. Cleanouts.
3. Miscellaneous sanitary drainage piping specialties.

1.2 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.3 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 BACKWATER VALVES

A. Horizontal, Cast-Iron Backwater Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Josam Company; Josam Div.
   b. MIFAB, Inc.
   c. Smith, Jay R. Mfr. Co.; Division of Smith Industries, Inc.
   d. Tyler Pipe; Wade Div.
   e. Watts Drainage Products Inc.
   f. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.14.1.
3. Size: Same as connected piping.
4. Body: Cast iron.
5. Cover: Cast iron with bolted or threaded access check valve.
6. End Connections: Hub and spigot.
7. Type Check Valve: Removable, bronze, swing check, factory assembled, or field modified to hang open for airflow unless subject to backflow condition.
8. Extension: ASTM A 74, Service class; full-size, cast-iron, soil-pipe extension to field-installed cleanout at floor; replaces backwater valve cover.

B. Drain-Outlet Backwater Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Josam Company; Josam Div.
   b. Smith, Jay R. Mfr. Co.; Division of Smith Industries, Inc.
   c. Watts Drainage Products Inc.
   d. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Size: Same as floor drain outlet.
3. Body: Cast iron or bronze made for vertical installation in bottom outlet of floor drain.
4. Check Valve: Removable ball float.
5. Inlet: Threaded.
6. Outlet: Threaded or spigot.

2.2 CLEANOUTS

A. Cast-Iron Exposed Cleanouts:

1. Standard: ASME A112.36.2M for cast iron for cleanout test tee.
2. Size: Same as connected drainage piping
3. Body Material: Hub-and-spigot, cast-iron soil pipe T-branch as required to match connected piping.
4. Closure: Countersunk or raised-head, brass or cast-iron plug.

5. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
6. Closure: Stainless-steel plug with seal.

B. Cast-Iron Exposed Floor Cleanouts:

1. Standard: ASME A112.36.2M for heavy-duty, adjustable housing cleanout.
2. Size: Same as connected branch.
3. Type: Heavy-duty, adjustable housing.
4. Body or Ferrule: Cast iron.
5. Clamping Device: Required.
6. Outlet Connection: Spigot.
7. Closure: Brass plug with tapered threads.
8. Adjustable Housing Material: Cast iron with threads.
9. Frame and Cover Material and Finish: Nickel-bronze, copper alloy.
10. Frame and Cover Shape: Round or Square as Scheduled.
11. Top Loading Classification: Heavy Duty.
12. Riser: ASTM A 74, Extra-Heavy class, cast-iron drainage pipe fitting and riser to cleanout.

C. Cast-Iron Wall Cleanouts:

1. Standard: ASME A112.36.2M. Include wall access.
2. Size: Same as connected drainage piping.
3. Body: Hub-and-spigot, cast-iron soil pipe T-branch or Hubless, cast-iron soil pipe test tee as required to match connected piping.
4. Closure Plug:

    a. Cast iron.
    b. Countersunk or raised head.
    c. Drilled and threaded for cover attachment screw.
    d. Size: Same as or not more than one size smaller than cleanout size.

5. Wall Access: 16 by 16-inches square, stainless-steel wall-installation frame and cover, cylinder lock and key, continuous concealed hinge.

2.3 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Open Drains:

1. Description: Shop or field fabricate from ASTM A 74, Service class, hub-and-spigot, cast-iron soil-pipe fittings. Include P-trap, hub-and-spigot riser section; and where required, increaser fitting joined with ASTM C 564 rubber gaskets.

2. Size: Same as connected waste piping with increaser fitting of size indicated.

B. Deep-Seal Traps:

1. Description: Cast-iron or bronze casting, with inlet and outlet matching connected piping and cleanout trap-seal primer valve connection.
2. Size: Same as connected waste piping.

a. NPS 2: 4-inch-minimum water seal.
b. NPS 2-1/2 and Larger: 5-inch-minimum water seal.

C. Floor-Drain, Trap-Seal Primer Fittings:

1. Description: Cast iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
2. Size: Same as floor drain outlet with NPS 1/2 side inlet.

D. Barrier Type Trap Seal Protection Devices (for each floor drain):

1. Basis-of-Design Product: Subject to compliance with requirements, provide SureSeal Manufacturing; Inline Floor Drain Trap Sealer, or a comparable product by one of the following:

a. ProVent Systems, Inc.

2. Standard: ASSE 1072.
3. Body: ASB Plastic.
4. Diaphragm & Sealing Gasket: Neoprene Rubber.
5. Size: 2 inch, 3 inch, 3-1/2 inch, or 4 inch.
6. Gravity Drain Outlet Connection: Compression fit sealing gasket 80 durometer.

E. Air-Gap Fittings:

1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
2. Body: Bronze or cast iron.
3. Inlet: Opening in top of body.
4. Outlet: Larger than inlet.

2.4 ROOF FLASHING ASSEMBLIES

A. Roof Flashing Assemblies:

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

a. Acorn Engineering Company; Elmdor/Stoneman Div.

b. Thaler Metal Industries Ltd.

2. Description: Manufactured assembly made of 4.0-lb/sq. ft., 0.0625-inch-thick, lead flashing collar and skirt extending at least 8 inches from pipe, with galvanized-steel boot reinforcement and counterflashing fitting.

a. Open-Top Vent Cap: Without cap.

b. Low-Silhouette Vent Cap: With vandal-proof vent cap.

c. Extended Vent Cap: With field-installed, vandal-proof vent cap.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:

1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
2. Locate at each change in direction of piping greater than 45 degrees.
3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
4. Locate at base of each vertical soil and waste stack.

B. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

C. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

D. Assemble open drain fittings and install with top of hub 1 inch above floor.

E. Install deep-seal traps on floor drains and other waste outlets, if indicated.

F. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.

1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
2. Size: Same as floor drain inlet.

G. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.

H. Install sleeve and sleeve seals with each riser and stack passing through floors with waterproof membrane.

I. Install wood-blocking reinforcement for wall-mounting-type specialties.

J. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

3.2 CONNECTIONS

A. Comply with requirements in Section 22 1316 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

3.3 FLASHING INSTALLATION

A. Comply with requirements in Section 07 6200 "Sheet Metal Flashing and Trim."

B. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required.

1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches, and skirt or flange extending at least 8 inches around pipe.
2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.

C. Set flashing on floors in solid coating of bituminous cement.

D. Secure flashing into sleeve and specialty clamping ring or device.

3.4 LABELING AND IDENTIFYING

A. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit.

1. Nameplates and signs are specified in Section 22 0553 "Identification for Plumbing Piping and Equipment."

3.5 PROTECTION

A. Protect drains during the remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 221319

SECTION 22 1319.13

SANITARY DRAINS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Floor drains.
2. Floor sinks.
3. Linear shower drains.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 DRAIN ASSEMBLIES

A. Sanitary drains shall bear label, stamp, or other markings of specified testing agency.

2.2 FLOOR DRAINS

A. Cast-Iron Floor Drains:

1. Manufacturers: Subject to compliance with requirements, as scheduled on drawings or provide products by one of the following:

   a. Jay R. Smith Mfg. Co.
   b. Josam Company.
   c. Zurn Industries, LLC.

2. Standard: ASME A112.6.3.
3. Pattern: Floor or Funnel floor or Sanitary drain as Scheduled.
4. Body Material: Gray iron.
5. Seepage Flange: Required.
6. Anchor Flange: Required.

7. Clamping Device: Required.
8. Outlet: Bottom or Side.
9. Backwater Valve: Not required.
10. Coating on Interior and Exposed Exterior Surfaces: Acid-resistant enamel.
11. Sediment Bucket: As Scheduled.
12. Top or Strainer Material: As Scheduled.
13. Top of Body and Strainer Finish: As Scheduled.
14. Top Shape: Shape to match flooring and floor patterns. As Scheduled.
15. Dimensions of Top or Strainer: As Scheduled.
16. Top Loading Classification: Heavy Duty, unless otherwise indicated.
17. Funnel: Required for indirect waste connections.
18. Inlet Fitting: Gray iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
19. Trap Material: Cast iron.
20. Trap Pattern: Deep-seal P-trap.
21. Trap Features: Barrier Type Trap Seal Protection Devices.

2.3 LINEAR SHOWER DRAINS

A. Trench Drains, TD:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Quickdrain, USA, PROLINE REINUOUS DRAIN - PLD36-N or comparable product by one of the following:

    a. Pre-Approved Equal.
2. General: Linear floor drain consisting of a formed and welded stainless steel channel body and cover that can be easily adjusted to tile or stone covering thicknesses from 1/8 inch to 1 inch. Provide custom spacers if the floor finish is greater than 1 inch. Fully sloped drain body trough to prevent standing water and solids being deposited in the trough. ADA compliant.
3. Material: 18-gauge Stainless Steel 316 L.
4. Flange: Bonding flange for liquid waterproofing attachment.
5. Clamping Device: Not required.
6. Outlet: Bottom.
7. Grate Material: Stainless steel.
8. Cover Design: As selected by Architect.
9. Dimensions of Frame and Grate: 36 inches total length. As Scheduled or Shown on Drawings.
10. Accessories: Levelling and placement brackets. Curb covers
11. Top Loading Classification: Medium Duty.
12. Trap Material: Cast iron.
13. Trap Pattern: Deep seal P-trap.
14. Trap Features: Barrier Type Trap Seal Protection Devices.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.

1. Position floor drains for easy access and maintenance.
2. Set floor drains below elevation of surrounding finished floor to allow floor drainage.
3. Set with grates depressed according to the following drainage area radii:

    a. Radius, 30 Inches or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.
    b. Radius, 30 to 60 Inches: Equivalent to 1 percent slope.
    c. Radius, 60 Inches or Larger: Equivalent to 1 percent slope, but not greater than 1-inch total depression.

4. Install floor-drain flashing collar or flange, so no leakage occurs between drain and adjoining flooring.

    a. Maintain the integrity of waterproof membranes where penetrated.

5. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

B. Install open drain fittings with top of hub 1 inch above floor.

C. Install trench drains at low points of surface areas to be drained.

1. Set grates of drains flush with finished surface, unless otherwise indicated.
2. Assemble channel drainage system components according to manufacturer's written instructions. Install on support devices so that top will flush with adjacent surface.
3. Assemble channel sections to form slope down toward drain outlets. Use sealants, adhesives, fasteners, and other materials recommended by system manufacturer.
4. Embed channel sections and drainage specialties in 4-inch (102-mm) minimum concrete around bottom and sides.
5. Fasten grates to channel sections if indicated.
6. Assemble channel sections with flanged or interlocking joints.

3.2 CONNECTIONS

A. Comply with requirements in Section 22 1316 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Comply with requirements in Section 22 1319 "Sanitary Waste Piping Specialties" for backwater valves, air admittance devices and miscellaneous sanitary drainage piping specialties.

C. Install piping adjacent to equipment to allow service and maintenance.

3.3 LABELING AND IDENTIFYING

A. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 22 0553 "Identification for Plumbing Piping and Equipment."

3.4 PROTECTION

A. Protect drains during the remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 221319.13

SECTION 223300

ELECTRIC, DOMESTIC-WATER HEATERS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Section Includes:

1. Commercial, electric, storage, domestic-water heaters.
2. Domestic-water heater accessories.

1.2 SUBMITTALS

A. Shop drawings shall be submitted for all items specified herein in accordance with Section 01 33 00 “SUBMITTAL PROCEDURES”. Shop drawings shall include, but not be limited to, physical characteristics, parts and materials lists, electrical characteristics, operating data, dimensional drawings, wiring diagrams, weights, and installation requirements, such as, but not limited to:

B. Product Data: For each type and size of domestic-water heater indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

C. Shop Drawings:

1. Wiring Diagrams: For power, signal, and control wiring.

D. Product Certificates: For each type of commercial, electric, domestic-water heater, from manufacturer.

E. Domestic-Water Heater Labeling: Certified and labeled by testing agency acceptable to authorities having jurisdiction.

F. Source quality-control reports.

G. Field quality-control reports.

H. Warranty: Sample of special warranty.

1.3 WARRANTY AND GUARANTEE

A. Warranty and guarantee shall be as specified in Section 01 78 36 with the exception that the warranty period shall be as mentioned below.

B. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of electric, domestic-water heaters that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Structural failures including storage tank and supports.
   b. Faulty operation of controls.

c. Deterioration of metals, metal finishes, and other materials beyond normal use.

2. Warranty Periods: From date of Substantial Completion.

a. Commercial, Electric, Storage, Domestic-Water Heaters:

1) Storage Tank: Three years.

2) Controls and Other Components: Three years.

b. Compression Tanks: Five years.

1.4 OPERATION AND MAINTENANCE MANUALS

A. Submit Operation and Maintenance Manuals for the electric, domestic-water heaters as specified in Section 01 78 23 “OPERATION AND MAINTENANCE DATA”.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1.

C. ASME Compliance: Where ASME-code construction is indicated, fabricate and label commercial, domestic-water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

D. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61 Annex G, "Drinking Water System Components - Health Effects."

1.6 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

PART 2 - PRODUCTS

2.1 COMMERCIAL, ELECTRIC, DOMESTIC-WATER HEATERS

A. Commercial, Electric, Storage, Domestic-Water Heaters (DWH-1) as scheduled:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. Bradford White Corporation.

b. Lochinvar, LLC.

c. PVI Industries, LLC.

d. Smith, A. O. Corporation.

e. State Industries.

2. Standard: UL 1453.

3. Storage-Tank Construction: ASME-code, steel vertical arrangement.
    a. Tappings: Factory fabricated of materials compatible with tank and piping connections. Attach tappings to tank before testing.
        1) NPS 2 (DN 50) and Smaller: Threaded ends according to ASME B1.20.1.
        2) NPS 2-1/2 (DN 65) and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges, and according to ASME B16.24 for copper and copper-alloy flanges.
    b. Pressure Rating: 150 psig.
    c. Interior Finish: Comply with NSF 61 Annex G barrier materials for potable-water tank linings, including extending lining material into tappings.
4. Factory-Installed Storage-Tank Appurtenances:
    a. Anode Rod: Replaceable magnesium.
    b. Drain Valve: Corrosion-resistant metal complying with ASSE 1005.
    c. Insulation: Comply with ASHRAE/IESNA 90.1.
    d. Jacket: Steel with enameled finish.
    e. Heating Elements: Electric, screw-in or bolt-on immersion type arranged in multiples of three. Each element controlled by an individually mounted thermostat and high temperature cut-off switch.
    f. Temperature Control: Adjustable thermostat.
    g. Safety Controls: High-temperature-limit and low-water cutoff devices or systems.
    h. Relief Valves: ASME rated and stamped for combination temperature-and-pressure relief valves. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.
    i. Gages: Combination temperature-and-pressure type or separate thermometer and pressure gage.
5. Special Requirements: NSF 5 construction with legs for off-floor installation.

2.2 DOMESTIC-WATER HEATER ACCESSORIES

A. Domestic-Water Compression Tanks:
1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
    a. AMTROL, Inc.
    b. Flexcon Industries.
    c. Smith, A. O. Corporation.

d. State Industries.

2. Description: Steel pressure-rated tank constructed with welded joints and factory-installed butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.

3. Construction:

a. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1 pipe thread.

b. Interior Finish: Comply with NSF 61 Annex G barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.

c. Air-Charging Valve: Factory installed.

4. Capacity and Characteristics:

a. Working-Pressure Rating: 150 psig.

b. Drain Pans: Corrosion-resistant metal with raised edge. Comply with ANSI/CSA LC 3. Include dimensions not less than base of domestic-water heater, and include drain outlet not less than NPS 3/4 with ASME B1.20.1 pipe threads or with ASME B1.20.7 garden-hose threads.

B. Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE/IESNA 90.1.

1. Pressure-Reducing Valves: ASSE 1003 for water. Set at 25-psig- maximum outlet pressure unless otherwise indicated.

C. Combination Temperature-and-Pressure Relief Valves: ASME rated and stamped. Include relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select relief valves with sensing element that extends into storage tank.

D. Vacuum Relief Valves: ANSI Z21.22/CSA 4.4.

E. Shock Absorbers: ASSE 1010 or PDI-WH 201, Size A water hammer arrester.

F. Domestic-Water Heater Stands: Manufacturer's factory-fabricated steel stand for floor mounting, capable of supporting domestic-water heater and water. Include dimension that will support bottom of domestic-water heater a minimum of 18 inches above the floor.

2.3 SOURCE QUALITY CONTROL

A. Factory Tests: Test and inspect domestic-water heaters specified to be ASME-code construction, according to ASME Boiler and Pressure Vessel Code.

B. Hydrostatically test commercial domestic-water heaters to minimum of one and one-half times pressure rating before shipment.

C. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Section 01 40 00 "Quality Requirements"

for retesting and reinspecting requirements and Section 01 73 00 "Execution" for requirements for correcting the Work.

D. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 DOMESTIC-WATER HEATER INSTALLATION

A. Commercial, Electric, Domestic-Water Heater Mounting: Install commercial, electric, domestic-water heaters on concrete base. Comply with requirements for concrete bases specified in Division 03.

1. Exception: Omit concrete bases for commercial, electric, domestic-water heaters if installation on stand, bracket, suspended platform, or directly on floor is indicated.
2. Maintain manufacturer's recommended clearances.
3. Arrange units so controls and devices that require servicing are accessible.
4. 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 concrete base.
5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
6. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
7. Install anchor bolts to elevations required for proper attachment to supported equipment.
8. Anchor domestic-water heaters to substrate.

B. Install electric, domestic-water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.

1. Install shutoff valves on domestic-water-supply piping to domestic-water heaters and on domestic-hot-water outlet piping. Comply with requirements for shutoff valves specified in Section 22 05 23.12 Ball Valves for Plumbing Piping."

C. Install combination temperature-and-pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

D. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for electric, domestic-water heaters that do not have tank drains. Comply with requirements for hose-end drain valves specified in Section 22 11 19 "Domestic Water Piping Specialties."

E. Install thermometers on outlet piping of electric, domestic-water heaters.

F. Install piping-type heat traps on inlet and outlet piping of electric, domestic-water heater storage tanks without integral or fitting-type heat traps.

G. Fill electric, domestic-water heaters with water.

H. Charge domestic-water compression tanks with air.

3.2 CONNECTIONS

A. Comply with requirements for piping specified in Section 22 11 16 "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where installing piping adjacent to electric, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.

3.3 IDENTIFICATION

A. Identify system components. Comply with requirements for identification specified in Section 22 05 53 "Identification for Plumbing Piping and Equipment."

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.

4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Section 01 40 00 "Quality Requirements" for retesting and reinspecting requirements and Section 01 73 00 "Execution" for requirements for correcting the Work.

C. Prepare test and inspection reports.

3.5 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain commercial, electric, domestic-water heaters.

END OF SECTION 223300

SECTION 22 4213.13

COMMERCIAL WATER CLOSETS

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. Water closets.
2. Flushometer valves.
3. Toilet seats.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for water closets.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For flushometer valves to include in operation and maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that are packaged with protective covering for storage and identified with labels describing contents.

1. Flushometer-Valve Repair Kits: Equal to 10 percent of amount of each type installed, but no fewer than three of each type.

PART 2 - PRODUCTS

2.1 FLOOR-MOUNTED, BOTTOM-OUTLET WATER CLOSETS

A. Water Closets WC-1, WC-1A: Floor mounted, bottom outlet, top spud.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings as scheduled or comparable product by one of the following:

   a. American Standard.
   b. Kohler Co.
   c. Sloan Valve Company.
   d. TOTO USA, INC.

2. Bowl:

   a. Standards: ASME A112.19.2/CSA B45.1 and ASME A112.19.5.
   b. Material: Vitreous china.
   c. Type: Siphon jet.
   d. Style: Flushometer valve.
   e. Height:
      1) WC-1: Standard
      2) WC-1A: Handicapped/elderly, complying with ICC/ANSI A117.1.
   f. Rim Contour: Elongated.
   g. Water Consumption: 1.28 gal. per flush.
   h. Spud Size and Location: NPS 1-1/2; top.
   i. Color: White.

3. Bowl-to-Drain Connecting Fitting: ASTM A1045 or ASME A112.4.3.
4. Flushometer Valve: WFV-1. Bumper on Angle Stop for open seat without cover.
5. Toilet Seat: TS-1.

2.2 FLUSHOMETER VALVES

A. Lever-Handle, Diaphragm Flushometer Valves WFV-1:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings.
   a. American Standard.
   b. Kohler Co.
   c. Sloan Valve Company.
   d. TOTO USA, INC.

2. Standard: ASSE 1037. WaterSense Listed.
3. Minimum Pressure Rating: 125 psig.
4. Features: Include integral check stop and backflow-prevention device.

5. Material: Brass body with corrosion-resistant components.
6. Exposed Flushometer-Valve Finish: Chrome plated.
7. Panel Finish: Chrome plated or stainless steel.
8. Style: Exposed.
9. Consumption: 1.28 gal. per flush.
10. Minimum Inlet: NPS 1.
11. Minimum Outlet: NPS 1-1/4.

2.3 TOILET SEATS

A. Toilet Seats TS-1:

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

   a. American Standard America.
   b. Bemis Manufacturing Company.
   c. Church Seats; Bemis Manufacturing Company.
   d. Kohler Co.
   e. Olsonite Seat Co.
   f. TOTO USA, INC.
   g. Zurn Industries, LLC.

2. Standard: IAPMO/ANSI Z124.5.
3. Material: Plastic.
4. Type: Commercial (Heavy duty).
5. Shape: Elongated rim, open front.
6. Hinge: Self-sustaining, check.
7. Hinge Material: Noncorroding metal.
8. Seat Cover: Not required.
9. Color: White.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before water-closet installation.

B. Examine walls and floors for suitable conditions where water closets will be installed.

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

3.2 INSTALLATION

A. Water-Closet Installation:

1. Install level and plumb according to roughing-in drawings.
2. Install floor-mounted water closets on bowl-to-drain connecting fitting attachments to piping or building substrate.
3. Install accessible, wall-mounted water closets at mounting height for handicapped/elderly, according to ICC/ANSI A117.1.

B. Support Installation:

1. Install supports, affixed to building substrate, for floor-mounted, back-outlet water closets.
2. Use carrier supports with waste-fitting assembly and seal.
3. Install floor-mounted, back-outlet water closets attached to building floor substrate, onto waste-fitting seals; and attach to support.
4. Install wall-mounted, back-outlet water-closet supports with waste-fitting assembly and waste-fitting seals; and affix to building substrate.

C. Flushometer-Valve Installation:

1. Install flushometer-valve, water-supply fitting on each supply to each water closet.
2. Attach supply piping to supports or substrate within pipe spaces behind fixtures.
3. Install lever-handle flushometer valves for accessible water closets with handle mounted on open side of water closet.
4. Install actuators in locations that are easy for people with disabilities to reach.

D. Install toilet seats on water closets.

E. Wall Flange and Escutcheon Installation:

1. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations and within cabinets and millwork.
2. Install deep-pattern escutcheons if required to conceal protruding fittings.

F. Joint Sealing:

1. Seal joints between water closets and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
2. Match sealant color to water-closet color.
3. Comply with sealant requirements specified in Section 07 92 00 "Joint Sealants."

3.3 CONNECTIONS

A. Connect water closets with water supplies and soil, waste, and vent piping. Use size fittings required to match water closets.

B. Comply with water piping requirements specified in Section 22 11 16 "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section 22 13 16 "Sanitary Waste and Vent Piping."

D. Where installing piping adjacent to water closets, allow space for service and maintenance.

3.4 ADJUSTING

A. Operate and adjust water closets and controls. Replace damaged and malfunctioning water closets, fittings, and controls.

B. Adjust water pressure at flushometer valves to produce proper flow.

3.5 CLEANING AND PROTECTION

A. Clean water closets and fittings with manufacturers' recommended cleaning methods and materials.

B. Install protective covering for installed water closets and fittings.

C. Do not allow use of water closets for temporary facilities unless approved in writing by Owner.

END OF SECTION 224213.13

SECTION 22 4216.13

COMMERCIAL LAVATORIES

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. Lavatories.
2. Faucets.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for lavatories.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For lavatories and faucets to include in operation and maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Faucet Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.
2. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.

PART 2 - PRODUCTS

2.1 VITREOUS-CHINA, WALL-MOUNTED LAVATORIES

A. Lavatory L-1 & L-1A: Rectangular, Vitreous China, Wall mounted, with backsplash.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings TOTO LT307.4 or comparable product by one of the following:

a. American Standard America.
b. Crane Plumbing, L.L.C.
c. Gerber Plumbing Fixtures LLC.
d. Kohler Co.
e. Sloan Valve Company.
f. TOTO USA, INC.
g. Zurn Industries, LLC; Commercial Brass and Fixtures.

2. Fixture:
a. Standard: ASME A112.19.2/CSA B45.1.
b. Type: For wall hanging.
c. Nominal Size: Rectangular, 20 by 18 inches.
d. Faucet-Hole Punching: Three holes, 2-inch centers.
e. Faucet-Hole Location: Top.
f. Color: Cotton
g. Mounting Material: Refer to Architectural Drawings.

3. Faucet: F-1, Solid-Brass, Manually Operated Lavatory Faucet.
4. Support: ASME A112.6.1M, Type II, concealed-arm lavatory carrier. Include rectangular, steel uprights. Unless otherwise shown on Architectural Drawings. Comply with the additional requirements in “Lavatory Support” article.
5. Lavatory Mounting Height: Standard for L-1. Handicapped/elderly according to ICC A117.1 for L-1A.

2.2 SOLID-BRASS, MANUALLY OPERATED FAUCETS

A. Lavatory faucets intended to convey or dispense water for human consumption are to comply with the U.S. Safe Drinking Water Act (SDWA), with requirements of the Authority Having Jurisdiction (AHJ), and with NSF 61/NSF 372, or be certified in compliance with NSF 61/NSF 372 by an American National Standards Institute (ANSI) accredited third-party certification body, that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.

B. Lavatory Faucets F-1: Manual-type, two-handle mixing, commercial, solid-brass valve.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Moen model 8210F05 or comparable product by one of the following:

a. Moen Incorporated.

2. Standard: ASME A112.18.1/CSA B125.1. Watersense Certified. ADA compliant.
3. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and fixture receptor.
4. Body Type: Centerset.
5. Body Material: Commercial, solid brass.
6. Finish: Polished chrome plate.
7. Maximum Flow Rate: 0.5 gpm.
8. Mounting Type: Deck, exposed.
9. Valve Handle(s): Wrist blade levers, 2 1/2-inches.
10. Spout: Rigid type.
11. Spout Outlet: Laminar flow.
12. Operation: Compression, manual.
13. Drain: Grid, not part of faucet.

2.3 LAMINAR-FLOW, FAUCET-SPOUT OUTLETS

A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for faucet-spout-outlet materials that will be in contact with potable water.

B. 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. AM Conservation Group, Inc.
2. Chronomite Laboratories, Inc.; a division of Acorn Engineering Company.
3. NEOPERL, Inc.

C. Description: Chrome-plated-brass, faucet-spout outlet that produces non-aerating, laminar stream. Include external or internal thread that mates with faucet outlet for attachment to faucets where indicated and flow-rate range that includes flow of faucet.

2.4 SUPPLY FITTINGS

A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for supply-fitting materials that will be in contact with potable water.

B. Standard: ASME A112.18.1/CSA B125.1.

C. Supply Piping: Chrome-plated-brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated-brass or stainless-steel wall flange.

D. Supply Stops: Chrome-plated-brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.

E. Operation: Loose key.

F. Risers:

1. NPS 1/2.
2. ASME A112.18.6, braided- or corrugated-stainless-steel, flexible hose riser.

2.5 WASTE FITTINGS

A. Standard: ASME A112.18.2/CSA B125.2.

B. Drain: Grid type with NPS 1-1/4 offset and straight tailpiece with Lav guard for ADA Compliant.

C. Trap:

1. Size: NPS 1-1/2 by NPS 1-1/4.
2. Material: Chrome-plated, two-piece, cast-brass trap and ground-joint swivel elbow with 0.032-inch-thick brass tube to wall; and chrome-plated, brass or steel wall flange.
3. Material: Stainless-steel, two-piece trap and swivel elbow with 0.012-inch-thick stainless-steel tube to wall; and stainless-steel wall flange.

2.6 LAVATORY SUPPORTS

A. Lavatory Carrier:

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

a. Jay R. Smith Mfg Co; a division of Morris Group International.
b. Josam Company.
c. WATTS; A Watts Water Technologies Company.
d. Zurn Industries, LLC.

2. Standard: ASME A112.6.1M.
3. Description: Universal Carrier System designed to reduce installation time and provide job site flexibility. Concealed Arm Carrier with Dura-Coated, ductile iron universal arms, including leveling screws, and soft-set elastomeric locking devices pre-installed. Reversible header plates with slots and integral welded arm sleeves that provide 2-inch of horizontal adjustment per plate, allowing for horizontal post anchoring adjustment from 13-inch to 21-inch. Factory assembled uprights, rigid spacing plates, and header plates. Dura-Coated uprights constructed of carbon-steel tubing that meet ASTM A500 Grade C standards. Uprights shall include welded steel plate mounting feet that feature separate bolt patterns for use with anchors per leg. Carrier shall include lower and upper rigid spacing plates. Upper spacing plate shall include horizontal slots for securing

water supply and vent piping. Carrier systems shall exceed load and deflection requirements when tested in accordance to ASME Standard A112.6.1M up to a 250 lb static load rating at all roughin positions, and shall meet OSHPD spacing requirements for two anchor per upright installation.

a. Waste line Sleeve: Dura-Coated cast iron waste line sleeve designed for use with lavatory carrier. Complete with integral positive stops for proper assembly with mating uprights and securing hardware. Sleeve shall allow for up to a 2 inch waste line to pass through while meeting the strength and deflection criteria of the carrier system.
b. Adapter lugs.
c. Extension sleeve.
d. ADA rough-in.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before lavatory installation.

B. Examine walls for suitable conditions where lavatories will be installed.

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

3.2 INSTALLATION

A. Install lavatories level and plumb according to roughing-in drawings.

B. Install supports, affixed to building substrate, for wall-mounted lavatories.

C. Install accessible wall-mounted lavatories at handicapped/elderly mounting height for people with disabilities or the elderly, according to ICC/ANSI A117.1.

D. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings.

E. Seal joints between lavatories, counters, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 07 9200 "Joint Sealants."

F. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible lavatories. Comply with requirements in Section 22 0719 "Plumbing Piping Insulation."

3.3 CONNECTIONS

A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section 22 1116 "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section 22 1316 "Sanitary Waste and Vent Piping."

3.4 ADJUSTING

A. Operate and adjust lavatories and controls. Replace damaged and malfunctioning lavatories, fittings, and controls.

B. Adjust water pressure at faucets to produce proper flow.

3.5 CLEANING AND PROTECTION

A. After completing installation of lavatories, inspect and repair damaged finishes.

B. Clean lavatories, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.

C. Provide protective covering for installed lavatories and fittings.

D. Do not allow use of lavatories for temporary facilities unless approved in writing by Owner.

END OF SECTION 224216.13

SECTION 224216.16

COMMERCIAL SINKS

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. Service basins.
   2. Sink faucets.
   3. Laminar-flow, faucet-spout outlets.
   4. Supply fittings.
   5. Waste fittings.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for sinks.
   2. Include rated capacities, operating characteristics and furnished specialties and accessories.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For sinks to include in maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.

PART 2 - PRODUCTS

2.1 SERVICE BASINS

A. Service Basins MB-1: Terrazzo, floor mounted.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide Swan MS2424 or comparable product by one of the following:
      a. Acorn Engineering Company.
      b. Crane Plumbing, L.L.C.
      c. Florestone Products Co., Inc.
      d. Stern-Williams Co., Inc.
      e. Swanstone
   2. Fixture:
      a. Standard: IAPMO PS 99.
      b. Type: One piece, precast terrazzo made of black and white marble chips in gray Portland cement to produce a compressive strength not less than 3000 psi seven days after casting. Terrazzo surface shall be ground and polished with all air holes or pits grouted and excess removed.
      c. Shape: Rectangular.
      d. Nominal Size: 24 by 24 inches.
      e. Height: 12 inches with dropped front.
      f. Tiling Flange: Not required.
      g. Rim Guard: On all top surfaces.
      h. Color: As selected by Architect.
      i. Drain: Stainless steel. Grid with NPS 3 outlet.
   3. Mounting: On floor and flush to wall.
   4. Faucet: SF-1.
   5. Accessories:
      a. Hose and Hose Bracket: 5/8-inch x 30-inch flexible, heavy-duty rubber cloth reinforced hose with ¾ NPS female thread chromium plated coupling for service faucet spout outlet. Hose bracket shall be 5-inch by 3-inch 18 gauge Type 302 stainless steel with Number 4 finish, and shall be mounted 18 inches above finished floor.
      b. Mop Hanger: Three, 24-inch by 3-inch 18 gauge Type 302 stainless steel with Number 4 finish, shall have three rubber tool grips.
         1) Mounting Height for Brooms: 60 inches above finished floor opposite to sink walls.
         2) Mounting Height for Mops: 24 inches above finished floor opposite to faucet side.
   6. Wall Guard: Heavy gauge stainless steel, on each side.

2.2 SINK/BASIN FAUCETS

A. NSF Standard: Comply with NSF/ANSI 61 Annex G, "Drinking Water System Components - Health Effects," for faucet-spout materials that will be in contact with potable water.

B. Sink Faucets SF-1: Manual type, two-lever-handle mixing valve.
   1. Commercial, Solid-Brass Faucets as scheduled on contract drawings FIAT model 830AA000.
      a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
         1) American Standard America.
         2) Bradley Corporation.
         3) Chicago Faucets.
         4) Delta Faucet Company.
         5) Elkay Manufacturing Co.
         6) GROHE America, Inc.
         7) Just Manufacturing.
         8) Kohler Co.
         9) Moen Incorporated.
         10) Speakman Company.
         11) T & S Brass and Bronze Works, Inc.
         12) Zurn Plumbing Products Group.
   2. Standard: ASME A112.18.1/CSA B125.1.
   3. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and sink receptor.
   4. Body Type: Widespread.
   5. Body Material: Commercial, solid brass.
   6. Finish: Chrome plated.
   7. Maximum Flow Rate: 2.2 gpm.
   8. Handle(s): Wrist blade, 4 inches.
   9. Mounting Type: Back/wall, exposed.
   10. Spout Type: Rigid, solid brass with wall brace.
   11. Vacuum Breaker: Required for hose outlet.
   12. Spout Outlet: Hose thread according to ASME B1.20.7.

2.3 LAMINAR-FLOW, FAUCET-SPOUT OUTLETS

A. NSF Standard: Comply with NSF/ANSI 61 Annex 61, "Drinking Water System Components - Health Effects," for faucet-spout-outlet materials that will be in contact with potable water.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. AM Conservation Group, Inc.

2. Chronomite Laboratories, Inc.
3. NEOPERL, Inc.

C. Description: Chrome-plated brass, faucet-spout outlet that produces non-aerating, laminar stream. Include external or internal thread that mates with faucet outlet for attachment to faucets where indicated and flow-rate range that includes flow of faucet.

2.4 SUPPLY FITTINGS

A. NSF Standard: Comply with NSF/ANSI 61 Annex G, "Drinking Water System Components - Health Effects," for supply-fitting materials that will be in contact with potable water.

B. Standard: ASME A112.18.1/CSA B125.1.

C. Supply Piping: Chrome-plated brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated brass or stainless-steel wall flange.

D. Supply Stops: Chrome-plated brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.

E. Operation: Loose key.

F. Risers:
1. NPS 1/2
2. Chrome-plated, soft-copper flexible tube or ASME A112.18.6, braided or corrugated stainless-steel flexible hose.

2.5 GROUT

A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before sink installation.

B. Examine walls, floors, and counters for suitable conditions where sinks will be installed.

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

3.2 INSTALLATION

A. Install sinks level and plumb according to roughing-in drawings.

B. Set floor-mounted sinks and basins in leveling bed of cement grout.

C. Install water-supply piping with stop on each supply to each sink faucet.
   1. Exception: Use ball or gate valves if supply stops are not specified with sink. Comply with valve requirements specified in Section 22 0523 "General-Duty Valves for Plumbing Piping."
   2. Install stops in locations where they can be easily reached for operation.

D. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings.

E. Seal joints between sinks and counters, floors, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 07 9200 "Joint Sealants."

F. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible sinks. Comply with requirements in Section 22 0719 "Plumbing Piping Insulation."

3.3 CONNECTIONS

A. Connect sinks with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section 22 1116 "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section 22 1316 "Sanitary Waste and Vent Piping."

3.4 ADJUSTING

A. Operate and adjust sinks and controls. Replace damaged and malfunctioning sinks, fittings, and controls.

B. Adjust water pressure at faucets to produce proper flow.

3.5 CLEANING AND PROTECTION

A. After completing installation of sinks, inspect and repair damaged finishes.

B. Clean sinks, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.

C. Provide protective covering for installed sinks and fittings.

D. Do not allow use of sinks/basins for temporary facilities unless approved in writing by Owner.

END OF SECTION 224216.16

SECTION 224223

COMMERCIAL SHOWERS

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. Individual showers.
2. Shower faucets.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for showers.
2. Include rated capacities, operating characteristics, and furnished specialties and accessories.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For shower faucets to include in maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Faucet Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.

2. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.

PART 2 - PRODUCTS

2.1 INDIVIDUAL SHOWERS

A. Individual Showers S-1A:

1. General: Accessible, shower enclosure with faucet and receptor and appurtenances. Refer to Architectural drawings and specifications.
2. Faucet: SHF-1 for S-1 and SHF-1A for S-1A.
3. Outlet: Grid drain with NPS 3 outlet. Center location.
4. Warranty: Manufacturer’s standard five years.

2.2 SHOWER FAUCETS

A. NSF Standard: Comply with NSF 61, "Drinking Water System Components - Health Effects," for shower materials that will be in contact with potable water.

B. Source Limitations: Obtain each type of plumbing fixture and compatible accessories through one source from a single approved manufacturer.

C. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities" ; Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act"; for plumbing fixtures for people with disabilities.

D. Water Flow and Consumption Requirements: Comply with Public Law 102-486 "Energy Policy Act."

E. Shower Faucets SHF-1:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Bradley faucet model as Scheduled on Drawings.
2. Description: Single-handle, heavy-duty thermostatic/pressure-balancing mixing valve with hot- and cold-water indicators; check stops; and shower head.
3. Faucet:

    a. Standards: ASME A112.18.1/CSA B125.1 and ASSE 1016. Water Sense Certified.
    b. Body Material: Solid brass.
    c. Finish: ASTM A 480/A 480M, No. 4 polished chrome finish on exposed surfaces.

d. Maximum Flow Rate: 1.5 gpm unless otherwise indicated.
e. Mounting: Concealed.
f. Operation: Single-handle, twist or rotate control with battery powered digital LCD temperature display for outlet water temperature in 40 – 120 deg. F or 4 – 49 deg. C.
   1) Temperature handle to operate counterclockwise through 270-degree arc, with off at 6 o'clock position and maximum hot at 9 o'clock position.
   2) Adjustable temperature limit stop to limit handle travel in hot direction.
   3) Pressure-balancing mechanism maintains selected discharge temperature to plus or minus 2 degrees F.
g. Antiscald Device: Integral with mixing valve.
h. Check Stops: Check-valve type, integral with or attached to body; on hot- and cold-water supply connections.
i. Showerhead Anchor Plate: 3/16-inch cadmium-plated steel plate with countersunk mounting holes and machine screws provide additional mounting length.
j. Showerhead Back Plate: 3/16-inch cadmium-plated steel plate furnished with couplings, studs and nuts allows most secure anchorage of wall-mounted components.

4. Supply Connections: NPS 1/2.

5. Shower Head:

   a. Standard: ASME A112.18.1/CSA B125.1.
   b. Type: Ball joint with arm and flange.
   c. Shower Head Material: Metallic with chrome-plated finish.
   d. Spray Pattern: Adjustable .
   e. Integral Volume Control: Not required.
   f. Shower-Arm, Flow-Control Fitting: 1.5 gpm.
   g. Temperature Indicator: Not required.

F. Shower Faucets SHF-1A:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Bradley faucet model as Scheduled on Drawings.
2. Description: Single-handle, heavy-duty pressure-balance mixing valve with hot- and cold-water indicators; check stops; and hand-held shower system.
3. Faucet:

   a. Standards: ASME A112.18.1/CSA B125.1 and ASSE 1016. Water Sense Certified.
   b. Body Material: Solid brass.
   c. Finish: Polished chrome finish on exposed surfaces.

d. Maximum Flow Rate: 1.5 gpm unless otherwise indicated.
e. Mounting: Concealed.
f. Operation: Single-handle, twist or rotate control.
    1) Lever-style handle with battery powered digital LCD temperature display on escutcheon.
    2) Temperature handle to operate counterclockwise through 270-degree arc, with off at 6 o'clock position and maximum hot at 9 o'clock position.
    3) Adjustable temperature limit stop to limit handle travel in hot direction.
    4) Pressure-balancing mechanism maintains selected discharge temperature to plus or minus 2 degrees F.
g. Antiscald Device: Integral with mixing valve. Brass cartridge with stainless steel materials.
h. Check Stops: Check-valve type, integral with or attached to body; on hot- and cold-water supply connections.
i. Showerhead Anchor Plate: 3/16-inch cadmium-plated steel plate with countersunk mounting holes and machine screws provide additional mounting length.
j. Showerhead Back Plate: 3/16-inch cadmium-plated steel plate furnished with couplings, studs and nuts allows most secure anchorage of wall-mounted components.

4. Supply Connections: NPS ½.

5. Hand Shower:

    a. Standard: ASME A112.18.1/CSA B125.1.
    b. Type: Hose with vandal-resistant, hand-held head with quick disconnect, wall hooks, and bracket. Glide rail not acceptable.
    c. Shower Head Material: Metallic with chrome-plated finish and swivel connections. 60 to 80-inches double spiral expandable chrome plated or stainless steel metal hose.
    d. Spray Pattern: Fixed.
    e. Integral Volume Control: Required.
    f. Shower-Arm, Flow-Control Fitting: 1.5 gpm.
    g. Temperature Indicator: Not required.
    h. Vacuum Breaker: In-line backflow preventer, chrome plated, NPS 1/2.

6. Shower Head:

    a. Standard: ASME A112.18.1/CSA B125.1.
    b. Type: Ball joint with arm and flange.
    c. Shower Head Material: Metallic with chrome-plated finish.
    d. Spray Pattern: Multi-Jet.
    e. Integral Volume Control: Not required.

f. Shower-Arm, Flow-Control Fitting: 1.5 gpm.
g. Temperature Indicator: Not required.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water-supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before shower installation.

B. Examine walls and floors for suitable conditions where showers will be installed.

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

3.2 INSTALLATION

A. Assemble shower components according to manufacturers' written instructions. Provide blocking for shower accessories/appurtenances that are not being supplied by shower manufacturer. Install per manufacturer's written instructions.

B. Install showers level and plumb according to roughing-in drawings.

C. Install water-supply piping with stop on each supply to each shower faucet.

1. Exception: Use ball valves if supply stops are not specified with shower. Comply with valve requirements specified in Section 220523.12 "Ball Valves for Plumbing Piping."
2. Install stops in locations where they can be easily reached for operation.

D. Install shower flow-control fittings with specified maximum flow rates in shower arms.

E. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings.

F. Seal joints between showers and floors and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

3.3 CONNECTIONS

A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

C. Comply with traps and soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

3.4 ADJUSTING

A. Operate and adjust showers and controls. Replace damaged and malfunctioning showers, fittings, and controls.

B. Adjust water pressure at faucets to produce proper flow.

C. Curtain Adjustment: After hanging curtains, test and adjust each track or rod to produce unencumbered, smooth operation. Steam and dress down curtains as required to produce crease- and wrinkle-free installation. Remove and replace curtains that are stained or soiled or that have stress points or diagonal folds.

3.5 CLEANING AND PROTECTION

A. After completing installation of showers, inspect and repair damaged finishes.

B. Clean showers, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.

C. Provide protective covering for installed fixtures and fittings.

D. Do not allow use of showers for temporary facilities unless approved in writing by Owner.

END OF SECTION 224223

SECTION 224500

EMERGENCY PLUMBING FIXTURES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Section Includes:

1. Combination units.

1.2 DEFINITIONS

A. Accessible Fixture: Emergency plumbing fixture that can be approached, entered, and used by people with disabilities.

B. Plumbed Emergency Plumbing Fixture: Fixture with fixed, potable-water supply.

C. Self-Contained Emergency Plumbing Fixture: Fixture with flushing-fluid-solution supply.

D. Tepid: Moderately warm.

1.3 SUBMITTALS

A. Shop drawings shall be submitted for all items specified herein in accordance with Section 01 33 00 “SUBMITTAL PROCEDURES”. Shop drawings shall include, but not be limited to, physical characteristics, parts and materials lists, electrical characteristics, operating data, dimensional drawings, wiring diagrams, weights, and installation requirements, such as, but not limited to:

B. Product Data: For each type of product indicated. Include flow rates and capacities, furnished specialties, and accessories.

C. Shop Drawings:

1. Include plans, elevations, sections, and mounting attachment details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
4. Include diagrams for power, signal, and control wiring.

D. Product Certificates: Submit certificates of performance testing specified in "Source Quality Control" Article.

E. Field quality-control test reports.

1.4 WARRANTY AND GUARANTEE

A. Warranty and guarantee shall be as specified in Section 01 78 36 with the exception that the warranty period shall be as mentioned below.

B. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of water tampering equipment that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including storage tank and supports.

b. Faulty operation of controls.

c. Deterioration of metals, metal finishes, and other materials beyond normal use.

2. Warranty Periods: From date of Substantial Completion.

a. Water Tampering Equipment: Three years.

1.5 OPERATION AND MAINTENANCE MANUALS

A. Submit Operation and Maintenance Manuals for the emergency plumbing fixtures as specified in Section 01 78 23 “OPERATION AND MAINTENANCE DATA”.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ISEA Standard: Comply with ISEA Z358.1.

C. NSF Standard: Comply with NSF 61 and NSF 372, for fixture materials that will be in contact with potable water.

D. Regulatory Requirements: Comply with requirements in ICC A117.1,; Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act"; for plumbing fixtures for people with disabilities.

2.2 COMBINATION UNITS

A. Standard, Plumbed Emergency Shower with Eyewash Combination Units,

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

a. Bradley Corporation.

b. Guardian Equipment Co.

c. Haws Corporation.

d. Speakman Company.

2. Piping:

a. Material: All stainless steel
b. Unit Supply: [NPS 1-1/4 minimum] [NPS 1-1/2].
c. Unit Drain: Outlet at back or side near bottom.

3. Shower:

a. Capacity: Not less than 20 gpm for at least 15 minutes.
b. Supply Piping: NPS 1 with flow regulator and stay-open control valve.
c. Control-Valve Actuator: Pull rod.
d. Shower Head: 8-inch-minimum diameter, Stainless steel
e. Mounting: Pedestal.

4. Eyewash Unit:

a. Capacity: Not less than 0.4 gpm for at least 15 minutes.
b. Supply Piping: NPS 1/2 with flow regulator and stay-open control valve.
c. Control-Valve Actuator: Paddle.
d. Spray-Head Assembly: Two receptor-mounted spray heads.
e. Receptor: stainless-steel bowl.
f. Mounting: Attached shower pedestal.

1) Capacity: Not less than 0.4 gpm for at least 15 minutes.
2) Drench Hose: Hand-held spray head with squeeze-handle actuator and hose.
3) Mounting: Bracket on shower pedestal.

2.3 WATER-TEMPERING EQUIPMENT

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

a. Acorn Safety; a Division of Morris Group International.
b. Bradley Corporation.
c. Guardian Equipment Co.
d. Haws Corporation.
e. Speakman Company.

2. Description: Factory-fabricated equipment with thermostatic mixing valve.

a. Thermostatic Mixing Valve: Designed to provide 85 deg F tepid, potable water at emergency plumbing fixtures, to maintain temperature at plus or minus 5 deg F throughout required 15-minute test period, and in case of unit failure to continue cold-water flow, with union connections, controls, metal piping, and corrosion-resistant enclosure.
b. Supply Connections: For hot and cold water.

B. Electric Water-Tempering Equipment, ESWH-1:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

   a. Bradley Corporation.

   b. Encon Safety Products.

   c. Haws Corporation.

   d. THERM OMEGA TECH

2. Description: Packaged Factory-fabricated equipment ESWH-1 as indicated on drawing P-600.

   a. Electric tank type safety shower water heater, UL 499, sized for stable, temperature duty to meet flow requirements and temperature requirements of ANSI Z358.1- compliant safety shower fixtures, with liquid-cooled solid-state relays, flow activation, external emergency stop button, anti-scald protection and TepidGuard™, an overshoot protection purge function.

   b. Heating System: Tank type Electric, designed to provide 85 deg F tepid, potable water at emergency plumbing fixtures, to maintain temperature at plus or minus 5 deg F throughout required 15-minute test period, and in case of unit failure to continue cold-water flow, with union connections, controls, heating coils, high-temperature-limit device, metal piping, and corrosion-resistant enclosure with insulation and jacket

      1) Electrical Characteristics: As Scheduled.

      2) Disconnect Switch: Fused or Non-Fused, door-interlocked, OSHA compliant.

3. Enclosure: UL 50E 0.063-inch/16-ga.- thick, steel

   a. Water Heater Freeze Protection: Not required.

   b. Mounting: Floor mounted, free standing with stand kit.

   c. Siren/Beacon (SB): For safety shower applications and include a flashing light and siren assembly which is activated when the heater is turned on.

   d. Dry Contact for remote monitoring of the water heater by BMS specified in Section 23 0923.

   4. Heat Exchanger: Copper sheathed tubing with brazed brass fittings and large internal passageways for minimal pressure drop. NSF 61 barrier materials for potable water with storage capacity ASME- and National Board- certified.

a. Connections: 1-1/4 inch NPT inlet, outlet, and purge.

b. Pressure Rating: 150 psig.

c. Heating Element: Incoloy 800 low-watt density sheathed resistive heating element.

d. Temperature Control: Microprocessor with PID logic and dual display of set-point and actual outlet water temperature.

e. Distributed Control System Link: Required.

f. Safety Controls:

1) 90 deg. F (32 deg. C) controller alarm sends a signal to disconnect power to elements

2) 95 deg. F internal thermostat with auto reset high- limit switch

3) 95 deg. F passive monitoring, TepidGuard™ anti-scald protection activates and purges excessively hot water to drain.

4) 100 deg. surface mounted bi-metal thermostat with manual reset.

5) Internal Fused Disconnect: Required.

6) Ground Fault Equipment Protection. For leakage to ground, greater than 1 amp, Door-mounted ground fault status light and reset: Required.

5. Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of electric, domestic-water heaters that fail in materials or workmanship within specified warranty period from Date of Substantial Completion.

a. Electrical Components, two years

b. Heating Elements, five years

c. Tank and Heat Exchanger Free From Leaks, ten years

C. WATER HEATER ACCESSORIES

1. Provide electric tank type water heater system including the following system with Hydrastone cement lined steel tank and accessories:

a. Pressure and Temperature Relief Valves: Pressure and Temperature Relief Valves: Stainless steel, ASME rated and stamped pressure relief valve. Adjust to pressure setting less than water heater working-pressure rating.

b. Pressure and Temperature Safety Relief Valve set to 80 psig.

c. Pressure-Reducing Valves: ASSE 1003.

d. Vacuum Relief Valves: ANSI Z21.22/CSA 4.4.

e. Shock Absorbers: ASSE 1010 or PDI-WH 201, Size A water hammer arrester.

f. Thread Adapters: NPT to BSPP, stainless steel.

g. Y-Strainer: Lead Free Stainless steel.

2.4 SOURCE QUALITY CONTROL

A. Certify performance of emergency plumbing fixtures by independent testing organization acceptable to authorities having jurisdiction.

B. Factory Tests: Test and inspect domestic-water heaters according to ASME "Boiler and Pressure Vessel Code," Section III. Submit test reports.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for water piping systems to verify actual locations of piping connections before plumbed emergency plumbing fixture installation.

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

3.2 INSTALLATION OF EMERGENCY PLUMBING FIXTURE INSTALLATION

A. Assemble emergency plumbing fixture piping, fittings, control valves, and other components.

B. Install fixtures level and plumb.

C. Fasten fixtures to substrate.

D. Install shutoff valves in water-supply piping to fixtures and equipment, to facilitate maintenance of the equipment. Use ball or gate valve if specific type valve is not indicated. Install valves chained or locked in open position if permitted. Install valves in locations where they can easily be reached for operation. Comply with requirements for valves specified in Section 22 05 23.12 "Ball Valves for Plumbing Piping" and Section 22 05 23.15 "Gate Valves for Plumbing Piping."

1. Exception: Omit shutoff valve on supply to group of plumbing fixtures that includes emergency equipment.
2. Exception: Omit shutoff valve on supply to emergency equipment if prohibited by authorities having jurisdiction.

E. Install shutoff valve and strainer in steam piping and shutoff valve in condensate return piping. Comply with requirements for steam and condensate piping specified in Section 23 22 13 "Steam and Condensate Heating Piping" and Section 23 22 16 "Steam and Condensate Heating Piping Specialties."

F. Install dielectric fitting in supply piping to emergency equipment if piping and equipment connections are made of different metals. Comply with requirements for dielectric fittings specified in Section 22 11 16 "Domestic Water Piping."

G. Install thermometers in supply and outlet piping connections to water-tempering equipment. Comply with requirements for thermometers specified in Section 22 05 19 "Meters and Gages for Plumbing Piping."

H. Install trap and waste piping on drain outlet of emergency equipment receptors that are indicated to be directly connected to drainage system. Comply with requirements for waste piping specified in Section 22 13 16 "Sanitary Waste and Vent Piping."

I. Install indirect waste piping on drain outlet of emergency equipment receptors that are indicated to be indirectly connected to drainage system. Comply with requirements for waste piping specified in Section 22 13 16 "Sanitary Waste and Vent Piping."

J. Install escutcheons on piping wall and ceiling penetrations in exposed, finished locations. Comply with requirements for escutcheons specified in Section 22 05 18 "Escutcheons for Plumbing Piping."

K. Electric, tank type, Domestic-Water Heater Mounting:

1. Install water heaters in accordance with manufacturer's written instructions.

2. Install water heaters level and plumb, according to layout drawings and referenced standards. Anchor to structure as recommended by manufacturer.

3. Maintain manufacturer's recommended clearance and access dimensions.

L. If shipped loose, install pressure and temperature safety relief valves on water heater. Manifold relief valve discharge and over-temperature purge lines as shown in manufacturer's instructions.

M. Extend relief-valve/over-temperature purge outlet line, and discharge by positive air gap above closest floor drain.

N. Install relief valve/over-temperature purge drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping.

O. Run relief valve/over-temperature purge drain piping without creating tripping hazard.

P. Install pressure-reducing valve with integral bypass relief valve in water heater cold water inlet piping and water hammer arrester in water-heater outlet piping, maximum outlet pressure 40 psig.

3.3 CONNECTIONS

A. Connect cold-water-supply piping to plumbed emergency plumbing fixtures not having water-tempering equipment. Comply with requirements for cold-water piping specified in Section 22 11 16 "Domestic Water Piping."

B. Connect hot- and cold-water-supply piping to hot- and cold-water, water-tempering equipment. Connect output from water-tempering equipment to emergency plumbing fixtures. Comply with requirements for hot- and cold-water piping specified in Section 22 11 16 "Domestic Water Piping."

C. Connect steam and cold-water-supply and condensate return piping to steam and cold water-tempering equipment. Connect output from water-tempering equipment to emergency plumbing fixtures. Comply with requirements for cold-water piping specified in Section 22 11 16 "Domestic Water Piping" and comply with requirements for steam and condensate piping specified in Section 23 22 13 "Steam and Condensate Heating Piping" and Section 23 22 16 "Steam and Condensate Heating Piping Specialties."

D. Connect cold water and electrical power to electric heating water-tempering equipment. Comply with requirements for cold-water piping specified in Section 22 11 16 "Domestic Water Piping."

E. Directly connect emergency plumbing fixture receptors with trapped drain outlet to sanitary waste and vent piping. Comply with requirements for waste piping specified in Section 22 13 16 "Sanitary Waste and Vent Piping."

F. Indirectly connect emergency plumbing fixture receptors without trapped drain outlet to sanitary waste or storm drainage piping.

G. Where installing piping adjacent to emergency plumbing fixtures, allow space for service and maintenance of fixtures.

3.4 IDENTIFICATION

A. Install equipment nameplates or equipment markers on emergency plumbing fixtures and equipment and equipment signs on water-tempering equipment. Comply with requirements for identification materials specified in Section 22 05 53 "Identification for Plumbing Piping and Equipment."

3.5 FIELD QUALITY CONTROL

A. Mechanical-Component Testing: After plumbing connections have been made, test for compliance with requirements. Verify ability to achieve indicated capacities.

B. Tests and Inspections:

1. Perform each visual and mechanical inspection.
2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Emergency plumbing fixtures and water-tempering equipment will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.6 ADJUSTING

A. Adjust or replace fixture flow regulators for proper flow.

B. Adjust equipment temperature settings.

END OF SECTION 22 45 00

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SECTION 224713

DRINKING FOUNTAINS

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. Drinking fountains.
   2. Bottle filling stations.
   3. Supports.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of drinking fountain and bottle filling station.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
   2. Include operating characteristics, and furnished specialties and accessories.

B. Sustainable Design Submittals:
   1. Product Data: For water consumption.
   2. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.

C. Shop Drawings:
   1. Include diagrams for power wiring.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For drinking fountains and bottle filling stations to include in maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Filter Cartridges: Equal to 10 percent of quantity installed for each type and size indicated, but no fewer than one of each.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Standards:
1. Drinking fountains and bottle filling stations intended to convey or dispense water for human consumption are to comply with the U.S. Safe Drinking Water Act (SDWA), requirements of the Authority Having Jurisdiction (AHJ), and with NSF 61 or NSF 372, or be certified in compliance with NSF 61 or NSF 372 by an ANSI-accredited third-party certification body, that the weighted average lead content at wetted surfaces is less than or equal to 0.25 pe
2. rcent.
3. Comply with ASME A112.19.3/CSA B45.4 for stainless steel drinking fountains and bottle filling stations.
4. Comply with ICC A117.1 for accessible drinking fountains and bottle filling stations.

2.2 DRINKING FOUNTAINS

A. Drinking Fountains ADA compliant bilevel Outdoor Wall-Mounted, Stainless Steel: DF-1.
1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings Elkay model LK4409BF or comparable product by one of the following:

a. Halsey Taylor.
b. Murdock Manufacturing; A Division of Morris Group International.
c. Elkay
2. Source Limitations: Obtain, wall-mounted, stainless steel drinking fountains from single source from single manufacturer.
3. Type: Vandal-resistant
4. Receptor(s):

a. Number: Two and integral bottle filling station.
b. Shape: Round.
c. Bubbler: Stainless steel. One for each receptor, with adjustable stream regulator, located on deck.
d. Drain: Grid with NPS 1-1/4 minimum horizontal waste and trap, complying with ASME A112.18.2/CSA B125.2.
5. Maximum Water Flow: 0.5 gpm.
6. Control: Push button mechanical.
7. Access to Internal Components: Bottom panel required.
8. Supply: NPS 3/8 with shutoff valve.
9. Waste Fitting: ASME A112.18.2/CSA B125.2, NPS 1-1/4 brass P-trap.
10. Filter: standard inline strainer
11. Support: Provide manufacturer's support frame attached to substrate.
12. Drinking Fountain Mounting Height: High/low - standard/Accessible in accordance with ICC A117.1.

13. Bottle Filling Station: Integral assembly. Comply with the requirements in Article “Bottle Filling Station - Recessed, Wall-Mounted, Stainless Steel.”
14. Color: As selected by Architect

2.3 BOTTLE FILLING STATIONS

A. Bottle Filling Station -Wall-Mounted, Stainless Steel: Integral with DF-1.
1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. Halsey Taylor.
b. Most Dependable Fountains, Inc.
c. Murdock Manufacturing; A Division of Morris Group International.
d. Elkay

2. Source Limitations: Obtain wall-mounted, stainless steel, bottle filling stations from single source from single manufacturer.
3. Type: Vandal resistant and freeze resistant.
4. Cabinet: Stainless steel.
5. Bottle Filler: Push-button activation, with 20-second automatic shutoff timer. Fill rate 0.5 to 1.5 gpm.
6. Drain: Grid type with NPS 1-1/4 tailpiece.
7. Supply: NPS 3/8 with shutoff valve.
8. Waste Fitting: ASME A112.18.2/CSA B125.2, NPS 1-1/4 brass P-trap.
9. Filter: One or more water filters complying with NSF 42 and NSF 53 and with capacity sized for peak flow rate.
10. Support: Provide manufacturer's frame attached to substrate.
11. Bottle Filling Station Mounting Height: Standard.

2.4 SUPPORTS

A. Drinking Fountain Carrier:
1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. Josam Company.

b. MIFAB, INC.

c. WADE; a subsidy of McWane Inc.

2. Description: Support system with top and bottom plates. Complete with Dura-Coated rectangular steel uprights with welded feet, adjustable support plates, and mounting fasteners.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for water-supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before fixture installation.

B. Examine walls and floors for suitable conditions where fixtures will be installed.

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

3.2 INSTALLATION

A. Install fixtures level and plumb according to roughing-in drawings. For fixtures indicated for children, install at height required by authorities having jurisdiction.

B. Install wall mount, drinking fountains and bottle filling stations secured to wall as per written instructions from manufacturer

C. Provide additional wall support to prevent vandalization.

D. Install water-supply piping with shutoff valve on supply to each fixture to be connected to domestic-water distribution piping. Use ball valve. Install valves in locations where they can be easily reached for operation. Valves are specified in Section 220523.12 "Ball Valves for Plumbing Piping"

E. Install trap and waste piping on drain outlet of each fixture to be connected to sanitary drainage system.

F. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons where required to conceal protruding fittings.

G. Seal joints between fixtures and walls using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

3.3 PIPING CONNECTIONS

A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

C. Install ball shutoff valve on water supply to each fixture. Install valve upstream from filter for drinking fountain. Comply with valve requirements specified in Section 220523.12 "Ball Valves for Plumbing Piping"

D. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

3.4 ELECTRICAL CONNECTIONS

A. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

B. Install electrical devices furnished by manufacturer, but not factory mounted, according to NFPA 70 and NECA 1.

C. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.
1. Nameplates to be laminated acrylic or melamine plastic signs, as specified in Section 260553 "Identification for Electrical Systems."
2. Nameplates to be laminated acrylic or melamine plastic signs with a black background and engraved white letters at least 1/2 inch high.

3.5 ADJUSTING

A. Adjust fixture flow regulators for proper flow and stream height.

3.6 CLEANING

A. After installing fixtures, inspect unit. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.

B. Clean fixtures, on completion of installation, according to manufacturer's written instructions.

C. Provide protective covering for installed fixtures.

D. Do not allow use of fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 224713

SECTION 230500

GENERAL HVAC REQUIREMENTS

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 DESCRIPTION

A. Section includes general administrative and procedural requirements for HVAC work. The following administrative and procedural requirements are included in this Section to expand the requirements specified in Division 01:

1. Submittals.
2. Coordination drawings.
3. Record documents.
4. Operation and Maintenance manuals.
5. Rough-ins.
6. Mechanical installations.
7. Electrical Requirements for Mechanical Equipment.
8. Mechanical sleeve seals.
9. Sleeves.
10. Escutcheons.
11. Grout.
12. HVAC demolition.
13. Equipment installation requirements common to equipment sections.
14. Painting and finishing.
15. Concrete bases.
16. Supports and anchorages.

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

F. HVAC: Heating, Ventilating and Air Conditioning.

G. System Installer: An entity (firm), identified by the Contractor and approved as qualified by the Owner, designated to perform HVAC system installation duties as described herein.

1.4 SUBMITTALS

A. Shop drawings shall be submitted for all items specified herein in accordance with Section 01 3300 “Submittal Procedures”. Shop drawings shall include, but not be limited to, physical characteristics, parts and materials lists, electrical characteristics, operating data, dimensional drawings, wiring diagrams, weights, and installation requirements, such as, but not limited to:

B. General: Follow the procedures specified in the General and Supplementary Conditions, and individual Division 23 Sections.

1. Edit manufacturer's standard dimension drawings, performance and product data by deleting reference to equipment, features or information which is not applicable to the product being supplied for this project.

2. Provide sufficient copies of submittals, with the Engineer’s submittal review stamp for inclusion in the Operation and Maintenance Manuals.

C. Product Data: For each type of products and materials.

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

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

E. Wiring Diagrams: For power, signal, and control wiring.

F. Coordination Drawings: Prepare Coordination Drawings if limited space availability necessitates maximum utilization of space for efficient installation of different components or if coordination is required for installation of

products and materials fabricated by separate entities.

1. Content: Project-specific information, drawn accurately to minimum scale of ¼" = 1'-0" or larger. Do not base Coordination Drawings on reproductions of the Contract Documents or standard printed data. Include the following information, as applicable:

    a. Indicate functional and spatial relationships of components of architectural, structural, civil, process mechanical, mechanical, and electrical systems.

    b. Indicate required installation sequences.

    c. Indicate reflected ceiling plans to coordinate and integrate installations, air outlets and inlets, light fixtures, communication systems components, sprinklers, and other ceiling-mounted items.

    d. Indicate dimensions shown on the Contract Drawings and make specific note of dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect for resolution of such conflicts. Minor dimension changes and difficult installations will not be not be considered changes to the Contract

    e. Indicate detailing major elements, components, and systems of mechanical equipment and materials in relationship with other systems, installations, and building components. Indicate locations where space is limited for installation and access and where sequencing and coordination of installations are of importance to the efficient flow of the Work, including (but not necessarily limited to) the following:

        1) Indicate the proposed locations of piping, ductwork, equipment, and materials. Including but not limi
        2) ted to the following:

            a) Clearances for installing and maintaining insulation.

            b) Clearances for servicing and maintaining equipment, including tube removal, filter removal, and space for equipment disassembly required for periodic maintenance.

            c) Equipment service connections and support details.

            d) Exterior wall and foundation penetrations.

            e) Fire-rated wall and floor penetrations.

            f) Smoke-rated wall penetrations.

            g) Sizes and location of required concrete pads and bases.

            h) Valve stem movement.

3) Indicate scheduling, sequencing, movement, and positioning of large equipment into the building during construction.

4) Prepare floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.

a) Include planned duct systems layout, including elbow radii and duct accessories.

b) Include planned piping layout, including valve and specialty locations.

2. Sheet Size: At least 11 by 17 inches but no larger than 24 by 36 inches.

3. Number of Copies: Submit four opaque copies of each submittal. Engineer will return one copy.

a. Submit five copies where Coordination Drawings are required for operation and maintenance manuals. Engineer will retain two copies; remainder will be returned. Mark up and retain one returned copy as a Project Record Drawing.

4. Refer to individual Sections for Coordination Drawing requirements for Work in those Sections.

5. Schedule: Refer to Division 1.

G. If the coordination drawings submitted are not approved in accordance with their requirements, the Owner will not review and approve additional partial payment requests until such time as the coordination drawings submittals are brought into compliance.

H. Samples: For each exposed product and for each color and texture specified, prepared on Samples of size to adequately show color.

I. Warranty: Special warranty specified in this Section.

J. Welding certificates.

K. Permits.

L. Qualification Data: For qualified Installer, manufacturer, fabricator, professional, testing agency, and factory-authorized service representative.

M. Calculations.

N. Operation and Maintenance Manuals: For each HVAC systems, subsystems, or equipment to include in emergency, operation, and maintenance manuals.

1. Prepare operation and maintenance manuals in accordance with the requirements in General Conditions, Division 1 Sections and ASHRAE Guideline 4 “Preparation of operating and Maintenance Documentation for Building Systems.” In addition to the requirements specified in above references, include the following:

a. Include for equipment items:

1) Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.

2) Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.

3) Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.

4) Include manufacturer's schedule for routine preventive maintenance, inspections, tests and adjustments required to ensure proper and economical operation and to minimize corrective maintenance and repair. Provide manufacturer's projection of preventive maintenance work-hours on a daily, weekly, monthly, and annual basis including craft requirements by type of craft. For periodic calibrations, provide manufacturer's specified frequency and procedures for each separate operation.

5) Servicing instructions and lubrication charts and schedules.

6) Spare Parts Lists: Include a recommended spare parts list for all equipment furnished for the project. The parts list must include a tabulation of descriptive data for all the electrical-electronic spare parts and all the mechanical spare parts proposed for each type of equipment or system. Each part must be properly identified by part number and manufacturer.

7) Test reports for all field and factory tests performed.

8) Start-up reports for all start-up work performed.

9) Warranties and guarantees.

a) List and explain the various warranties and include the servicing and technical precautions prescribed by the manufacturers or contract documents to keep warranties in force. Include warranty information for primary components such as the compressor of air conditioning system.

10) Contractor’s, Supplier’s, and Local representative’s name, address, telephone number, and contact person.

b. Material Safety Data Sheets (MSDS).

c. Refer to other Division 23 sections for additional requirements for Operation and Maintenance Manuals, Operating Instructions, Training and other deliverables.

2. Posted Operating Instructions:

a. General: Prepare operating instructions and diagrams for posting near the equipment. Posted operating instructions must be photographic or equal non-fading reproductions framed under glass or encased in non-discoloring plastic and shall be mounted in locations as directed. Include and use copies of the posted operating instructions with the operating and maintenance manuals as a basis for training Owner's employees in the operation and maintenance of systems and related equipment installed under contract at the facility.

b. Posted operating instructions shall consist of simplified, consolidated equipment, control, and power diagrams graphically representing the entire system and actual equipment installed, including concise written instructions on how to start and stop systems, what settings and conditions are to be observed, and what control adjustments are to be made or maintained by the operation. Posted operating instructions shall include, but are not limited to the following:

1) Heating, ventilating, and air-conditioning co
2) ntrols for each system.

3) Ventilation systems controls.

4) One-line diagrams of refrigerant piping systems, including risers, main shutoff valves, and the like.

O. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals.

2. Program Software Backup: On magnetic media or compact disk, complete with data files.

3. Device address list.

4. Printout of software application and graphic screens.

P. Record Documents:

1. Prepare record documents in accordance with the requirements in Division 1. In addition to the requirements specified in Division 1, indicate the following installed conditions:

a. Ductwork mains and branches, size and location, for both exterior and interior; locations of dampers and other control devices; filters, boxes, and terminal units requiring periodic maintenance or repair.

b. Mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located (i.e., traps, strainers, expansion compensators, tanks, etc.). Valve location diagrams, complete with valve tag chart. Refer to Division 23 Section "Identification of HVAC Piping and Equipment."

c. Indicate actual invert elevations and horizontal locations of underground equipment, piping and ductwork.

d. Indicate actual elevations and horizontal locations of aboveground equipment, piping and ductwork.

e. Equipment locations (exposed and concealed), dimensioned from prominent building lines.

f. Approved substitutions, Contract Modifications, and actual equipment and materials installed.

g. Refer to other Division 23 sections for additional requirements.

2. Record Drawings:

a. Drawings showing final as-built conditions of the project. The final CADD as-built drawings shall consist of one set of electronic CADD drawing files in the specified format, one set of Mylar drawings, 2 sets of blue-line prints of the mylars, and one set of the approved working as-built drawings unless otherwise indicated. Documents shall not be copyrighted.

b. Only personnel proficient in the preparation of CADD drawings shall be employed to modify the contract drawings or prepare additional new drawings. Additions and corrections to the contract drawings shall be equal in quality and detail to that of the originals. Line colors, line weights, lettering, layering conventions, and symbols shall be the same as the original line colors, line weights, lettering, layering conventions, and symbols. If additional drawings are required, they shall be prepared using the specified electronic file format applying the same graphic standards specified for original drawings. The title block and drawing border to be used for any new final as-built drawings shall be identical to that used on the contract drawings. Additions and corrections to the contract drawings shall be accomplished using CADD files. The Contractor shall use AUTOCAD Release 2016 software and a Windows 10 operating system. The electronic files will be supplied on compact disc, read-only memory (CD-ROM). The Contractor shall be responsible for providing all program files and hardware necessary to prepare final as-built drawings. The Architect will review final as-built drawings for accuracy and the Contractor shall make required corrections, changes, additions, and deletions.

1) CADD colors shall be the "base" colors of red, green, and blue. Color code for changes shall be as follows:

a) Deletions (red) - Deleted graphic items (lines) shall be colored red with red lettering in notes and leaders.

b) Additions (Green) - Added items shall be drawn in green with green lettering in notes and leaders.

c) Special (Blue) - Items requiring special information, coordination, or special detailing or detailing notes shall be in blue.

3. As-Built Record of Equipment and Materials: Copies of the record listing the as-built materials and equipment incorporated into the construction of the project.

1.5 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."

2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. Sheet Metal Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" details for fabrication of units, including flanges and cap flashing to coordinate with type of roofing indicated.

D. Electrical Characteristics for HVAC Equipment: Equipment of higher electrical characteristics, capacities, and ratings than the basis of design may be furnished provided such proposed equipment is approved in writing and connecting mechanical and electrical services, circuit breakers, bases, equipment spaces, and conduit sizes are appropriately modified. No additional costs will be approved for these modifications, if equipment is approved. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

E. The Contractor shall be responsible for any and all deviations from the construction documents. The Contractor, at his/her expense, shall coordinate and provide all modifications associated with deviations, including approved alternates and manufacturers, from the basis of design. Any deviation affecting structural systems shall require the approval and the stamp of a professional structural engineer.

F. NRCA Compliance: Roof accessories shall be constructed according to

recommendations of NRCA.

G. Reference Standards: Comply with all Federal, State and City laws or ordinances, as well as all applicable codes, standards, regulations and/or regulatory agency requirements including the partial listing below. In case of a conflict between standards, the more stringent shall be followed.

1. Associated Air Balance Council.
2. American Conference of Governmental Industrial Hygienist (ACGIH). Industrial Ventilation: A Manual of Recommended practices (latest edition).
3. Air Movement and Control Association (AMCA).
4. American National Standards Institute (ANSI)
5. Air Conditioning, Heating and Refrigeration Institute (AHRI)
6. American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE). Handbook Series (latest editions).
7. American Society of Plumbing Engineers (ASPE)
8. American Society for Testing and Materials (ASTM)
9. American Welding Society (AWS)
10. American Water Works Association (AWWA)
11. International Building Code/ 2015, International Plumbing Code/ 2015, International Mechanical Code/2015, International Fire Prevention Code/2015, International Fuel Gas Code/2015, International Energy Conservation Code/2015, and International Green Building Code/2012 as amended by State of Maryland and other regulatory agencies having jurisdiction.
12. All applicable provisions of the State of Maryland “Maryland Building Performance Standards (MBPS).”
13. Midwest Insulation Contractors' Association, Inc. (MICA)
14. Manufacturers' Standardization Society (MSS)
15. National Environmental Balancing Bureau (NEBB)
16. NEC, National Electric Code as amended by the State of Maryland and other regulatory agencies having jurisdiction.
17. Standards of National Electrical Manufacturers. (NEMA)
18. National Fire Protection Association (NFPA) Codes and Standards.
19. OSHA, Occupational Safety and Health Act.
20. Sheet Metal and Air Conditioning Contractors National Association (SMACNA).
21. Underwriters Laboratories Inc. (UL)

H. Regulatory Requirements:

1. It is the intention of the Contract Documents that the work described therein is in compliance with codes. Should the Contractor or System Installer discover work shown or noted which is not in code compliance, s/he shall immediately notify the Owner and Engineer. S/He shall not install the work in contravention of any code provision.

2. All packaged equipment shall be independently third party labeled as a system for its intended use by a Nationally Recognized Testing Laboratory (NRTL) in accordance with OSHA Federal Regulations 29 CFR 1910.303 and 1910.399, NFPA 70, and National Electric Code (NEC), Article 90-7.

I. HVAC System Installer Qualifications Installer shall:

1. Be a licensed mechanical Contractor in the State of Maryland and City of Baltimore.

2. Have ten years, minimum, of experience in the installation and maintenance of industrial and heavy commercial HVAC systems.

3. Maintain a full-time, local, staff of engineers, technicians and service/maintenance personnel.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification.

B. Procurement and Delivery: Coordinate procurement of materials and equipment being supplied by subcontractors and suppliers to insure timely delivery and installation.

C. Coordination: Coordinate all work with that of other trades to insure proper system operation and a complete building system as desired by Architect/Engineer.

D. Interferences: In case of interferences or scheduling problems during any portion of construction, Architect/Engineer shall decide which work is to be relocated, regardless of which is installed first.

E. Preparation for Finishing: Schedule all prefinish preparation work sufficiently in advance so as not to impede progress of work.

1.7 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for HVAC installations.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

C. Coordinate requirements for access panels and doors for HVAC items requiring access that are concealed.

D. Coordinate layout and installation of roof accessories with roofing membrane and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.

E. With Architect's approval, adjust location of roof accessories that would interrupt roof drainage routes, and roof expansion joints.

1.8 PROJECT CONDITIONS

A. Field Measurements: Verify required openings for each type of roof accessory by field measurements before fabrication and indicate measurements on Shop Drawings.

B. Scheduling: Refer to the Construction Sequence Drawings and related sections for requirements for construction scheduling.

1.9 WARRANTY AND GUARANTEE

A. Warranty and guarantee shall be as specified in Section 01 77 00 with the exception that the warranty period shall be as mentioned below.

B. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components or equipment that fail(s) in materials or workmanship within specified warranty period inclusive of parts, labor, travel and shipping expenses.

1. Warranty Period: Minimum two years from date of Substantial Completion.

1.10 SOFTWARE SERVICE AGREEMENT

A. Technical Support: Beginning with Substantial Completion, provide software support for two years.

B. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of software.

1.11 Provide 30 days' notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment if necessary.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.
2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by the manufacturers specified.

2.2 METAL MATERIALS

A. Galvanized Steel Sheet: ASTM A 653/A 653M, G90 coated and mill phosphatized for field painting.

B. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, AZ50 coated.

C. Prepainted, Metallic-Coated Steel Sheet: Steel sheet metallic coated by hot-dip process and prepainted by coil-coating process to comply with ASTM A 755/A 755M.

1. Galvanized Steel Sheet: ASTM A 653/A 653M, G90 coated.
2. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, Class AZ50 coated.
3. Exposed Finishes: High-Performance Organic Finish (2-Coat Fluoropolymer): Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturer's written instructions.
    a. Fluoropolymer 2-Coat System: Manufacturer's standard 2-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with physical properties and coating performance requirements in AAMA 2605, except as modified below:
        1) Humidity Resistance: 2000 hours.
        2) Salt-Spray Resistance: 2000 hours.

D. Aluminum Sheet: ASTM B 209, alloy and temper recommended by manufacturer for type of use and mill finish. Coil-coat finish as follows:

1. Factory-Prime Coating: Where painting after installation is indicated, provide pretreatment and white or light-colored, factory-applied, baked-on epoxy primer coat; with a minimum dry film thickness of 0.2 mil.
2. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: Nonspecular as fabricated; Chemical Finish: Etched, medium matte;

Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 611.

3. High-Performance Organic Finish (2-Coat Fluoropolymer): AA-C12C40R1x (Chemical Finish: Cleaned with inhibited chemicals; Chemical Finish: Conversion coating; Organic Coating: Manufacturer's standard 2-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 2605 and with coating and resin manufacturer's written instructions.

   a. Color and Gloss: As selected by Architect from manufacturer's full range.

4. Powder-Coat Finish: Immediately after cleaning and pretreating, electrostatically apply manufacturer's standard baked-polymer thermosetting powder finish. Comply with resin manufacturer's written instructions for application, baking, and minimum dry film thickness.

   a. Color and Gloss: As selected by Architect from manufacturer's full range.

E. Aluminum Extrusions and Tubes: ASTM B 221, alloy and temper recommended by manufacturer for type of use, mill finished.

F. Stainless-Steel Shapes or Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304 or Type 316, No. 2D finish.

G. Steel Shapes: ASTM A 36/A 36M, hot-dip galvanized to comply with ASTM A 123/A 123M, unless otherwise indicated.

H. Steel Tube: ASTM A 500, round tube, baked-enamel finished.

I. Galvanized Steel Tube: ASTM A 500, round tube, hot-dip galvanized to comply with ASTM A 123/A 123M.

J. Galvanized Steel Pipe: ASTM A 53/A 53M.

2.3 MISCELLANEOUS MATERIALS

A. Fasteners: Same metal as metals being fastened, or nonmagnetic stainless steel or other noncorrosive metal as recommended by manufacturer. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners.

B. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, or PVC; or flat design of foam rubber, sponge neoprene, or cork.

C. Elastomeric Sealant: ASTM C 920, silicone sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

D. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant, polyisobutylene plasticized, and heavy bodied for hooked-type expansion joints with limited movement.

E. Roofing Cement: ASTM D 4586, non-asbestos, fibrated asphalt cement designed for trowel application or other adhesive compatible with roofing system.

2.4 ROOF CURBS

A. Roof Curbs: Provide metal roof curbs, internally reinforced and capable of supporting superimposed live and dead loads, including equipment loads and other construction to be supported on roof curbs. Fabricate with welded or sealed mechanical corner joints, with stepped integral metal cant raised the thickness of roof insulation and integral formed mounting flange at perimeter bottom. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

1. Manufacturers:
    a. Curbs Plus Inc.
    b. Custom Curb, Inc.
    c. Loren Cook Company.
    d. Pate Company (The).
    e. Roof Products & Systems Corporation.
    f. ThyCurb; Div. of Thybar Corporation.
2. Material: Aluminum sheet, 0.090 inch thick.
    a. Finish: Mill.
3. Liner: Same material as curb, of manufacturer's standard thickness and finish.
4. Factory install wood nailers at tops of curbs.
5. Insulation and Adhesive: Comply with NFPA 90A or NFPA 90B.
    a. Factory insulate curbs with 2 inches thick, cellulosic or glass-fiber board insulation. ASTM C 1071, Type I or II.
    b. Application: Factory applied with adhesive and mechanical fasteners to the internal surface of curb.
        1) Liner Adhesive: Comply with ASTM C 916, Type I.
        2) Mechanical Fasteners: Galvanized steel, suitable for adhesive attachment, mechanical attachment, or welding attachment to duct without damaging liner when applied as recommended by manufacturer and without causing leakage in cabinet.

3) Liner materials applied in this location shall have air-stream surface coated with a temperature-resistant coating or faced with a plain or coated fibrous mat or fabric depending on service air velocity.

4) Liner Adhesive: Comply with ASTM C 916, Type I.

6. Curb height may be determined by adding thickness of roof insulation and minimum base flashing height recommended by roofing membrane manufacturer. Fabricate units to minimum height of 24 inches, unless otherwise indicated.

7. Sloping Roofs: Where slope of roof deck exceeds 1:48, fabricate curb units with water diverter or cricket and with height tapered to match slope to level tops of units.

2.5 EQUIPMENT SUPPORTS

A. Equipment Supports: Provide metal equipment supports, internally reinforced and capable of supporting superimposed live and dead loads, including equipment loads and other construction to be supported. Fabricate with welded or sealed mechanical corner joints, with stepped integral metal cant raised the thickness of roof insulation and integral formed mounting flange at perimeter bottom. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

1. Manufacturers:

a. Curbs Plus Inc.

b. Custom Curb, Inc.

c. Loren Cook Company.

d. Pate Company (The).

e. Roof Products & Systems Corporation.

f. ThyCurb; Div. of Thybar Corporation.

2. Material: Aluminum sheet, 0.090 inch thick.

3. Factory-install continuous wood nailers 11-1/2 inches wide and minimum 2 inches thick at tops of equipment supports. Softwood lumber, pressure treated with waterborne preservatives for aboveground use, complying with AWPA C2.

4. Metal Counterflashing: Manufacturer's standard removable counterflashing, fabricated of same metal and finish as equipment support.

5. Fabricate units to minimum height of 24 inches, unless otherwise indicated.

6. Sloping Roofs: Where slope of roof deck exceeds 1:48, fabricate curb units with water diverter or cricket and with height tapered to match slope to level tops of units.

7. Fasteners: Same metal as metals being fastened, or nonmagnetic stainless steel or other noncorrosive metal as recommended by manufacturer. Match finish of exposed fasteners with finish of material being fastened.

2.6 PIPE PENETRATION SYSTEMS

A. Graduated Boot Type, Pipe Penetration Systems: Consist of a pre-fabricated roof curb, a laminated acrylic coated ABS thermoplastic reinforced cover with pre-punched mounting holes and molded sealing ring on the collared opening, cadmium-plated fastening screws, EPDM compression molded rubber boots suitable for use with installed pipe sizes and minimum of two stainless steel snap lock swivel action clamps for each boot. Covers shall be resistant to ozone and ultraviolet rays and shall have a serviceable temperature range of -40 degrees F to 250 degrees F. Coordinate dimensions with rough-in information of piping and conduit penetrations.

1. Manufacturers:
   a. Custom Curb, Inc.
   b. Pate Company (The).
   c. Roof Products & Systems Corporation.
   d. ThyCurb; Div. of Thybar Corporation.
2. Roof Curbs: Separate roof curb for each assembly. Comply with the requirements specified in Article “ROOF CURBS” of this section.

B. Hood Type, Pipe Penetration Systems (Dog-House): Removable top cover, faceplate and 3-sided body to provide access to the hood interior.

1. Manufacturers:
   a. Custom Curb, Inc.
   b. Pate Company (The).
   c. Roof Products & Systems Corporation.
   d. ThyCurb; Div. of Thybar Corporation.
2. Material: Aluminum sheet, 0.090 inch thick.
3. Material: Stainless-steel sheet, 0.078 inch thick.
   a. Finish: Mill.
4. Roof Curb: Separate roof curb for each assembly. Comply with the requirements specified in Article “ROOF CURBS” of this section.

5. Field insulate hood interior with 1-1/2-inch- thick, cellulosic glass-fiber board insulation and caulk all exposed joints.

2.7 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.

1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psi, 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 HVAC DEMOLITION

A. Refer to Division 01 Section "Alteration Project Procedures" and Division 02 Section "Selective Demolition" for general demolition requirements and procedures.

B. Disconnect, demolish, and remove HVAC 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 and cap or plug piping with same or compatible piping material.
3. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
4. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.
5. Equipment to Be Removed: Disconnect and cap services and remove equipment.
6. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
7. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.2 MECHANICAL INSTALLATION – COMMON REQUIREMENTS

A. Sequence, coordinate, and integrate the various elements of mechanical systems, materials, and equipment.

B. Coordinate mechanical systems, equipment, and materials installation with other building components.

C. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.

D. Verify all dimensions by field measurements.

E. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for mechanical installations.

F. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.

G. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.

H. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.

I. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.

J. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are sh

K. own only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Architect.

L. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed.

M. Install mechanical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location.

N. Install access panel or doors where units are concealed.

O. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.

3.3 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 23 Sections specifying piping systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install piping to allow application of insulation.

K. Select system components with pressure rating equal to or greater than system operating pressure.

L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:

1. New Piping:

    a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.

    b. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.

    c. Insulated Piping: One-piece, stamped-steel type with spring clips.

    d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.

    e. Bare Piping at Ceiling Penetrations in Finished Spaces: One-

piece or split-casting, cast-brass type with polished chrome-plated finish.

f. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge and set screw.

2. Existing Piping: Use the following:

a. Chrome-Plated Piping: Split-casting, cast-brass type with chrome-plated finish.

b. Insulated Piping: Split-plate, stamped-steel type with concealed hinge and spring clips.

c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-casting, cast-brass type with chrome-plated finish.

d. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-casting, cast-brass type with chrome-plated finish.

e. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge and set screw.

M. Sleeves are not required for core-drilled holes.

N. Permanent sleeves are not required for holes formed by removable PE sleeves.

O. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.

1. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.

2. Install sleeves in new walls and slabs as new walls and slabs are constructed.

3. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:

a. Steel Pipe Sleeves: For pipes smaller than NPS 6.

b. Steel Sheet Sleeves: For pipes NPS 6 and larger, penetrating gypsum-board partitions.

c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2

inches above finished floor level. Refer to Division 07 Section "Sheet Metal Flashing and Trim" for flashing.

1) Seal space outside of sleeve fittings with grout.

4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.

P. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Install steel pipe for sleeves smaller than 6 inches in diameter.

2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.

3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

Q. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

R. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.

3.4 Verify final equipment locations for roughing-in.

3.5 Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.6 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.

2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

3.7 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

B. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.

C. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

D. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.

E. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect

piping materials of dissimilar metals.

3.8 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install HVAC equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

D. Install equipment to allow right of way for piping installed at required slope.

E. Comply with NECA 1.

F. Wiring Method: Install cables in raceways except within consoles, cabinets, desks, and counters. Conceal raceway and cables except in unfinished spaces.

1. Comply with requirements for raceways and boxes specified in Division 26 Section "Raceways and Boxes for Electrical Systems."

G. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

H. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

3.9 ELECTRICAL REQUIREMENTS FOR MECHANICAL EQUIPMENT

A. Regulatory Requirements: For all electrical equipment, components and wiring, comply with the requirements of NFPA 70, "National Electrical Code" and of the public utility providing power to the project site.

B. Comply with all codes, laws, ordinances, rules and regulations of all federal, state and local governmental authorities having jurisdiction over a project site and of public utilities having connection with any systems shown or specified. Include costs to accomplish compliance.

C. Provide motors for all motor driven equipment included under Division 23 including motors that are factory-installed as part of equipment and appliances as well as field-installed motors. Comply with Division 23 Section “Common Mo

D. tor Requirements for HVAC Equipment.”

1. The horsepower of motors specified or indicated on the Drawings are those estimated to be required and have been used to determine the electrical feeder and breaker sizes. If the actual horsepower required

for any equipment proposed to be furnished differs with that specified or shown on the Drawings, include all costs relative to the electrical changes required under Division 23.

E. Motor Starters: Provide each motor with a motor starter of proper design to meet the requirements of the motor and drive. Provide starters as specified unless modified by other sections of Division 23, by details, control diagrams on the Drawings. Provide all starters of the same manufacturer and comply with Division 26.

1. The Mechanical Contractor shall review the requirements for motor starters against mechanical and electrical drawings; other Division 23 sections; and Division 26 specifications and shall provide those starters required by Division 23 specifications to integrate the mechanical control system. The electrical interface required to utilize low voltage control devices shall be at the sole description of the Division 23 Contractor and the Division 23 Controls Sub-Contractor. Include all materials required for such low voltage installation under Division 23.

F. Under Division 23, furnish a full complement of electrical components required for intended use and/or operation of specified equipment, including line starters, contactors, magnetic controllers, start-stop switches, multi-speed switches and/or other similar devices required, whether integral or remote.

1. Installation of these control devices, power wiring, power wiring through these devices, where required, is under Division 26.

2. Under Division 23, furnish and install control and combination control power wiring and accessories for these devices, for temperature, pressure and other similar control devices, and be responsible for proper functioning of equipment.

3. Provide components and systems in hazardous locations that are suitable for hazard.

G. Conduit and power wiring of required size and voltage from a panel board or motor control center or similar source, shall be furnished and installed under Division 26 to the equipment furnished under Division 23. A junction box or means of disconnect as required by the National Electrical Code shall be furnished and installed at each piece of equipment - either as supplied by the equipment manufacturer or under Division 26.

H. Provide weatherproof components when installed in locations exposed to weather.

I. Electrical work required for system products and installation shall meet or exceed those specified in applicable portions of Division 26 ELECTRICAL. The Division 23 Contractor shall coordinate all electrical work related to mechanical systems' installation with the Division 26 Contractor.

J. Wiring: Run all wiring in rigid galvanized conduit or electrical metallic tubing.

1. Run wiring exposed to view in surface metal raceway in existing construction only.
2. Conceal all wiring in new construction.
3. Refer to Division 26 Sections "Low-Voltage Electrical Power Conductors and Cables" for additional requirements.

K. Refer to Electrical Drawings and Division 26 Specifications for electrical characteristics for this project and, in each case, the service which will be made available for each individual motor. It shall be the responsibility under Division 23 to provide motors of proper current characteristics as required under Division 26.

L. Perform final connections to the terminals (within the terminal housing of the equipment) of motors, electric heaters and other electrical equipment furnished under Division 23. Check

M. for proper rotation of three phase motors and proper functioning of each equipment.

3.10 FIELD QUALITY CONTROL

A. Coordination:

1. The System Installer shall coordinate the dimensions, connections, electrical requirements, controls and arrangements of the equipment, piping, ductwork and other materials, so that these component parts of the system are compatible with each other and so that alignment and other conflicts are eliminated.
2. Accordingly, the System Installer shall review and stamp all shop drawing submittals required by the vendors of the HVAC items prior to submittals to the Engineer. The System Installer's stamp shall warrant that s/he has reviewed such submittals and that the coordination described above has been achieved.

B. Permits: The System Installer shall obtain forms, fill out, pay fees for, and schedule inspections for all permits required for the HVAC work. Any corrective work required as a result of a permit inspection shall be borne by the System Installer at no additional cost to the Owner.

C. Calculations: Following submittals on the HVAC equipment and ductwork, the System Installer shall submit computer generated printouts from new calculations showing duct static pressure losses and noise levels in decibels at various locations along the system. The calculations shall be accompanied with any recommendations for adjustments to fan speeds, type or horsepower or duct sizes or locations so that the design airflows can be met.

3.11 CUTTING AND PATCHING

A. General: Protect installed work and adjacent installations during cutting and patching operations.

B. Perform cutting, fitting, and patching of mechanical equipment and materials required to:

1. Uncover work to provide for installation of ill-timed work.
2. Remove and replace defective work.
3. Remove and replace work not conforming to requirements of the Contract Documents.
4. Remove samples of installed work as specified for testing.
5. Install equipment and materials in existing structures. Provide temporary steel lintels above opening in masonry, concrete, or weight bearing structures.
6. Upon written instructions from the Engineer, uncover and restore work to provide for observation of concealed work.

C. Cut, remove and legally dispose of selected mechanical equipment, components and materials as indicated, including but not limited to removal of mechanical piping, ducts, heating units, plumbing fixtures and trim, and other mechanical items made obsolete by work under this contract. In no case is work allowed to be abandoned in place, unless otherwise noted on the drawings.

D. Protect the structure, furnishings, finishes and adjacent materials not indicated or scheduled to be removed.

E. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.

3.12 PAINTING

A. Painting of HVAC systems, equipment, and components is specified in Division 09 Sections.

B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.13 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. Chamfer edges and corners.
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.

4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.
6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
7. Use 3000-psi, 28-day compressive-strength concrete and reinforcement as specified in Division 03 Section "Cast-in-Place Concrete" or on Drawings.
8. Paint edges of the pads with yellow safety paint.

3.14 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Division 05 Section "Metal Fabrications" for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor HVAC materials and equipment.

C. Field Welding: Comply with AWS D1.1.

3.15 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor HVAC materials and equipment.

B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

D. Refer to Division 06 Section “Miscellaneous Rough Carpentry Wood” for wood and anchorage materials and installation requirements.

3.16 TOUCH UP

A. Touch up factory-primed surfaces with compatible primer ready for field painting in accordance with Division 09 painting Sections.

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

3.17 CLEANING

A. Clean exposed surfaces according to manufacturer's written instructions.

3.18 GROUTING

A. Mix and install grout for HVAC equipment base bearing surfaces, pump and

other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

3.19 CLOSEOUT PROCEDURES

A. Training: Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain equipment and systems.

B. Equipment/System manufacturer shall provide field training to Owner on the operation and maintenance of the mechanical equipment and system provided. The instructor shall be experienced and approved by the Manufacturer of the equipment/system provided.

1. Refer to other Divisions for minimum training hours requirements. Minimum two (2) hours for each type of equipment in two two (2) hour sessions.
2. Contractor shall coordinate with Equipment/System Supplier and shall schedule instruction session(s) with the Owner, provide at least 7-day notice to Owner of training date.
3. Schedule training after performing all tests and correction of all deficiencies.
4. Submit to the Owner’s Representative sign-in sheets with the dates and names of all training participants. Training sheets must be reviewed and certified by an authorized facility manager.

3.20 FIELD QUALITY CONTROL

A. Each contractor, sub-contractor and supplier of equipment shall include in its quoted price the cost of furnishing the material requested and manpower necessary for the operation and maintenance manuals, training and system verification as specified under Division 23.

END OF SECTION 230500

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SECTION 230513

COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on alternating-current power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:

1. Motor controllers.
2. Torque, speed, and horsepower requirements of the load.
3. Ratings and characteristics of supply circuit and required control sequence.
4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

A. Comply with NEMA MG 1 unless otherwise indicated.

B. Comply with IEEE 841 for severe-duty motors.

C. Provide superior quality motors that provide consistent performance, highest efficiency, improved life cycle and lowest maintenance cost. The motors shall be built to provide the following:

1. Safe operation.
2. Highest efficiency.
3. Reliability in an application, which may be corrosive and wet.
4. Minimum maintenance requirement due to the design and quality of materials and workmanship.

5. Lowest noise pollution.
6. Starting: Each automatically controlled motor shall be capable of starting as frequently as the control sequence may demand. Motors not automatically controlled shall be capable of making no fewer than 4 starts per hour.

D. All motors shall be listed under UL recognized component file.

E. All motors shall be suitable for installation according to the requirements of NEC.

2.2 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.

B. 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.

1. Size motors to be non-overloading under all possible conditions of operation.

2. Motors shall not be smaller than indicated on drawings or in the specifications but may be larger to meet the above requirements.

3. All motors shall be approved by the manufacturer as being appropriate for the services, duties, applications, and operating environments in the manner which they are installed, operated, connected to driven equipment, and otherwise used in mechanical systems. Whenever an equipment supplier purchases motors separately and factory-assembles them into systems, the equipment supplier shall secure the motor manufacturer’s approval that said motors are appropriate fo

4. r all intended uses.

C. Motors 1 HP and Larger: Three phase.

D. Motors Smaller Than 1 HP: Single phase.

E. Frequency Rating: 60 Hz.

F. Voltage Rating: NEMA standard voltage selected to operate on nominal circuit voltage to which motor is connected.

G. Enclosure: Manufacturer’s standard Open drip proof (ODP) or Totally Enclosed, Fan Cooled (TEFC) unless otherwise indicated.

H. Totally Enclosed, Air Over (TEAO), where indicated.

2.3 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Efficiency: Premium efficient, as defined in NEMA MG 1. Comply with the latest ASHRAE 90.1 and International Energy Conservation Code.

C. Service Factor: 1.15 for 1-1/2 HP and larger. 1.25 for 1 HP and smaller.

D. Multispeed Motors: Separate winding for each speed.

E. Rotor: Random-wound, squirrel cage.

F. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

G. Temperature Rise: Match insulation rating.

H. Insulation: Class F.

I. Code Letter Designation:

1. Motors 15 HP and Larger: NEMA starting Code F or Code G.

2. Motors Smaller Than 15 HP: Manufacturer's standard starting characteristic.

J. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 ADDITIONAL REQUIREMENTS FOR POLYPHASE MOTORS

A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

B. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

2.5 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:

1. Permanent-split capacitor.

2. Split phase.

3. Capacitor start, inductor run.

4. Capacitor start, capacitor run.

B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.

C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

D. Motors 1/20 HP and Smaller: Shaded-pole type.

E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 230513

SECTION 230529

HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Fiberglass pipe hangers.
4. Metal framing systems.
5. Fiberglass strut systems.
6. Thermal-hanger shield inserts.
7. Fastener systems.
8. Pipe stands.
9. Equipment supports.

B. Related Requirements:

1. Section 05 5000 "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. Section 23 0548.13 "Vibration Controls for HVAC" for vibration isolation devices.
3. Section 23 3113 "Metal Ducts" for duct hangers and supports.

1.3 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.
2. Product Certificates: For indigenous materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each indigenous material.

3. Environmental Product Declaration: For each product.

C. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following; include Product Data for components:

1. Trapeze pipe hangers.
2. Metal framing systems.
3. Fiberglass strut systems.
4. Pipe stands.
5. Equipment supports.

D. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Detail fabrication and assembly of trapeze hangers.
2. Include design calculations for designing trapeze hangers.

1.4 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.5 QUALITY ASSURANCE

A. Structural-Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code, Section IX.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 4000 "Quality Requirements," to design trapeze pipe hangers and equipment supports.

B. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.

2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

3. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

2.2 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.

2. Galvanized Metallic Coatings: Pregalvanized, 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.

B. Stainless-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.

2. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.

3. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

C. Copper Pipe and Tube Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-plated steel, factory-fabricated components.

2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-plated steel.

2.3 TRAPEZE PIPE HANGERS

A. Description: MSS SP-58, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.4 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:

1. Products: Subject to compliance with requirements, provide one of the following:
    a. B-line, an Eaton business;.
    b. Flex-Strut Inc.;.
    c. Thomas & Betts Corporation; A Member of the ABB Group;.
    d. Unistrut; Part of Atkore International;.
2. Description: Shop- or field-fabricated, pipe-support assembly made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
3. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
4. Channels: Continuous slotted carbon-steel (indoor) and stainless-steel, Type 316 (outdoor) channel with inturned lips.
5. Channel Width: Selected for applicable load criteria.
6. Channel Nuts: Formed or stamped nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
7. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
8. Metallic Coating: Hot-dip galvanized.

B. Non-MFMA Manufacturer Metal Framing Systems:

1. Products: Subject to compliance with requirements, provide one of the following:
    a. Anvil International;.
    b. Empire Industries, Inc.;.
    c. Gripple Inc.;PHD Manufacturing, Inc;.
2. Description: Shop- or field-fabricated, pipe-support assembly made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
3. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
4. Channels: Continuous slotted carbon-steel (indoor) and stainless-steel (outdoor) channel with inturned lips.
5. Channel Width: Select for applicable load criteria.
6. Channel Nuts: Formed or stamped nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.

7. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
8. Metallic Coating: Pregalvanized G90 or Hot-dip galvanized.
9. Paint Coating: Green epoxy, acrylic, or urethane.
10. Plastic Coating: PVC.

2.5 THERMAL-HANGER SHIELD INSERTS

A. Products: Subject to compliance with requirements, provide one of the following:
1. Carpenter & Paterson, Inc;.
2. Clement Support Services;.
3. National Pipe Hanger Corporation;.
4. Pipe Shields Inc.;.

B. Insulation-Insert Material for Cold Piping: ASTM C552, Type II cellular glass with 100-psi or ASTM C591, Type VI, Grade 1 polyisocyanurate with 125-psi minimum compressive strength and vapor barrier.

C. Insulation-Insert Material for Hot Piping: ASTM C552, Type II cellular glass with 100-psi or ASTM C591, Type VI, Grade 1 polyisocyanurate with 125-psi minimum compressive strength.

D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

F. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.6 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: Insert-wedge-type anchors for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
1. Indoor Applications: Zinc-coated or stainless-steel.
2. Outdoor Applications: Stainless steel.

2.7 PIPE STANDS

A. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.

B. High-Profile, Single Base, Single-Pipe Stand:

1. Description: Single base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.
2. Base: Single vulcanized rubber or molded polypropylene.
3. Vertical Members: Two, galvanized- or stainless-steel, continuous-thread 1/2-inch rods.
4. Horizontal Member: One, adjustable height, galvanized- or stainless-steel pipe support slotted channel or plate.
5. Pipe Supports: Clevis hanger.
6. Hardware: Galvanized- or Stainless-steel.
7. Accessories: Protection pads, 1/2-inch continuous-thread galvanized-steel rod, or 1/2-inch continuous-thread stainless-steel rod.
8. Height: 36 inches above roof.

C. High-Profile, Multiple-Pipe Stand:

1. Description: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.
2. Bases: Two or more; vulcanized rubber or molded polypropylene.
3. Vertical Members: Two or more, galvanized- or stainless-steel channels.
4. Horizontal Members: One or more, adjustable height, galvanized- or stainless-steel pipe support.
5. Pipe Supports: Strut clamps.
6. Hardware: Galvanized- or Stainless-steel.
7. Accessories: Protection pads, 1/2-inch continuous-thread rod.
8. Height: 36 inches above roof.

D. Curb-Mounted-Type Pipe Stands: Shop- or field-fabricated pipe supports made from structural-steel shapes, continuous-thread rods, and rollers, for mounting on permanent stationary roof curb.

2.8 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.9 MATERIALS

A. Aluminum: ASTM B221.

B. Carbon Steel: ASTM A1011/A1011M.

C. Structural Steel: ASTM A36/A36M, carbon-steel plates, shapes, and bars; galvanized.

D. Stainless Steel: ASTM A240/A240M.

E. Threaded Rods: Continuously threaded. Zinc-plated or galvanized steel for indoor applications and stainless steel for outdoor applications. Mating nuts and washers of similar materials as rods.

F. Grout: ASTM C1107/C1107M, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.

2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with requirements in Section 07 8413 "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.

3.2 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 the building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-58. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.

2. Field fabricate from ASTM A36/A36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled strut systems.

D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

E. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.

2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

F. Pipe Stand Installation:

1. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.

2. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. See Section 07 7200 "Roof Accessories" for curbs.

G. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

H. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

I. 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.

J. Install lateral bracing with pipe hangers and supports to prevent swaying.

K. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

L. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

M. 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.

N. Insulated Piping:

1. Attach clamps and spacers to piping.
    a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
    b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
    c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
    a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
    a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
4. Shield Dimensions for Pipe: Not less than the following:
    a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
    b. NPS 4: 12 inches long and 0.06 inch thick.
    c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
    d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
    e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.
5. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.

6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.3 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.4 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

2. Obtain fusion without undercut or overlap.

3. Remove welding flux immediately.

4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.6 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Touchup: Comply with requirements in Section 09 9123 "Interior Painting" for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A780/A780M.

3.7 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-58 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel metal trapeze pipe hangers and metal framing systems and attachments for general service applications.

F. Use stainless-steel pipe hangers and or corrosion-resistant attachments for hostile environment applications.

G. Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.

H. Use padded hangers for piping that is subject to scratching.

I. Use thermal-hanger shield inserts for insulated piping and tubing.

J. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.

2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F, pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.

3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.

4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.

5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8.
7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.
11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.
12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
14. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
17. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.
18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24, from single rod if horizontal movement caused by expansion and contraction might occur.

19. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is unnecessary.

20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is unnecessary.

21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

K. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.

2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.

L. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.

2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.

3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.

4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.

5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

M. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.

2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.

3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.

4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
    a. Light (MSS Type 31): 750 lb.
    b. Medium (MSS Type 32): 1500 lb.
    c. Heavy (MSS Type 33): 3000 lb.
13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

N. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

O. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
    a. Horizontal (MSS Type 54): Mounted horizontally.
    b. Vertical (MSS Type 55): Mounted vertically.
    c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

P. Comply with MSS SP-58 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

Q. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

R. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION 230529

SECTION 230548.13

VIBRATION CONTROLS FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Elastomeric isolation pads.
2. Housed-restrained-spring isolators.
3. Elastomeric hangers.
4. Spring hangers.
5. Vibration isolation equipment bases.

1.3 DEFINITIONS

A. IBC: International Building Code.

B. ICC-ES: ICC-Evaluation Service.

C. FEMA: Federal Emergency Management Agency.

D. NRC: Noise Reduction Coefficient.

E. OSHPD: Office of Statewide Health Planning and Development for the State of California.

F. STC: Sound Transmission Coefficient.

G. VISCMA: Vibration Isolation and Seismic Control Manufacturer's Association.

1.4 PERFORMANCE REQUIREMENTS

A. Wind-Restraint Loading:

1. Basic Wind Speed: Refer to Structural Drawings.
2. Building Classification Category: Refer to Structural Drawings.
3. Minimum 10 lb/sq. ft. multiplied by the maximum area of the HVAC component projected on a vertical plane that is normal to the wind direction, and 45 degrees either side of normal.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.

2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of vibration isolation device type required.

B. Shop Drawings:

1. Detail fabrication and assembly of equipment bases. Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.

2. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.

C. Delegated-Design Submittal: For each vibration isolation device.

1. Include design calculations for selecting vibration isolators and for designing vibration isolation bases.

2. Vibration Isolation Base Details: Detail overall dimensions, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, base weights, equipment static loads, power transmission, component misalignment, and cantilever loads. Include inertia-block mass relative to support equipment weight; spring loads and free, operating, and solid heights of spring; spring diameters; nonmetallic isolator loading and deflection; disturbing frequency; natural frequency of mounts; deflection of working member; and anticipated amount of physical movement at the reference points.

1.6 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Show coordination of vibration isolation device installation for HVAC piping and equipment with other systems and equipment in the vicinity, including other supports and restraints, if any.

B. Qualification Data: For testing agency.

C. Welding certificates.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air-spring mounts and restrained-air-spring mounts to include in operation and maintenance manuals.

1.8 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Source Limitations: Obtain sound-absorbing materials from single source from single manufacturer.

C. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 ELASTOMERIC ISOLATION PADS

A. Elastomeric Isolation Pads:

1. Fabrication: Single or multiple layers of sufficient durometer stiffness for uniform loading over pad area.

2. Size: Factory or field cut to match requirements of supported equipment.

3. Pad Material: Oil and water resistant with elastomeric properties.

4. Surface Pattern: Ribbed pattern.

5. Infused nonwoven cotton or synthetic fibers.

6. Load-bearing metal plates adhered to pads.

7. Sandwich-Core Material: Resilient and elastomeric.

a. Surface Pattern: Ribbed pattern.

b. Infused nonwoven cotton or synthetic fibers.

2.2 HOUSED-RESTRAINED-SPRING ISOLATORS

A. Freestanding, Steel, Open-Spring Isolators with Vertical-Limit Stop Restraint in Two-Part Telescoping Housing:

1. Two-Part Telescoping Housing: A steel top and bottom frame separated by an elastomeric material and enclosing the spring isolators. Housings are equipped with adjustable snubbers to limit vertical movement.

a. Drilled base housing for bolting to structure with an elastomeric isolator pad attached to the underside. Bases shall limit floor load to 500 psig.

b. Threaded top housing with adjustment bolt and cap screw to fasten and level equipment.

2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.

3. Minimum Additional Travel: 50 percent of the required deflection at rated load.

4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.

5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

2.3 ELASTOMERIC HANGERS

A. Elastomeric Mount in a Steel Frame with Upper and Lower Steel Hanger Rods:

1. Frame: Steel, fabricated with a connection for an upper threaded hanger rod and an opening on the underside to allow for a maximum of 30 degrees of angular lower hanger-rod misalignment without binding or reducing isolation efficiency.

2. Dampening Element: Molded, oil-resistant rubber, neoprene, or other elastomeric material with a projecting bushing for the underside opening preventing steel to steel contact.

2.4 SPRING HANGERS

A. Combination Coil-Spring and Elastomeric-Insert Hanger with Spring and Insert in Compression:

1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.

2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.

3. Minimum Additional Travel: 50 percent of the required deflection at rated load.

4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.

5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

6. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.

7. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.

8. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.

2.5 VIBRATION ISOLATION EQUIPMENT BASES

A. Steel Rails: Factory-fabricated, welded, structural-steel rails.

1. Design Requirements: Lowest possible mounting height with not less than 1-inch clearance above the floor. Include equipment anchor bolts and auxiliary motor slide rails.
    a. Include supports for suction and discharge elbows for pumps.
2. Structural Steel: Steel shapes, plates, and bars complying with ASTM A36/A36M. Rails shall have shape to accommodate supported equipment.
3. Support Brackets: Factory-welded steel brackets on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.

B. Steel Bases: Factory-fabricated, welded, structural-steel bases and rails.

1. Design Requirements: Lowest possible mounting height with not less than 1-inch clearance above the floor. Include equipment anchor bolts and auxiliary motor slide bases or rails.
    a. Include supports for suction and discharge elbows for pumps.
    b. Height of steel members shall be sufficient to provide stiffness required to maintain equipment manufacturer's recommended alignment and duty efficiency of power-transmission components. Height of steel member shall not result in member deflection at midpoint of unsupported span of more than 1/1,440th of the span between isolators. Minimum height shall be 5 inches.
2. Structural Steel: Steel shapes, plates, and bars complying with ASTM A36/A36M. Bases shall have shape to accommodate supported equipment with closed-perimeter configuration.
3. Support Brackets: Factory-welded steel brackets on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and equipment to receive vibration isolation control devices for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

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

3.2 VIBRATION CONTROL DEVICE INSTALLATION

A. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Section 03 3000 "Cast-in-Place Concrete."

B. Installation of vibration isolators must not cause any change of position of equipment, piping, or ductwork resulting in stresses or misalignment.

C. Rails, structural steel bases, and concrete inertia blocks shall be raised not less than 1 inch above the floor and be level when equipment supported is under operating load.

3.3 APPLICATIONS

A. General: Except as otherwise indicated, select vibration control products in accordance with ASHRAE, 2019 "HVAC Applications" Handbook, Chapter 49 "Noise and Vibration Control. " Where more than one type of product is offered, selection is Professional Engineer's option.

B. Provide vibration isolation hangers for piping and ductwork with a velocity 1500 fpm or higher and for all size ducts in Pressure Classes 2-Inch wg and higher. The isolator deflection shall be equal to or greater than the static deflection of the vibration isolators provided for the connected equipment as follows:

1. High-pressure ductwork: For a distance of 50 feet from fans, exhausters and blowers.

2. Piping connected to vibration isolated equipment: For a distance of 50 feet or 50 pipe diameters, whichever is greater.

C. Seal all piping passing through the equipment walls, floors or ceilings to protect against sound leakage by means of an acoustical seal.

D. Installation of vibration isolators shall not cause any change of position of equipment, piping or duct work resulting in stresses or misalignment.

E. No rigid connections between equipment and the building structure shall be made that degrades the noise and vibration control system herein specified.

3.4 FIELD QUALITY CONTROL

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

B. Tests and Inspections:

1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.

2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.
3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
5. Test to 90 percent of rated proof load of device.
6. Measure isolator restraint clearance.
7. Measure isolator deflection.
8. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.

C. Remove and replace malfunctioning units and retest as specified above.

D. Prepare test and inspection reports.

3.5 ADJUSTING

A. Adjust isolators after piping system is at operating weight.

B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

C. Adjust active height of spring isolators.

D. Adjust restraints to permit free movement of equipment within normal mode of operation.

END OF SECTION 230548.13

SECTION 230553

IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.
4. Duct labels.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:

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

    a. Brady Corporation.
    b. Brimar Industries, Inc.
    c. Carlton Industries, LP.
    d. Champion America.
    e. Craftmark Pipe Markers.
    f. emedco.
    g. LEM Products Inc.
    h. Seton Identification Products.

2. Material and Thickness: Brass, 0.032-inch or anodized aluminum, 0.032-inch minimum thickness and having predrilled or stamped holes for attachment hardware.
3. Letter Color: Black.
4. Background Color: White.
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and

proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.

7. Fasteners: Stainless-steel self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Plastic Labels for Equipment:

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

    a. Brady Corporation.
    b. Brimar Industries, Inc.
    c. Carlton Industries, LP.
    d. Champion America.
    e. Craftmark Pipe Markers.
    f. emedco.
    g. LEM Products Inc.
    h. Seton Identification Products.

2. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick and having predrilled holes for attachment hardware.
3. Letter Color: Red.
4. Background Color: Black.
5. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
6. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
7. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
8. Fasteners: Stainless-steel self-tapping screws.
9. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.

D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and

identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

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

1. Brady Corporation.
2. Brimar Industries, Inc.
3. Carlton Industries, LP.
4. Champion America.
5. Craftmark Pipe Markers.
6. emedco.
7. LEM Products Inc.
8. Seton Identification Products.

B. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick and having predrilled holes for attachment hardware.

C. Letter Color: Red.

D. Background Color: Yellow.

E. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

F. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

G. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.

H. Fasteners: Stainless-steel self-tapping screws.

I. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

J. Label Content: Include caution and warning information plus emergency notification instructions.

2.3 PIPE LABELS

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

1. Brady Corporation.
2. Brimar Industries, Inc.
3. Carlton Industries, LP.
4. Champion America.
5. Craftmark Pipe Markers.
6. emedco.
7. LEM Products Inc.
8. Seton Identification Products.

B. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction according to ASME A13.1.

C. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; 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.
2. Lettering Size: Size letters according to ASME A13.1 for piping.

2.4 DUCT LABELS

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

1. Brady Corporation.
2. Brimar Industries, Inc.
3. Carlton Industries, LP.
4. Champion America.
5. Craftmark Pipe Markers.
6. emedco.
7. LEM Products Inc.
8. Seton Identification Products.

B. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick and having predrilled holes for attachment hardware.

C. Letter Color: Black.

D. Background Color: Blue.

E. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

F. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

G. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.

H. Fasteners: Stainless-steel self-tapping screws.

I. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

J. Duct Label Contents: Include identification of duct service using same designations or abbreviations as used on Drawings; also include duct size and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with duct system service lettering to accommodate both directions or as separate unit on each duct label to indicate flow direction.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

A. 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 on 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 25 feet along each run. Reduce intervals to 15 feet in areas of congested piping and equipment.

B. Pipe Label Color Schedule:
   1. Heating Water Piping: White letters on a safety-green background.
   2. Refrigerant Piping: Black letters on a safety-orange background.

3.4 DUCT LABEL INSTALLATION

A. Install plastic-laminated duct labels with permanent adhesive on air ducts in the following color codes:

   1. Blue: For cold-air supply ducts.
   2. Yellow: For hot-air supply ducts.
   3. Green: For exhaust-, outside-, relief-, return-, and mixed-air ducts.

B. Locate labels near points where ducts enter into and exit from concealed spaces and at maximum intervals of 25 feet in each space where ducts are exposed or concealed by removable ceiling system.

END OF SECTION 230553

SECTION 230593

TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Balancing Air Systems:

    a. Constant-volume air systems.

2. Testing, Adjusting, and Balancing Equipment:

    a. Motors.
    b. Condensing units.
    c. Heat-transfer coils.

3. Testing, adjusting, and balancing existing systems and equipment.
4. Duct leakage tests.
5. Control system verification.

1.3 DEFINITIONS

A. AABC: Associated Air Balance Council.

B. BAS: Building automation systems.

C. NEBB: National Environmental Balancing Bureau.

D. Season of maximum heating load: Time of year when outdoor ambient temperature at equipment installation site remains within following range throughout the period of data recording for TAB work.

1. Indicated winter outdoor design dry bulb temperature plus 30 to minus 30 degrees Fahrenheit.

E. Season of maximum cooling load: Time of year when outdoor ambient temperature at equipment installation site remains within following range throughout the period of data recording for TAB work.

1. Indicated summer outdoor design dry bulb temperature plus 15, minus 5 degrees Fahrenheit.

F. TAB: Testing, adjusting, and balancing.

G. TABB: Testing, Adjusting, and Balancing Bureau.

H. TAB Specialist: An independent entity meeting qualifications to perform TAB work.

I. TDH: Total dynamic head.

1.4 PREINSTALLATION MEETINGS

A. TAB Conference: If requested by the Owner, conduct a TAB conference at Project site after approval of the TAB strategies and procedures plan to develop a mutual understanding of the details. Provide a minimum of 14 days' advance notice of scheduled meeting time and location.

1. Minimum Agenda Items:

a. The Contract Documents examination report.
b. The TAB plan.
c. Needs for coordination and cooperation of trades and subcontractors.
d. Proposed procedures for documentation and communication flow.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: Within 7 days of Contractor's Notice to Proceed, submit documentation that the TAB specialist and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.

B. Contract Documents Examination Report: Within 10 days of Contractor's Notice to Proceed, submit the Contract Documents review report as specified in Part 3.

C. Strategies and Procedures Plan: Within 10 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article.

D. System Readiness Checklists: Within 21 days of Contractor's Notice to Proceed, submit system readiness checklists as specified in "Preparation" Article.

E. Examination Report: Submit a summary report of the examination review required in "Examination" Article.

F. Certified TAB reports.

1. Draft reports: Upon completion of testing, adjusting, and balancing procedures, prepare draft reports on the approved forms. Draft reports may be handwritten, but must be complete, factual, accurate, and legible. Organize and format draft reports in the same manner specified for the final reports. Submit four (4) complete sets of draft reports for review prior to final acceptance of Project. Only 1 complete set of draft reports will be returned.
2. Final Report: Upon verification and approval of draft reports, prepare final reports, type written, and organized and formatted as specified below. Submit eight (8) complete sets of final reports. Provide additional co
3. pies for inclusion in operation and maintenance manuals. Also, submit two copies in electronic format in Acrobat PDF, Microsoft Word, and Microsoft Excel.
4. Provide reports in binder manuals, complete with index page and indexing tabs, with cover identification at front and side. Include set of reduced drawings with air outlets and equipment identified to correspond with data sheets, and indicating thermostat locations.

G. Sample report forms.

H. Instrument calibration reports, to include the following:

1. Instrument type and make.
2. Serial number.
3. Application.
4. Dates of use.
5. Dates of calibration.

1.6 QUALITY ASSURANCE

A. TAB Specialists Qualifications: Certified by AABC or NEBB or TABB.

1. TAB Field Supervisor: Employee of the TAB specialist and certified by AABC or NEBB or TABB.
2. TAB Technician: Employee of the TAB specialist and certified by AABC or NEBB or TABB as a TAB technician.

3. The TAB Firm, in addition to meeting the requirements of certification by the specified balancing entities, shall possess credentials indicating a knowledge and familiarity with the ASHRAE publications listed herein. The TAB Engineer personally or the TAB team members collectively shall attend each of the ASHRAE sponsored seminars listed.
4. Certified in all categories and functions where measurements or performance are specified on the plans and specifications, including TAB of environmental systems building systems commissioning and the measuring of sound and vibration in environmental systems.
5. Maintain the certification for the entire duration of duties specified herein. If, for any reason, the firm loses subject certification during this period, the Contractor shall immediately notify the Contracting Officer and submit another TAB Firm for
6. approval. Any firm that has been the subject of disciplinary action by either the AABC, the NEBB, or the TABB within the five years preceding Contract Award shall not be eligible to perform any duties related to the HVAC systems, including TAB. All work spe
7. cified in this Section and in other related Sections to be performed by the TAB Firm shall be considered invalid if the TAB Firm loses its certification prior to Contract completion and must be performed by an approved successor.
8. These TAB services are to assist the prime Contractor in performing the quality oversight for which it is responsible. The TAB Firm shall be a subcontractor of the prime Contractor and shall be financially and corporately independent of the mechanical subcontractor, and shall report to and be paid by the prime Contractor.

B. Instrumentation Type, Quantity, Accuracy, and Calibration: Comply with requirements in ASHRAE 111, Section 4, "Instrumentation."

C. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."

D. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.7.2.3 - "System Balancing."

1.7 FIELD CONDITIONS

A. Full Owner Occupancy: Owner will occupy the site and buildings during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

PART 2 - PRODUCTS

2.1 SHEAVES AND BELTS

A. The TAB Agent shall be responsible for providing and installing new fan sheaves and belts when required to obtain the designed air flow.

2.2 AIR FILTERS

A. The TAB Agent shall be responsible for providing and installing new, clean air filters. Filters shall be installed before final inspection and before giving notice for the testing, adjusting and balancing.

2.3 BALANCING INSTRUMENTS

A. General: Instruments shall be manufactured by companies regularly engaged in the manufacture of precision instruments of the specific type for a minimum of 10 years. Use of shop-made instruments or use of instruments modified from their original configuration is prohibited. Use of instruments not in manufacture for 10 years is specifically prohibited. Submit data on instruments as specified in submittals paragraph above.

B. Air Flow Measuring Instruments: Instruments used to measure airflow shall be of the P

C. itot tube type, hot wire anemometer type, turban type, or vortex shedding type.

1. Airflow from air distribution devices shall be measured using an airflow hood with grid type Pitot tube sensing element and inclined liquid manometer for output. The manometer shall be scaled in inches of water column and a conversion chart prepared to convert the readings to air flow in cubic feet per minute at the site elevation and atmospheric conditions.
2. Airflow in ducts shall be measured using precision Pitot tubes and inclined liquid manometers for output. The output from the manometer shall be scale
3. d as specified above. Traverses in the duct shall be as prescribed by ASHRAE or SMACNA.

D. Temperature Measuring Instruments: Instruments used to measure temperature shall be one of the types described below. Use of bimetallic thermometers is prohibited. Mercury or alcohol-filled glass tube thermometers may be used when temperature changes are 0 or less than 1 degree F per hour. Thermometers shall be high quality and have a correction chart furnished with it for temperatures on either side of its true calibration point.

1. Variable resistance devices, RTD's, thermistors, etc., shall be used when temperatures may vary more than 1 degree F per hour. Readings shall be taken using an electronic balanced bridge and meter arrangement. Direct reading instruments are prohibited. Hot wire anemometers may be used in varying temperature situations provided each of the components are a factory-matched assembly.
2. When required or at the contractor's option, thermocouples may be used to measure temperature. An electronic balanced bridge s
3. hall be used for output as described above.

2.4 PRESSURE MEASURING INSTRUMENTS

A. Instruments used to measure pressure shall be the liquid manometer type, bourdon tube type, precision transducer type, strain gauge type, or dead weight, piston and cylinder type.

B. Manometers using water or alcohol shall be used to measure low pressures or differential pressures in the zero to 60 inches of water range.

C. Manometers utilizing mercury shall be used to measure pressures in the zero to 60 inches of mercury range.

D. Bourdon tube type pressure gauges, precision transducers, strain gauges, and deadweight type instruments shall be used for pressures 10 psi and above or –5 psi and below. Compound gauges shall not be used to measure pressures below atmospheric.

E. Atmospheric pressure shall be measured by using a mercury barometer.

2.5 HUMIDITY MEASURING INSTRUMENTS

A. Instruments used to measure humidity shall be of the precision electronic type or the use of a sling psychrometer may be used.

2.6 ROTARY SPEED MEASURING INSTRUMENTS

A. Rotary speeds, generally in RPM, shall be measured using a precision, magnetic direct reading tachometer, strobic effect type electronic tachometer or a revolution counter with stopwatch.

B. When rotary speed is expected to vary as in variable speed equipment, strobic effect devices or electronic tachometers shall be used.

2.7 ELECTRICAL MEASURING INSTRUMENTS

A. Electrical measurements shall be taken with precision, solid state, electronic devices. Voltage, amperage, wattage and power factor readings shall utilize digital output type reading and recording instruments.

PART 3 - EXECUTION

3.1 TAB SPECIALISTS

A. Subject to compliance with requirements, engage one of the following:

1. Baltimore Air Balance.

2. Complete Commissioning, Inc.

3. Mechanical Testing, Inc.

4. Eastern Air Balance, Inc.

3.2 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems designs that may preclude proper TAB of systems and equipment.

B. Examine installed systems for balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, and manual volume dampers. Verify that locations of these balancing devices are applicable for intended purpose and are accessible.

C. Examine the approved submittals for HVAC systems and equipment and identify discrepancies.

D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems output, and statements of philosophies and assumptions about HVAC system and equipment controls.

E. Examine ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that they are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.

F. Examine equipment performance data including fan and pump curves.

1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems
3. - Duct Design." Compare results with the design data and installed conditions.

G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

H. Examine test reports specified in individual system and equipment Sections.

I. Examine HVAC equipment and verify that bearings are greased, belts are aligned and tight, filters are clean, and equipment with functioning controls is ready for operation.

J. Examine strainers. Verify that startup screens have been replaced by permanent screens with indicated perforations.

K. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

L. Examine operating safety interlocks and controls on HVAC equipment.

M. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.3 PREPARATION

A. Prepare a TAB plan that includes the following:

1. Equipment and systems to be tested.
2. Strategies and step-by-step procedures for balancing the systems.
3. Instrumentation to be used.
4. Sample forms with specific identification for all equipment.

B. Perform system-readiness checks of HVAC systems and equipment to verify system readiness for TAB work. Include, at a minimum, the following:

1. Airside:

a. Verify that leakage and pressure tests on air distribution systems have been satisfactorily completed.
b. Duct systems are complete with terminals installed.
c. Volume, smoke, and fire dampers are open and functional.
d. Clean filters are installed.
e. Fans are operating, free of vibration, and rotating in correct direction.
f. Variable-frequency controllers' startup is complete and safeties are verified.
g. Automatic temperature-control systems are operational.
h. Ceilings are installed.
i. Windows and doors are installed.
j. Suitable access to balancing devices and equipment is provided.

3.4 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance",or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems", ASHRAE 111 and in this Section.

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.

1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
2. After testing and balancing, install test ports and duct access doors that comply with requirements in Section 233300 "Air Duct Accessories."
3. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section 230713 "Duct Insulation," and Section 230719 "HVAC Piping Insulation."

C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.5 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Cross-check the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' "as-built" duct layouts.

C. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

D. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.

E. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

F. Verify that motor starters are equipped with properly sized thermal protection.

G. Check dampers for proper position to achieve desired airflow path. Dampers further from the air distribution device shall be set first. Dampers within the device shall be used for final airflow settings to minimize noise generation.

H. Check for airflow blockages.

I. Check condensate drains for proper connections and functioning.

J. Check for proper sealing of air-handling-unit components.

K. Verify that air duct system is sealed as specified in Section 233113 "Metal Ducts."

3.6 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.

1. Measure total airflow.

a. Set outside-air, return-air, and relief-air dampers for proper position that simulates minimum outdoor-air conditions.
b. Where duct conditions allow, measure airflow by Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses to obtain total airflow.
c. Where duct conditions are not suitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.
d. If a reliable Pitot-tube traverse or coil traverse is not possible, measure airflow at terminals and calculate the total airflow.

2. Measure fan static pressures as follows:

a. Measure static pressure directly at the fan outlet or through the flexible connection.
b. Measure static pressure directly at the fan inlet or through the flexible connection.
c. Measure static pressure across each component that makes up the air-handling system.
d. Report artificial loading of filters at the time static pressures are measured.

3. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
4. Obtain approval from Construction Manager and Commissioning Authority for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in HVAC Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
5. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload occurs. Measure amperage in full-cooling, full-heating, economizer, and any
6. other operating mode to determine the maximum required brake horsepower.

B. Test and adjust outside air on applicable equipment using a pitot-tube traverse. If a traverse is not practical use the mixed-air temperature method if the inside and outside temperature difference is at least 20 degrees F or use the difference between Pitot-tube traverses of the supply and return air ducts.

C. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows.

1. Measure airflow of submain and branch ducts.
2. Adjust submain and branch duct volume dampers for specified airflow.
3. Re-measure each submain and branch duct after all have been adjusted.

D. Adjust air inlets and outlets for each space to indicated airflows.

1. Set airflow patterns of adjustable outlets for proper distribution without drafts.
2. Measure inlets and outlets airflow.
3. Adjust each inlet and outlet for specified airflow.
4. Re-measure each inlet and outlet after they have been adjusted.

E. Verify final system conditions.

1. Re-measure and confirm that minimum outdoor, return, and relief airflows are within design. Readjust to design if necessary.
2. Re-measure and confirm that total airflow is within design.
3. Re-measure all final fan operating data, rpms, volts, amps, and static profile.
4. Mark all final settings.
5. Test system in economizer mode. Verify proper operation and adjust if necessary.
6. Measure and record all operating data.
7. Record final fan-performance data.

3.7 PROCEDURES FOR MOTORS

A. Motors 1/2 HP and Larger: Test at final balanced conditions and record the following data:

1. Manufacturer's name, model number, and serial number.
2. Motor horsepower rating.
3. Motor rpm.
4. Phase and hertz.
5. Nameplate and measured voltage, each phase.
6. Nameplate and measured amperage, each phase.
7. Starter size and thermal-protection-element rating.
8. Service factor and frame size.

B. Motors Driven by Variable-Frequency Controllers: Test manual bypass of controller to prove proper operation.

3.8 PROCEDURES FOR CONDENSING UNITS

A. Verify proper rotation of fans.

B. Measure entering- and leaving-air temperatures.

C. Record fan and motor operating data.

3.9 PROCEDURES FOR HEAT-TRANSFER COILS

A. Measure, adjust, and record the following data for each electric heating coil:

1. Nameplate data.
2. Airflow.
3. Entering- and leaving-air temperature at full load.
4. Voltage and amperage input of each phase at full load.
5. Calculated kilowatt at full load.

6. Fuse or circuit-breaker rating for overload protection.

B. Measure, adjust, and record the following data for each steam coil:

1. Dry-bulb temperature of entering and leaving air.
2. Airflow.
3. Inlet steam pressure.

C. Measure, adjust, and record the following data for each refrigerant coil:

1. Dry-bulb temperature of entering and leaving air.
2. Wet-bulb temperature of entering and leaving air.
3. Airflow.

3.10 DUCT LEAKAGE TESTS

A. Witness the duct pressure testing performed by Installer.

B. Verify that proper test methods are used and that leakage rates are within specified tolerances.

C. Report deficiencies observed.

3.11 CONTROLS VERIFICATION

A. In conjunction with system balancing, perform the following:

1. Verify temperature control system is operating within the design limitations.
2. Confirm that the sequences of operation are in compliance with Contract Documents.
3. Verify the operation of lockout or interlock systems.
4. Verify the operation of damper actuators.
5. Verify that controlled devices are properly installed and connected to correct controller.
6. Verify that controlled devices travel freely and are in position indicated by controller: open, closed, or modulating.
7. Verify location and installation of sensors to ensure that they sense only intended temperature, humidity, or pressure.

B. Reporting: Include a summary of verifications performed, remaining deficiencies, and variations from indicated conditions.

3.12 TOLERANCES

A. Set HVAC system's airflow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans and Equipment with Fans: 0 or Plus 5 percent.
2. Air Outlets and Inlets: 0 or Plus 10 percent.

B. Maintaining pressure relationships as designed shall have priority over the tolerances specified above.

C. Equipment capacities shall be adjusted in accordance with the following:

1. Fan capacities shall be adjusted by changing fan speeds provided the adjustment does not result in increasing the energy consumption beyond 10 percent. Obtain approval from the Design A/E prior to making permanent changes. Verify that changing speeds will not result in unstable or noisy operation of the system.

3.13 PROGRESS REPORTING

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems balancing devices. Recommend changes and additions to systems balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

B. Status Reports: Prepare weekly progress reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

C. Prepare report of recommendations for correcting unsatisfactory performance when system cannot be successfully balanced. Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.

3.14 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.

1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
2. Include a list of instruments used for procedures, along with proof of calibration.
3. Certify validity and accuracy of field data.

B. Final Report Contents: In addition to certified field-report data, include the following:

1. Pump curves.
2. Fan curves.
3. Manufacturers' test data.
4. Field test reports prepared by system and equipment installers.
5. Other information relative to equipment performance; do not include Shop Drawings and Product Data.

C. General Report Data: In addition to form titles and entries, include the following data:

1. Title page.
2. Name and address of the TAB specialist.
3. Project name.
4. Project location.
5. Architect's name and address.
6. Engineer's name and address.
7. Contractor's name and address.
8. Report date.
9. Signature of TAB supervisor who certifies the report.
10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
11. Summary of contents including the following:

    a. Indicated versus final performance.
    b. Notable characteristics of systems.
    c. Description of system operation sequence if it varies from the Contract Documents.

12. Nomenclature sheets for each item of equipment.
13. Data for terminal units, including manufacturer's name, type, size, and fittings.
14. Notes to explain why certain final data in the body of reports vary from indicated values.
15. Test conditions for fans and pump performance forms including the following:

    a. Settings for outdoor-, return-, and exhaust-air dampers.
    b. Conditions of filters.
    c. Cooling coil, wet- and dry-bulb conditions.
    d. Face and bypass damper settings at coils.
    e. Fan drive settings including settings and percentage of maximum pitch diameter.
    f. Settings for supply-air, static-pressure controller.

g. Other system operating conditions that affect performance.

D. System Diagrams: Include schematic layouts of air distribution systems. Present each system with single-line diagram and include the following:

1. Quantities of outdoor, supply, return, and exhaust airflows.
2. Duct, outlet, and inlet sizes.
3. Pipe and valve sizes and locations.
4. Terminal units.
5. Balancing stations.
6. Position of balancing devices.

E. System Control Performance Report: Include the operation of each of the control devices including dampers, motors, flow metering devices and actuators during the occupied period. The report shall be in two parts, interim and final report. The report shall identify ASHRAE Standards 90.1 and 62 compliance and deviations shall be documented. Report shall include performance of:
1. Control dampers.
2. Sensors.

F. Fan Test Reports: For supply, return, and exhaust fans, include the following:

1. Fan Data:

a. System identification.
b. Location.
c. Make and type.
d. Model number and size.
e. Manufacturer's serial number.
f. Arrangement and class.
g. Sheave make, size in inches, and bore.
h. Center-to-center dimensions of sheave and amount of adjustments in inches.

2. Motor Data:

a. Motor make, and frame type and size.
b. Horsepower and rpm.
c. Volts, phase, and hertz.
d. Full-load amperage and service factor.
e. Sheave make, size in inches, and bore.
f. Center-to-center dimensions of sheave, and amount of adjustments in inches.
g. Number, make, and size of belts.

3. Test Data (Indicated and Actual Values):

    a. Total airflow rate in cfm.
    b. Total system static pressure in inches wg.
    c. Fan rpm.
    d. Discharge static pressure in inches wg.
    e. Suction static pressure in inches wg.

G. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:

1. Report Data:

    a. System and air-handling-unit number.
    b. Location and zone.
    c. Traverse air temperature in deg F.
    d. Duct static pressure in inches wg.
    e. Duct size in inches.
    f. Duct area in sq. ft..
    g. Indicated airflow rate in cfm.
    h. Indicated velocity in fpm.
    i. Actual airflow rate in cfm.
    j. Actual average velocity in fpm.
    k. Barometric pressure in psig.

H. Air-Terminal-Device Reports:

1. Unit Data:

    a. System and air-handling unit identification.
    b. Location and zone.
    c. Apparatus used for test.
    d. Area served.
    e. Make.
    f. Number from system diagram.
    g. Type and model number.
    h. Size.
    i. Effective area in sq. ft..

2. Test Data (Indicated and Actual Values):

    a. Airflow rate in cfm.
    b. Air velocity in fpm.
    c. Preliminary airflow rate as needed in cfm.
    d. Preliminary velocity as needed in fpm.
    e. Final airflow rate in cfm.

f. Final velocity in fpm.
g. Space temperature in deg F.

I. Instrument Calibration Reports:

1. Report Data:

a. Instrument type and make.
b. Serial number.
c. Application.
d. Dates of use.
e. Dates of calibration.

3.15 VERIFICATION OF TAB REPORT

A. The TAB specialist's test and balance engineer shall conduct the inspection in the presence of Construction Manager or Commissioning Authority.

B. Construction Manager or Commissioning Authority shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.

C. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."

D. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.

E. If TAB work fails, proceed as follows:

1. TAB specialists shall recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
2. If the second final inspection also fails, Owner may contract the services of another TAB specialist to complete TAB work according to the Contract Documents and deduct the cost of the services from the original TAB specialist's final payment.
3. If the second verification also fails, Owner or design professional may contact AABC Headquarters regarding the AABC National Performance Guaranty.

F. Prepare test and inspection reports.

3.16 ADDITIONAL TESTS

A. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION 230593

SECTION 230993.11

SEQUENCE OF OPERATIONS FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes control sequences for HVAC systems, subsystems, and equipment.

1.3 DEFINITIONS

A. Analog Output: Proportional output signal (zero- to 10-V dc, 4 to 20 mA).

B. Binary Output: On/off output signal or contact closure.

C. Digital Output: Data output that must be interpreted digitally.

1.4 ACTION SUBMITTALS

A. Product Data:

1. An instrumentation list for each controlled system. Label each element of the controlled system in table format. Show, in the table element name, type of device, manufacturer, model number, and control device product data sheet number.

2. A complete description of the operation of the control system, including sequences of operation. Include and reference a schematic diagram of the controlled system.

B. Shop Drawings:

1. Riser diagrams showing control network layout, communication protocol, and wire types.

2. Schematic diagram of each controlled system. Include all control points labeled with point names shown or listed. Show the location of control elements in the system.

3. Wiring diagram for each controlled system. Show all control elements labels. Where a control element is the same as that shown on the control system schematic, label with the same name. Label all terminals.

1.5 PACKAGE TERMINAL AIR CONDITIONERS (PTAC)

A. Provide PTAC manufacturers hardware to perform this Sequence of Operation, and to provide auxiliary control inputs at manufacturer interface as specified. Install and wire system control components furnished by the system manufacturer. Comply with additional requirements in Section 23 8113 “Package terminal Air Conditioners”.

B. Package Air Conditioner Sequence of Operation (PTAC)

1. The Package Air Conditioning unit shall operate when manually enabled at local panel or automatically whenever the unit(s) are off and the auxiliary freeze sentinel / heat sentinel mode enabled. The PTAC unit shall operate in constant volume auto (heat/cool) mode. When in manually enabled cool or heat mode, the unit shall maintain the supply air temperature setpoint, adjustable (temperature setpoint range is between 50 deg F and 85 deg F).

2. Electric heating coil shall be interlocked with the PTAC unit and operated as per the unit central controller.

3. The user shall be able to manually start/stop the PTAC by selecting on/off at the PTAC Centralized Controller, unit mounted control panel.

C. The PTAC CC panel interface shall utilized to set the occupied, cooling and heating modes temperature set-points based on the CC panel input.

D. Heat/Cool Changeover Modes: The manufacturer Central Controller auxiliary Freeze Sentinel / Heat Sentinel settings shall determine and set the Heating/Cooling MODE of the indoor unit and the resultant control action, based on auxiliary mode setpoints and the zone heating/cooling demand. The heat pump type outdoor unit shall change between heating and cooling mode on the PTAC CC unit change of the mode.

E. Display:

1. CC Panel.

2. CC system on-off indication.

3. CC system cooling / heating mode.

1.6 VENTILATION SEQUENCES

A. Exhaust fan serving Toilets, Janitor Closets, Showers, and Locker Rooms [EF-1, EF-2]

1. When the ON-AUTO-OFF switch is manually indexed to ON position, and the fan shall be automatically started.

2. When the ON-AUTO-OFF switch is manually indexed to OFF position, the fan shall remain de-energize.

B. Heat Rejection Exhaust Fans [EF-3]

1. When ON-AUTO-OFF switch at the starter is manually indexed to normal AUTO position, OCC/UNOCC time schedule on programmable thermostat shall energize the fan intermittently (Adj., every 2 hour) for 30 minutes (Adj.) during occupied cycle after the make-up air damper is fully opened. On a rise in space temperatures during unoccupied cycle, the reverse acting thermostats shall energize the fan and de-energize the fan on a drop in space temperature.

2. When the ON-AUTO-OFF switch is manually indexed to ON position, the make-up air damper shall open and the fan shall be automatically started when the motor operated damper is proven fully open. The fan shall be automatically stopped and the motor operated damper shall be fully closed when the switch is manually indexed to OFF position.

3. Provide a motor operated control damper with end switch and related control and interface wiring for each fan. Each fan shall have a user definable (adj.) minimum runtime.

4. Provide 7-day programmable smart thermostat.

1.7 TERMINAL UNIT OPERATING SEQUENCE

A. Unit Heater, Electric: Room thermostat cycles fan and sequences stages of heating.

1. Space Temperature:

    a. Input:

        1) Device: Electric multistage thermostat.
        2) Location: Space.

    b. Output:

        1) Device: Hard wired.
        2) Location: Unit control panel.
        3) Transference: Electric multistage contactors.

    c. Action: Sequence electric coil stages to maintain 55 deg F space temperature.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 230993.11

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SECTION 233113

METAL DUCTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Single-wall rectangular ducts and fittings.
2. Single-wall round and flat-oval ducts and fittings.
3. Sheet metal materials.
4. Sealant and gaskets.
5. Hangers and supports.

B. Related Sections:

1. Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
2. Section 233300 "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.3 DEFINITIONS

A. Sealing Requirements Definitions: For the purposes of duct systems sealing requirements specified in this Section, the following definitions apply:

1. Seams: A seam is defined as joining of two longitudinally (in the direction of airflow) oriented edges of duct surface material occurring between two joints. All other duct surface connections made on the perimeter are deemed to be joints.
2. Joints: Joints include girth joints; branch and sub branch intersections, so-called duct collar tap-ins; fitting subsections; louver and air terminal

connections to ducts; access door and access panel frames and jambs; duct, plenum, and casing abutments to building struct

3. ures.

B. Thermal Conductivity and Apparent Thermal Conductivity (k-Value): As defined in ASTM C168. In this section, these values are the result of the formula Btu x in./h x sq. ft. x deg F (W/m x K) at the temperature difference specified. Values are expressed as Btu or W.

1. Example: Apparent Thermal Conductivity (k-Value): 0.26 or 0.037.

C. Density: Expressed in lbs/sq.ft (PCF).

D. Transverse Joints: Connections of two duct or fitting elements oriented perpendicular to air flow and include, but are not limited to, spin-ins, taps, and other branch connections, access doors frames, and duct connection to equipment.

1.4 SYSTEM DESCRIPTION

A. Duct system design, as indicated, has been used to select size and type of air-moving and -distribution equipment and other air system components. Changes to layout or configuration of duct system must be specifically approved in writing by Architect. Accompany requests for layout modifications with calculations showing that proposed layout will provide original design results without increasing s

B. ystem total pressure.

C. Right is reserved by Architect for the final locations and equivalent size of the ductwork until final fabrication and installation.

1.5 PERFORMANCE REQUIREMENTS

A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article whichever is most stringent.

B. Structural Performance: Duct hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"

C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

1.6 ACTION SUBMITTALS

A. Product Data: For each type of the following products:

1. Liners and adhesives. For adhesives and sealants, including printed statement of VOC content.
2. Sealants and gaskets. For adhesives and sealants, including printed statement of VOC content.
3. Sheet metal materials, including printed statement of thicknesses in inches.
4. Hangers and supports.
5. Fire stopping materials.
6. Prefabricated metal ductwork.

B. Shop Drawings: CAD-generated and drawn to 1/4-inch equals 1-foot scale.

1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
2. Factory- and shop-fabricated ducts and fittings.
3. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.
4. Elevation of top of ducts.
5. Dimensions of main duct runs from building grid lines.
6. Fittings.
7. Reinforcement and spacing.
8. Seam and joint construction.
9. Penetrations through fire-rated and other partitions.
10. Equipment installation based on equipment being used on Project.
11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
12. Hangers and supports, including methods for duct and building attachment and vibration isolation.

C. Delegated-Design Submittal:

1. Sheet metal thicknesses.
2. Joint and seam construction and sealing.
3. Reinforcement details and spacing.
4. Materials, fabrication, assembly, and spacing of hangers and supports.
5. Design Calculations: Calculations, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation for selecting hangers and supports.

1.7 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans, elevations, sections, drawn to minimum 1/4-inch equals 1-foot (1:50) scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.
2. Suspended ceiling components.
3. Structural members to which duct will be attached.
4. Other systems installed in same space as ducts.
5. Ceiling- and wall-mounting access doors and panels required to provide access to dampers and other operating devices.
6. Size and location of initial access modules for acoustical tile.
7. Penetrations of smoke barriers and fire-rated construction.
8. Detailed view of duct shape, reinforcement, and hanger support for exposed ducts.
9. Entire project work area of the facility including existing ductwork to remain.
10. Items penetrating finished ceiling including the following:

    a. Lighting fixtures.
    b. Air outlets and inlets.
    c. Speakers.
    d. Sprinklers.
    e. Access panels.
    f. Perimeter moldings.

B. Welding certificates.

C. Field quality-control reports.

1. Indicate leakage tests performed. Include date; section tested, test pressure, and leakage rate, following SMACNA HVAC Air Duct Leakage Test Manual.
2. Documentation of work performed for compliance with ASHRAE/IESNA 90.1-2010, Section 6.4.4.2.2 - "Duct Leakage Tests" and 2012 International Energy Conservation Code.

D. Record Drawings: Indicate actual routing, elevations, fittings details, reinforcement, support, and installed accessories and devices. Comply with the requirements of Division 1 Sections.

1.8 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum," for aluminum supports.
3. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.

B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment," and Section 7 - "Construction and System Start-up."

C. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

D. NFPA Compliance:

1. NFPA 90A, "Installation of Air Conditioning and Ventilating Systems."
2. NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

E. Sheet Metal & Air Conditioning Contractors' National Association, Inc. (SMACNA) Compliance:

1. SMACNA HVACADLTM "HVAC Air Duct Leakage Test Manual."
2. SMACNA HVAC DCS, "HVAC Duct Construction Standard - Metal and Flexible, Third Edition, 2005."

F. Mockups:

1. Before installing duct systems, build mockups representing static-pressure classes in excess of 3-inch wg. Build mockups to comply with the following requirements, using materials indicated for the completed Work:

a. Five transverse joints.
b. One access door(s).
c. Two typical branch connections, each with at least one elbow.
d. Two typical flexible-connector connections for each duct and apparatus.
e. One 90-degree turn(s) with turning vanes.

f. One fire damper(s).
g. One discharge plenum at air handling unit.
h. Three joints and supports on exterior exposed ducts.
i. Three typical security supply grille assembly at inmate cells.
j. Three typical return air perforated door sweep assembly at existing cell doors.
k. Perform leakage tests specified in "Field Quality Control" Article. Revise mockup construction and perform additional tests as required to achieve specified minimum acceptable results.

2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

G. Fabricator and Installer’s Qualifications: Company specializing in performing the work of this section with minimum ten years documented experience.

H. Single Source Responsibility: Provide all prefabricated round, flat oval, rectangular duct, and fittings manufactured by the same manufacturer. Prefabricated ductwork shall refer to ductwork constructed and assembled by one of the listed manufacturers below who specialize in this trade. Contractor or shop-fabricated ductwork as specified by this section is not acceptable.

PART 2 - PRODUCTS

2.1 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

B. Transverse Joints: Unless otherwise indicated, select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible." Prefabricated slide-on joints and components constructed using manufacturer's guidelines for material thickness, reinforcement size and spacing, and joint re

C. inforcement.

1. Transverse Duct Connection System: SMACNA "F", "J" or “K” rated rigidly class connection, interlocking angle and duct edge connection system with sealant, gasket, metal cleats, and corner clips.

2. Use transverse joints with T24 or T 25a/T 25b reinforcement or gasketed slip on flange In accordance with SMACNA HVAC DCS, Figure 2-1 and applicable Tables

D. Longitudinal Seams: Unless otherwise indicated, select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible." Use Pittsburgh Lock on all longitudinal seams and seal with mastic sealant. Type L-2 (Snap Lock), Type L-4(Standing Seam), Type L-5 (Single Corner Seam) are not acceptable.

E. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

F. Cross Breaking or Cross Beading: Cross break or cross bead duct sides 19 inches and larger and 0.0359-inch-thick or less, with more than 10 sq. ft. of nonbraced panel area unless ducts are lined or duct pressure class is over 3-inch wg Beading and cross breaking is not substitutes for reinforcement.

2.2 SINGLE-WALL ROUND AND FLAT-OVAL DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

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

   a. Ductmate Industries, Inc.
   b. Hamlin Sheet Metal, Inc.
   c. Lindab Inc.
   d. McGill AirFlow LLC.
   e. SEMCO LLC.
   f. Sheet Metal Connectors, Inc.
   g. Spiral Manufacturing Co., Inc.

B. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter of the round sides connecting the flat portions of the duct (minor dimension).

C. Diameter as applied to flat-oval ducts in this Article is the diameter of a round duct with a circumference equal to the perimeter of a given size of flat-oval duct.

D. Transverse Joints: Unless otherwise indicated, select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.

E. Round Longitudinal Seams and Spiral Lock Seams: Unless otherwise indicated, select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Use Seams Types RL-1, RL-4 or RL-5. Seams types RL-2 or RL-3 may be used if spot-welded on 1-inch intervals or tack welded on 3-inch intervals.
2. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.
3. Fabricate flat-oval ducts larger than 72 inches in width (major dimension) with butt-welded longitudinal seams.
4. Use only spiral lock seams (without intermediate ribs) for exposed ducts.

F. Flat-Oval, Longitudinal- and Spiral Lock-Seam Ducts: Unless otherwise indicated, select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-7, "Flat Oval Ducts," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Fabricate flat-oval ducts larger than 72 inches in width (major dimension) with butt-welded longitudinal seams.
2. Use only spiral lockseams (without intermediate ribs) for exposed ducts.

G. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class,

applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

H. Lined Ducts: Fabricate lined insulated ducts with an outer shell, liner insulation, as specified below. Dimensions indicated on internally lined ducts are nominal inside dimensions.

1. Liner Insulation:

a. Duct liner complying with the requirements of Article “Duct Liner.”
b. Apply duct liner as specified in Article “Application of Liner in Rectangular, Round and Flat-Oval Ducts.” Terminate insulation where internally insulated duct connects to single-wall duct or uninsulated components. Terminate insulation and reduce outer duct diameter to inner liner diameter.
c. Maintain concentricity of liner to outer shell by mechanical means. Retain insulation from dislocation by mechanical means.

2.3 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

1. All metal thicknesses shall be in even gauges using nominal to maximum thickness range in inches indicated in SMACNA HVAC DCS Appendix A.1.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G90.
2. Finishes for Surfaces Exposed to View: Mill phosphatized.

C. Aluminum Sheets: Comply with ASTM B209 (ASTM B209M) Alloy 3003, H14 temper; with mill finish for concealed ducts, and standard, one-side bright finish for duct surfaces exposed to view.

D. Factory- or Shop-Applied Antimicrobial Coating:

1. Apply to the surface of sheet metal that will form the interior surface of the duct. An untreated clear coating shall be applied to the exterior surface.

2. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
3. Coating containing the antimicrobial compound shall have a hardness of 2H, minimum, when tested according to ASTM D 3363.
4. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
5. Shop-Applied Coating Color: Black.
6. Antimicrobial coating on sheet metal is not required for duct containing liner treated with antimicrobial coating.

E. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.

F. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.4 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL and UL 181. Shall not promote or support microbial growth as tested in accordance with ASTM G21 and G22 for mold, fungus and bacteria growth.

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

a. Ductmate Industries, Inc.
b. Carlisle Hardcast.
c. Foster Products.
d. Lindab Inc.
e. Lockformer.
f. McGill AirFlow LLC.
g. Ward Industries, Inc.

B. Two-Part Tape Sealing System:

1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
2. Tape Width: 6 inches.
3. Sealant: Modified styrene acrylic.
4. Water resistant.
5. Mold and mildew resistant.
6. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
7. Service: Indoor and outdoor.
8. Service Temperature: Minus 40 to plus 200 deg F.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.
10. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
11. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Water-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Solids Content: Minimum 65 percent.
3. Shore A Hardness: Minimum 20.
4. Water resistant.
5. Mold and mildew resistant.
6. VOC: Maximum 75 g/L (less water).
7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
8. Service: Indoor or outdoor.
9. Service Temperature: Minus 25 to plus 175 deg F.
10. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

D. Flanged Joint Sealant: Comply with ASTM C 920.

1. General: Single-component, acid-curing, silicone, elastomeric.
2. Type: S.
3. Grade: NS.
4. Class: 25.
5. Use: O.
6. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the

Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

E. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer. Gasket complying with MIL-C 18969B, Type II Class B, TT-C-1796 A, Type II Class B, and TTS-S-001657. Ductmate 440 or approved equal.

F. Round Duct Joint O-Ring Seals:

1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for10-inch wg static-pressure class, positive or negative.
2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.5 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."

D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.

E. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

F. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

G. Trapeze and Riser Supports:

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.

3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.

B. Fabricate and install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

C. Install round and flat-oval ducts in maximum practical lengths.

D. Install ducts with fewest possible joints.

E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

F. Install couplings tight to duct wall surface with a minimum of projections into duct. Secure couplings with sheet metal screws. Install screws at intervals of 12 inches, with a minimum of 3 screws in each coupling.

G. Provide factory installed flanges. Shipments of loose flanges for field installation into spiral pipe will not be allowed.

H. All flat oval ducts shall be reinforced with trapeze type reinforcement, as recommended by the manufacturer, to limit wall deflection to 3/4" and reinforcement deflection to 1/4".

I. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines. Install duct systems in shortest route that does not obstruct usable space or block access for servicing building and its equipment.

J. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

K. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

L. Conceal ducts from view in finished spaces. Do not encase horizontal runs in solid partitions unless specifically indicated.

M. Coordinate layout with suspended ceiling, fire- and smoke-control dampers, lighting layouts, and similar finished work.

N. Seal all joints and seams. Apply sealant to male end connectors before insertion, and afterward to cover entire joint and sheet metal screws

O. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

P. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

Q. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Section 233300 "Air Duct Accessories" for fire and smoke dampers.

R. Provide electrical isolation between dissimilar metals. Electrical isolation can be fluorinated elastomers or sponge-rubber gaskets.

S. Moisture Traps:

1. Construct watertight and airtight. Use single component type silicone sealants conforming to Federal Standard TT-S-001543.
2. Provide drains at base of moisture trap. Provide drain connections of one-inch (25 mm) pipe size corrosion resistant steel couplings welded to duct and provided with plug where drainage piping is not indicated. Provide drain lines with a trap of one inch (25 mm) greater depth than the positive or negative pressure in the duct but not less than 2 inches (50 mm).

T. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."

3.2 INSTALLATION OF EXPOSED DUCTWORK

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.

B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.

D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

E. Repair or replace damaged sections and finished work that does not comply with these requirements.

F. Aesthetic Requirements for Exposed Ducts:

1. Paintable galvanized steel for Painting in compliance with Division 9.
2. Aligned spiral seams for the appearance of a continuous length of duct.
3. Reduce number of duct joints.
4. Duct connectors, hangers, and reinforcements as approved by Architect and Engineer that minimize their use or make them as inconspicuous as possible.

3.3 DUCT SEALING

A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

B. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":

1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
2. Outdoor, Supply-Air Ducts: Seal Class A.
3. Outdoor, Exhaust Ducts: Seal Class B.
4. Outdoor, Return-Air Ducts: Seal Class B.
5. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class B.
6. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class A.
7. Unconditioned Space, Exhaust Ducts: Seal Class B.
8. Unconditioned Space, Return-Air Ducts: Seal Class B.
9. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class B.

10. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class A.
11. Conditioned Space, Exhaust Ducts: Seal Class B.
12. Conditioned Space, Return-Air Ducts: Seal Class B.

C. Seal ducts before external insulation is applied.

D. Circumferential and longitudinal seams of all fittings shall be continuous welded or continuous stitch welded on exposed installations and pressure applications equal to and greater than 5-inch wg both sides of all welds shall be painted to prevent corrosion.

E. All field joints, up to and including 60-inch diameter round, shall be made with a 2-inch slip-fit or sleeve coupling. Field joints with diameter 62-inch round and larger shall be joined with 2 x 2 x 3/16 Van Stone flanges for fittings and solid-welded

F. flanges for spiral duct.

G. Pressure sensitive tapes shall not be used.

3.4 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Where practical, install concrete inserts before placing concrete.
2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
5. Do not use powder-actuated concrete fasteners for seismic restraints.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.

D. Hangers Exposed to View: Threaded rod and angle or channel supports.

E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.

F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.5 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Section 233300 "Air Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.6 PAINTING

A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner, for 24-inches upstream of grilles, registers, and diffusers. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Section 099123 "Interior Painting."

3.7 FIELD QUALITY CONTROL

A. Perform tests and inspections, in presence of Construction Manager, TAB Agent, and Owner’s Representative.

B. Leakage Tests:

1. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual." Submit a test report for each test.
2. Test the following systems:

    a. Ducts with a Pressure Class Higher Than 3-Inch wg: Test representative duct sections, selected by Architect from sections installed, totaling no less than 25 percent of total installed duct area for each designated pressure class.
    b. Supply Ducts with a Pressure Class of3-Inch wg or Higher: Test representative duct sections, selected by Architect from sections installed, totaling no less than 50 percent of total installed duct area for each designated pressure class.

c. Return Ducts with a Pressure Class of 2-Inch wg or Higher: Test representative duct sections, selected by Architect from sections installed, totaling no less than 50 percent of total installed duct area for each designated pressure class.
d. Exhaust Ducts with a Pressure Class of 2-Inch wg or Higher: Test representative duct sections, selected by Architect from sections installed, totaling no less than 50 percent of total installed duct area for each designated pressure class.
e. Outdoor Air Ducts with a Pressure Class of 2-Inch wg or Higher: Test representative duct sections, selected by Architect from sections installed, totaling no less than 50 percent of total installed duct area for each designated pressure class.

3. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
4. Test for leaks before applying external insulation.
5. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.
6. Test duct construction for leakage prior to installation. Each test section must have a minimum of 20 foot straight run, two elbows and a connection to the terminal or grilles and diffusers.
7. Give seven days' advance notice for testing.

C. Duct System Cleanliness Tests:

1. Visually inspect duct system to ensure that no visible contaminants are present.
2. Test sections of metal duct system, chosen randomly by Owner, for cleanliness according to "Vacuum Test" in NADCA ACR, "Assessment, Cleaning and Restoration of HVAC Systems."

a. Acceptable Cleanliness Level: Net weight of debris collected on the filter media shall not exceed 0.75 mg/100 sq. cm.

D. Duct system will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports. Prepare a written report on findings and recommended corrective actions. After complete installation and test, the Test Engineer shall provide a signed letter of compliance with all recommendations for deficiency corrections and instructions.

3.8 DUCT CLEANING

A. Clean new and existing duct system(s) before testing, adjusting, and balancing.

B. Use service openings for entry and inspection.

1. Create new openings and install access panels appropriate for duct static-pressure class if required for cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer. Comply with Section 233300 "Air Duct Accessories" for access panels and doors.
2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.
3. Remove and reinstall ceiling to gain access during the cleaning process.

C. Particulate Collection and Odor Control:

1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.
2. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.

D. Clean the following components by removing surface contaminants and deposits:

1. Air outlets and inlets (registers, grilles, and diffusers).
2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
4. Coils and related components.
5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
6. Supply-air ducts, dampers, actuators, and turning vanes.
7. Dedicated exhaust and ventilation components and makeup air systems.

E. Mechanical Cleaning Methodology:

1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.
5. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
6. Provide drainage and cleanup for wash-down procedures.
7. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents according to manufacturer's written instructions after removal of surface deposits and debris.

3.9 START UP

A. Air Balance: Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC."

3.10 DUCT SCHEDULE

A. Fabricate ducts with aluminum sheet steel except as otherwise indicated.

B. Exhaust Ducts:

1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:

    a. Pressure Class: Negative 3-inch wg.
    b. Minimum SMACNA Seal Class: B if negative pressure, and A if positive pressure.
    c. SMACNA Leakage Class for Rectangular: 12.
    d. SMACNA Leakage Class for Round and Flat Oval: 6.

2. Ducts Connected to Air-Handling Units:

a. Pressure Class: Positive or negative 3-inch wg.
b. Minimum SMACNA Seal Class: A if negative pressure, and A if positive pressure.
c. SMACNA Leakage Class for Rectangular: 6.
d. SMACNA Leakage Class for Round and Flat Oval: 6.

3. Ducts Connected to Equipment Not Listed Above:

a. Pressure Class: Positive or negative 3-inch wg.
b. Minimum SMACNA Seal Class: B if negative pressure, and A if positive pressure.
c. SMACNA Leakage Class for Rectangular: 6.
d. SMACNA Leakage Class for Round and Flat Oval: 6.

C. Outdoor-Air (Not Filtered, Heated, or Cooled) Ducts:

1. Ducts Connected to plenums:

a. Pressure Class: Positive or negative 3-inch wg.
b. Minimum SMACNA Seal Class: A.
c. SMACNA Leakage Class for Rectangular: 12.
d. SMACNA Leakage Class for Round and Flat Oval: 6.

2. Ducts Connected to Equipment Not Listed Above:

a. Pressure Class: Positive or negative 3-inch wg.
b. Minimum SMACNA Seal Class: A.
c. SMACNA Leakage Class for Rectangular: 6.
d. SMACNA Leakage Class for Round and Flat Oval: 6.

D. Intermediate Reinforcement:

1. Galvanized-Steel Ducts: Galvanized steel.

2. Aluminum Ducts: Aluminum.

E. Liner:
1. Transfer Ducts: Fibrous glass, Type II, 2 inches thick.

F. Elbow Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."

a. Velocity 1000 fpm or Lower:

1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
2) Mitered Type RE 4 without vanes.

b. Velocity 1000 to 1500 fpm:

1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.
3) Only in restricted areas, Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

c. Velocity 1500 fpm or Higher:

1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
3) Only in restricted areas, Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

2. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."

a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.

1) Velocity 1000 fpm or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
2) Velocity 1000 to 1500 fpm: 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
3) Velocity 1500 fpm or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
4) Radius-to Diameter Ratio: 1.5.

b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.
c. Round Elbows, 14 Inches and Larger in Diameter: Standing seam.

G. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."

   a. Rectangular Main to Rectangular Branch: 45-degree entry.
   b. Rectangular Main to Round Branch: Spin in.

2. Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.

   a. Velocity 1000 fpm or Lower: 90-degree tap.
   b. Velocity 1000 to 1500 fpm: Conical tap.
   c. Velocity 1500 fpm or Higher: 45-degree lateral.

H. Construct T's with radius of not less than 1-1/2 times width of duct on centerline. Do not use Bullhead Tees. Where not possible, provide air foil turning vanes. Where acoustical lining is indicated, provide acoustical turning vanes of perforated metal with glass fiber liner.

I. Offsets and Transitions:

1. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.
2. Offset Type 3 (radiussed or ogee) complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-7, "Offsets and Transitions."
3. Offset Type 1 (angled), only where space restrictions do not permit using Type 3 offset, complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-7, "Offsets and Transitions."

J. Applications:
1. Use rectangular or preformed single-wall round ducts for exhaust air as shown on Drawings.
2. Use rectangular lined ducts for transfer air.

END OF SECTION 233113

SECTION 233300

AIR DUCT ACCESSORIES

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. Backdraft and pressure relief dampers.
2. Manual volume dampers.
3. Control dampers.
4. Fire dampers.
5. Flange connectors.
6. Turning vanes.
7. Duct-mounted access doors.
8. Flexible connectors.
9. Duct accessory hardware.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Product data showing compliance with ASHRAE 62.1.

C. Shop Drawings: For duct accessories. Include plans, elevations, sections, details and attachments to other work.

1. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances; and method of field assembly into duct systems and other construction. Include the following:

a. Special fittings.
b. Manual volume damper installations.

c. Control-damper installations.
d. Fire-damper installations, including sleeves; and duct-mounted access doors and remote damper operators.
e. Wiring Diagrams: For power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted access panels and access door

B. s required for access to duct accessories are shown and coordinated with each other, using input from Installers of the items involved.

C. Source quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fusible Links: Furnish quantity equal to 10 percent of amount installed.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTION

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

2.2 MATERIALS

A. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G60 where indicated OR unless otherwise G90.
2. Exposed-Surface Finish: Mill phosphatized.

B. Aluminum Sheets: Comply with ASTM B 209, Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.

C. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

D. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.3 BACKDRAFT AND PRESSURE RELIEF DAMPERS

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

1. American Warming and Ventilating; a Mestek Architectural Group company.
2. Cesco Products; a divsion of MESTEK, Inc.
3. Greenheck Fan Corporation.
4. Nailor Industries Inc.
5. Pottorff.
6. Ruskin Company.

B. Description: Gravity balanced.

C. Maximum Air Velocity: 2000 fpm.

D. Maximum System Pressure: 6-inch wg.

E. Frame: Hat-shaped, 0.094-inch-thick, galvanized sheet steel, with welded corners or mechanically attached and mounting flange.

F. Blades: Multiple single-piece blades, center pivoted, maximum 6-inch width, 0.050-inch-thick aluminum sheet with sealed edges.

G. Blade Action: Parallel.

H. Blade Seals: Extruded vinyl, mechanically locked.

I. Blade Axles:

1. Material: Nonferrous metal.
2. Diameter: 0.20 inch.

J. Tie Bars and Brackets: Aluminum.

K. Return Spring: Adjustable tension.

L. Bearings: Steel ball or synthetic pivot bushings.

M. Accessories:

1. Adjustment device to permit setting for varying differential static pressure.
2. Counterweights and spring-assist kits for vertical airflow installations.
3. Electric actuators.
4. Chain pulls.
5. Screen Mounting: Front mounted in sleeve.
    a. Sleeve Thickness: 20 gage minimum.
    b. Sleeve Length: 6 inches minimum.
6. Screen Mounting: Rear mounted.
7. Screen Material: Aluminum.
8. Screen Type: Bird.
9. 90-degree stops.

2.4 MANUAL VOLUME DAMPERS

A. Low-Leakage, Steel, Manual Volume Dampers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. American Warming and Ventilating; a Mestek Architectural Group company.
    b. Flex-Tek Group.
    c. McGill AirFlow LLC.
    d. Nailor Industries Inc.
    e. Pottorff.
    f. Ruskin Company.
    g. Trox USA Inc.

2. Comply with AMCA 500-D testing for damper rating.
3. Low-leakage rating, with linkage outside airstream, and bearing AMCA's Certified Ratings Seal for both air performance and air leakage.
4. Suitable for horizontal or vertical applications.
5. Frames:

    a. Hat shaped.
    b. 0.094-inch-thick, galvanized sheet steel in galvanized steel ducts0.05-inch-thick stainless steel in stainless steel ducts.
    c. Mitered and welded corners.
    d. Flanges for attaching to walls and flangeless frames for installing in ducts.

6. Blades:

    a. Multiple or single blade.
    b. Parallel- or opposed-blade design.
    c. Stiffen damper blades for stability.
    d. Galvanized or Stainless, roll-formed steel, 0.064 inch thick.

7. Blade Axles: Nonferrous metal.
8. Bearings:

    a. Oil-impregnated bronze.
    b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.

9. Blade Seals: Vinyl.
10. Jamb Seals: Cambered stainless steel.
11. Tie Bars and Brackets: Galvanized steel.
12. Accessories:

    a. Include locking device to hold single-blade dampers in a fixed position without vibration.

B. Low-Leakage, Aluminum, Manual Volume Dampers:

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

    a. American Warming and Ventilating; a Mestek Architectural Group company.
    b. McGill AirFlow LLC.
    c. Nailor Industries Inc.
    d. Pottorff.

e. Ruskin Company.
f. Trox USA Inc.

2. Comply with AMCA 500-D testing for damper rating.
3. Low-leakage rating, with linkage outside airstream, and bearing AMCA's Certified Ratings Seal for both air performance and air leakage.
4. Suitable for horizontal or vertical applications.
5. Frames: Hat-shaped, 0.10-inch-thick, aluminum sheet channels; frames with flanges for attaching to walls and flangeless frames for installing in ducts.
6. Blades:

   a. Multiple or single blade.
   b. Parallel- or opposed-blade design.
   c. Roll-Formed Aluminum Blades: 0.10-inch-thick aluminum sheet.
   d. Extruded-Aluminum Blades: 0.050-inch-thick extruded aluminum.

7. Blade Axles: Nonferrous metal.
8. Bearings:

   a. Oil-impregnated bronze.
   b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.

9. Blade Seals: Vinyl.
10. Jamb Seals: Cambered stainless steel.
11. Tie Bars and Brackets: Aluminum.
12. Accessories:

    a. Include locking device to hold single-blade dampers in a fixed position without vibration.

C. Jackshaft:

1. Size: 0.5-inch diameter.
2. Material: Galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
3. Length and Number of Mountings: As required to connect linkage of each damper in multiple-damper assembly.

D. Damper Hardware:

1. Zinc-plated, die-cast core with dial and handle made of 3/32-inch-thick zinc-plated steel, and a 3/4-inch hexagon locking nut.

2. Include center hole to suit damper operating-rod size.
3. Include elevated platform for insulated duct mounting.

2.5 CONTROL DAMPERS

A. Low-leakage rating, with linkage outside airstream, and bearing AMCA's Certified Ratings Seal for both air performance and air leakage.

B. Frames:

1. Hat or Angle shaped.
2. 0.094-inch-thick, galvanized sheet steel or aluminum.
3. Mitered and welded corners.

C. Blades:

1. Multiple blade with maximum blade width of 6 inches.
2. Parallel- and opposed-blade design.
3. Galvanized-steel or Aluminum.
4. 0.064 inch thick single skin or 0.0747-inch-thick dual skin.
5. Blade Edging: Inflatable seal blade edging, or replaceable rubber seals.

D. Blade Axles: 1/2-inch-diameter; galvanized steel; blade-linkage hardware of zinc-plated steel and brass; ends sealed against blade bearings.
1. Operating Temperature Range: From minus 40 to plus 200 deg F.

E. Bearings:

1. Oil-impregnated bronze or Oil-impregnated stainless-steel sleeve or Stainless-steel sleeve.
2. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
3. Thrust bearings at each end of every blade.

2.6 FIRE DAMPERS

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

1. Aire Technologies.
2. American Warming and Ventilating; a Mestek Architectural Group company.
3. Arrow United Industries.
4. Cesco Products; a divsion of MESTEK, Inc.

5. Greenheck Fan Corporation.
6. Ruskin Company.

B. Type: Dynamic; rated and labeled according to UL 555 by an NRTL.

C. Closing rating in ducts up to 4-inch wg static pressure class and minimum 2000-fpm velocity.

D. Fire Rating: 1-1/2 and 3 hours.

E. Frame: Curtain type with blades outside airstream; fabricated with roll-formed, 0.034-inch-thick galvanized steel; with mitered and interlocking corners.

F. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel.

1. Minimum Thickness: 0.138 inch or 0.39 inch thick, as indicated, and of length to suit application.
2. Exception: Omit sleeve where damper-frame width permits direct attachment of perimeter mounting angles on each side of wall or floor; thickness of damper frame must comply with sleeve requirements.

G. Mounting Orientation: Vertical or horizontal as indicated.

H. Blades: Roll-formed, interlocking, 0.024-inch-thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch-thick, galvanized-steel blade connectors.

I. Horizontal Dampers: Include blade lock and stainless-steel closure spring.

J. Heat-Responsive Device: Replaceable, 165 deg F rated, fusible links.

2.7 FLANGE CONNECTORS

A. Description: Add-on or roll-formed, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.

B. Material: Galvanized steel.

C. Gage and Shape: Match connecting ductwork.

2.8 TURNING VANES

A. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.

B. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 4-3, "Vanes and Vane Runners," and 4-4, "Vane Support in Elbows."

C. Vane Construction: Single wall for ducts up to 24 inches wide and double wall for larger dimensions.

2.9 DUCT-MOUNTED ACCESS DOORS

A. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 7-2, "Duct Access Doors and Panels," and 7-3, "Access Doors - Round Duct."

1. Door:

   a. Double wall, rectangular.
   b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
   c. Vision panel.
   d. Hinges and Latches: 1-by-1-inchbutt or piano hinge and cam latches.
   e. Fabricate doors airtight and suitable for duct pressure class.

2. Frame: Aluminum or Galvanized sheet steel, with bend-over tabs and foam gaskets.
3. Number of Hinges and Locks:

   a. Access Doors Less Than 12 Inches Square: No hinges and two sash locks.
   b. Access Doors up to 18 Inches Square: Two hinges and two sash locks.
   c. Access Doors up to 24 by 48 Inches: Three hinges and two compression latches with outside and inside handles.
   d. Access Doors Larger Than 24 by 48 Inches: Four hinges and two compression latches with outside and inside handles.

B. Pressure Relief Access Door:

1. Door and Frame Material: Aluminum or Galvanized sheet steel.
2. Door: Double wall with insulation fill with metal thickness applicable for duct pressure class.

3. Operation: Open outward for positive-pressure ducts and inward for negative-pressure ducts.
4. Factory set at 3.0- to 8.0-inch wg.
5. Doors close when pressures are within set-point range.
6. Hinge: Continuous piano.
7. Latches: Cam.
8. Seal: Neoprene or foam rubber.
9. Insulation Fill: 1-inch-thick, fibrous-glass or polystyrene-foam board.

2.10 DUCT ACCESS PANEL ASSEMBLIES

A. Labeled according to UL 1978 by an NRTL.

B. Panel and Frame: Minimum thickness 0.0528-inch carbon steel.

C. Fasteners: Carbon steel. Panel fasteners shall not penetrate duct wall.

D. Gasket: Comply with NFPA 96; grease-tight, high-temperature ceramic fiber, rated for minimum 2000 deg F.

E. Minimum Pressure Rating: 10-inch wg, positive or negative.

2.11 FLEXIBLE CONNECTORS

A. Materials: Flame-retardant or noncombustible fabrics.

B. Coatings and Adhesives: Comply with UL 181, Class 1.

C. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches wide attached to two strips of 2-3/4-inch-wide, 0.028-inch-thick, galvanized sheet steel or 0.032-inch-thick aluminum sheets. Provide metal compatible with connected ducts.

D. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.

1. Minimum Weight: 26 oz./sq. yd..
2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
3. Service Temperature: Minus 40 to plus 200 deg F.

E. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.

1. Minimum Weight: 24 oz./sq. yd..
2. Tensile Strength: 530 lbf/inch in the warp and 440 lbf/inch in the filling.

3. Service Temperature: Minus 50 to plus 250 deg F.

F. High-Temperature System, Flexible Connectors: Glass fabric coated with silicone rubber.

1. Minimum Weight: 16 oz./sq. yd..
2. Tensile Strength: 285 lbf/inch in the warp and 185 lbf/inch in the filling.
3. Service Temperature: Minus 67 to plus 500 deg F.

2.12 FLEXIBLE DUCT CONNECTORS:

A. Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action in sizes 3 through 18 inches, to suit duct size.

2.13 DUCT ACCESSORY HARDWARE

A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.

B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts.

B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.

C. Compliance with ASHRAE/IESNA 90.1 includes Section 6.4.3.3.3 - "Shutoff Damper Controls," restricts the use of backdraft dampers, and requires control dampers for certain applications. Install backdraft dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.

D. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in

ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.

1. Install steel volume dampers in steel ducts.
2. Install aluminum volume dampers in aluminum ducts.
3. Install remote damper operators for volume dampers concealed above the non-accessible ceiling.

E. Set dampers to fully open position before testing, adjusting, and balancing.

F. Install test holes at fan inlets and outlets and elsewhere as indicated.

G. Install fire dampers according to UL listing.

H. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:

1. On both sides of duct coils.
2. Upstream and downstream from duct filters.
3. At outdoor-air intakes and mixed-air plenums.
4. At drain pans and seals.
5. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.
6. Adjacent to and close enough to fire dampers, to reset or reinstall fusible links. Access doors for access to fire dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
7. At each change in direction and at maximum 50-foot spacing.
8. Upstream and downstream from turning vanes.
9. Upstream or downstream from duct silencers.
10. Control devices requiring inspection.
11. Elsewhere as indicated.

I. Install access doors with swing against duct static pressure.

J. Access Door Sizes:

1. One-Hand or Inspection Access: 8 by 5 inches.
2. Two-Hand Access: 12 by 6 inches.
3. Head and Hand Access: 18 by 10 inches.
4. Head and Shoulders Access: 21 by 14 inches.
5. Body Access: 25 by 14 inches.
6. Body plus Ladder Access: 25 by 17 inches.

K. Label access doors according to Section 230553 "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.

L. Install flexible connectors to connect ducts to equipment.

M. For fans developing static pressures of 5-inch wg and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.

N. Install duct test holes where required for testing and balancing purposes.

3.2 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Operate dampers to verify full range of movement.
2. Inspect locations of access doors and verify that purpose of access door can be performed.
3. Operate fire dampers to verify full range of movement and verify that proper heat-response device is installed.
4. Inspect turning vanes for proper and secure installation.
5. Operate remote damper operators to verify full range of movement of operator and damper.

END OF SECTION 233300

SECTION 233423

HVAC POWER VENTILATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Centrifugal ventilators - roof upblast and sidewall.
   2. Centrifugal inline fans.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

   1. Construction details, material descriptions, dimensions of individual components and profiles, and finishes for fans.
   2. Rated capacities, operating characteristics, and furnished specialties and accessories.
   3. Certified fan performance curves with system operating conditions indicated.
   4. Certified fan sound-power ratings.
   5. Motor ratings and electrical characteristics, plus motor and electrical accessories.
   6. Material thickness and finishes, including color charts.
   7. Dampers, including housings, linkages, and operators.
   8. Prefabricated roof curbs.
   9. Fan speed controllers.

B. Shop Drawings:

   1. Include plans, elevations, sections, and attachment details.
   2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

3. Include diagrams for power, signal, and control wiring.
4. Design Calculations: Calculate requirements for selecting vibration isolators.

C. Delegated Design Submittal: For unit hangars and supports indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Design Calculations: Calculate requirements for selecting vibration isolators and for designing vibration isolation bases.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Floor plans, reflect

B. ed ceiling plans, and other details, or BIM model, drawn to scale, showing the items described in this Section and coordinated with all building trades.

C. Product Certificates: Submit certificates that specified equipment will withstand required wind forces, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculations.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of wind force and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

D. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For HVAC power ventilators to include in normal and emergency operation, and maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Belts: One set(s) for each belt-driven unit.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.

B. NFPA Compliance: Comply with NFPA 90A for design, fabrication, and installation of unit components.

C. ASHRAE 62.1 Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

D. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

2.2 CENTRIFUGAL VENTILATORS - ROOF UPBLAST

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

1. Greenheck Fan Corporation.
2. Loren Cook Company.
3. PennBarry; division of Air System Components.

B. Configuration: Centrifugal roof upblast ventilator.

C. Housing: Removable spun aluminum; square, one-piece aluminum base with venturi inlet cone.

1. Upblast Units: Provide spun-aluminum discharge baffle to direct discharge air upward, with rain and snow drains.

D. Fan Wheels: Aluminum hub and wheel with backward-inclined blades.

E. Accessories:

1. Variable-Frequency Motor Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
2. Disconnect Switch: Nonfusible type, NEMA 3R, with thermal-overload protection mounted outside fan housing, factory wired through an internal aluminum conduit.

3. Bird Screens: Removable, 1/2-inch mesh, aluminum or stainless-steel wire.
4. Dampers: Counterbalanced, parallel-blade, backdraft dampers mounted in curb base; factory set to close when fan stops.
5. Motorized Dampers: Low-leakage, parallel-blade, aluminum dampers mounted in curb base or duct plenum with electric actuator; wired to close when fan stops.
6. Vari-Flow Air Balance Kit (VFABK): An interface to integrate and simplify the interconnection of Vari-Flow motors and controls. A convenient point to set the speed range over which the Vari-Flow motor will operate. Provide with external signal capability with Vari-Flow motors. The VFABK contains an integral 24V control transformer. Include convenient terminals for landing Vari-Flow motors and controls as well as auxiliary control of motor operated dampers. Include means for remote on/off control. Status is indicated by a tricolor LED light.

F. Prefabricated Roof Curbs: Galvanized steel; mitered and welded corners; 1-1/2-inch- thick, rigid, fiberglass insulation adhered to inside walls; and 1-1/2-inch wood nailer. Size as required to suit roof opening and fan base.

1. Configuration: Built-in raised cant and mounting flange Manufactured to accommodate roof slope.

2.3 FANS, CENTRIFUGAL, INLINE – SQUARE

A. Basis-of Design Product: Subject to compliance with requirements, provide Loren Cook products indicated on drawings or comparable product by one of the following:

1. Greenheck.

B. Description: Square-housing in-line centrifugal fans.

C. Standards: Comply with UL 705.

D. Housing: Steel or Aluminum.

E. Housing Coating: Manufacturers baked phenolic epoxy coating.

F. Direct-Drive Units: Motor mounted in airstream, factory wired to disconnect switch located on outside of fan housing, with wheel and cone inlet.

G. Belt-Driven Units: Motor mounted on adjustable base, with adjustable

sheaves, enclosures around belts within fan housing and lubricating tubes from fan bearings extended to outside of fan housing.

H. Fan Wheels: Aluminum air foil blades welded to aluminum hub.

I. Motor Enclosure: Totally enclosed, fan cooled.

J. Accessories:

1. Access for Inspection, Cleaning, and Maintenance: Comply with requirements in ASHRAE 62.1.
2. Motor: Epoxy-coated steel.
3. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
4. Belt Guards: Fabricate of prime-coated steel to comply with OSHA and SMACNA requirements for motors with exposed drive belt. Include provisions for adjustment of belt tension, lubrication, and use of tachometer with guard in place.
5. Companion Flanges: Rolled flanges for duct connections of same material as housing.

2.4 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."

1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

B. Electronically Commutated Motors:

1. Motor enclosures: Open type
2. DC electronic commutation type motor (ECM) specifically designed for fan applications. AC induction type motors are not acceptable. Examples of unacceptable motors are: Shaded Pole, Permanent Split Capacitor (PSC), Split Phase, Capacitor Start, and 3 phase induction type motors.
3. Permanently lubricated, heavy duty ball bearing type to match with the fan load and pre-wired to the specific voltage and phase.
4. Internal motor circuitry to convert AC power supplied to the fan to DC power to operate the motor.

5. Motor shall be speed controllable down to 20% of full speed (80% turndown). Speed shall be controlled by either a potentiometer dial mounted at the motor or by a 0-10 VDC signal. Integral mounted and wired transformer.
6. Motor shall be a minimum of 85% efficient at all speeds.

C. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 26 Sections.

2.5 SOURCE QUALITY CONTROL

A. AMCA Certification for Fan Sound Performance Rating: Test, rate, and label in accordance with AMCA 311.

B. AMCA Certification for Fan Aerodynamic Performance Ratings: Test, rate, and label in accordance with AMCA 211.

C. AMCA Certification for Fan Energy Index (FEI): Test, rate, and label in accordance with AMCA 211.

D. UL Standards: Power ventilators shall comply with UL 705. Power ventilators for use for restaurant kitchen exhaust shall also comply with UL 762.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Install power ventilators level and plumb.

B. Equipment Mounting:

1. Secure roof-mounted fans to roof curbs with zinc-plated hardware. See Section 077200 "Roof Accessories" for installation of roof curbs.
2. Ceiling Units: Suspend units from structure; use steel wire or metal straps.
3. Comply with requirements for vibration isolation devices specified in Section 230548.13 "Vibration Controls for HVAC."

C. Install units with clearances for service and maintenance.

D. Label units according to requirements specified in Section 230553 "Identification for HVAC Piping and Equipment."

1. Data: Manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliance, and essential data.
2. Location: Accessible and visible location.

3.2 DUCTWORK CONNECTIONS

A. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Section 233300 "Air Duct Accessories."

3.3 ELECTRICAL CONNECTIONS

A. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

B. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

C. Install electrical devices furnished by manufacturer, but not factory mounted, according to NFPA 70 and NECA 1.

1. Nameplate shall be laminated acrylic or melamine plastic signs, as specified in Section 260553 "Identification for Electrical Systems."
2. Nameplate shall be laminated acrylic or melamine plastic signs with a black background and engraved white letters at least 1/2 inch high.

3.4 CONTROL CONNECTIONS

A. Install control and electrical power wiring to field-mounted control devices.

B. Connect control wiring according to Section 260523 "Control-Voltage Electrical Power Cables."

3.5 STARTUP SERVICE:

A. Perform startup service.

1. Complete installation and startup checks in accordance with manufacturer's written instructions.
2. Verify that shipping, blocking, and bracing are removed.
3. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify

that proper thermal-overload protection is installed in motors, starters, and disconnect switches.

4. Verify that cleaning and adjusting are complete.
5. For direct-drive fans, verify proper motor rotation direction and verify fan wheel free rotation and smooth bearing operation.
6. For belt-drive fans, disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
7. Adjust belt tension.
8. Adjust damper linkages for proper damper operation.
9. Verify lubrication for bearings and other moving parts.
10. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
11. Disable automatic temperature-control operators, energize motor and confirm proper motor rotation and unit operation, adjust fan to indicated rpm, and measure and record motor voltage and amperage.
12. Shut unit down and reconnect automatic temperature-control operators.
13. Remove and replace malfunctioning units and retest as specified above.

3.6 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Adjust belt tension.

C. Lubricate bearings.

D. Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC."

3.7 CLEANING

A. After completing system installation and testing, adjusting, and balancing and after completing startup service, clean fans internally to remove foreign material and construction dirt and dust.

3.8 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Perform tests and inspections.

1. Fan Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
2. Test and adjust controls and safeties.
3. Fans and components will be considered defective if they do not pass tests and inspections.
4. Prepare test and inspection reports.

3.9 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain centrifugal fans.

END OF SECTION 233423

SECTION 233713.23

AIR REGISTERS AND GRILLES

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. Fixed face registers and grilles.

B. Related Requirements:

   1. Section 233300 "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to registers and grilles.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

   1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static pressure drop, and noise ratings. Indicate each selection on data sheets.
   2. Register and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

1.4 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of diffusers, registers, and grilles of types and capacities required, whose products have been in satisfactory use in similar service for not less than five years.

B. Codes and Standards:

1. ASHRAE Compliance: Test and rate diffusers, registers, and grilles in accordance with ASHRAE 70 "Method of Testing for Rating the Performance of Air Outlets and Inlets."
2. NFPA Compliance: Install diffusers, registers, and grilles according to NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems."

C. Single Source Responsibility: Obtain diffusers, registers, and grilles through one source from a single manufacturer where alike in one or more respects with regard type, design, or factory-applied color finish.

D. Design Concept: The drawings indicate types of diffusers based on the specific descriptions, manufacturers, models, and numbers indicated.

1. Refer to the Conditions of the Contract and Division 1 specification sections for the requirements of product substitution.
2. Where more than one manufacturer is named, only the Basis-of-Design manufacturer's item has been verified as suitable.

PART 2 - PRODUCTS

2.1 REGISTERS

A. Fixed Face Register (ER1):

1. Basis-of-Design Product: Subject to compliance with requirements, provide Tuttle & Bailey Model A117DG or comparable product by one of the following:

    a. Anemostat Products; a Mestek company.
    b. Hart & Cooley Inc.
    c. Krueger.
    d. Price Industries.
    e. Titus.

2. Material: Extra heavy duty extruded aluminum.
3. Finish: Satin anodized or Baked enamel, color selected by Architect.
4. Face Blade Arrangement: Horizontal spaced 3/4 inch apart.
5. Face Arrangement: Perforated core.
6. Core Construction: Integral.
7. Frame: 1-1/4 inches wide.
8. Mounting: Countersunk screw with security fasteners or Concealed.
9. Damper Type: NRTL listed, opposed blade, spring closing, and with fusible link for 160 deg F.

2.2 GRILLES

A. Fixed Face Grille (EG1):

1. Basis-of-Design Product: Subject to compliance with requirements, provide Tuttle & Bailey Model A70D or comparable product by one of the following:

    a. Anemostat Products; a Mestek company.
    b. Hart & Cooley Inc.
    c. Krueger.
    d. Price Industries.
    e. Titus.

2. Material: Extra heavy duty stainless steel.
3. Finish: Satin or as selected by Architect.
4. Face Blade Arrangement: Fixed horizontal, streamlined foil-shaped 16-gauge bars spaced on 3/4 inch center with 42-degree face deflection. 75 percent minimum free area. Extruded brace bars to assure rugged heavy-duty unit.
5. Core Construction: Integral.
6. Frame: 1-1/4 inches wide.
7. Mounting: Countersunk screw with security fasteners or Concealed.

B. Fixed Grid Core Grille (EG / RG):

1. Basis-of-Design Product: Subject to compliance with requirements, provide Tuttle & Bailey; SDAPG-R or a comparable product by one of the following:

    a. Hart & Cooley Inc.
    b. Krueger.
    c. Nailor Industries Inc.
    d. Price Industries.
    e. Titus.

2. Material: Aluminum.
3. Finish: Color selected by Architect.
4. Face Arrangement: Mount directly to spiral duct eliminating the need for additional construction of register taps.
5. Core Construction: Perforated.
6. Frame: Aluminum channel, 1 inch wide with mitered corners.
7. Mounting: Duct mountedSurface.
8. Accessory: Curved endcaps to the specified radius for a flush mount to the duct.

2.3 SOURCE QUALITY CONTROL

A. Verification of Performance: Rate registers and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas where registers and grilles are installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.

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

3.2 INSTALLATION

A. Install registers and grilles level and plumb.

B. Wall and Ceiling Compatibility: Provide registers and grilles with border styles that are compatible with adjacent wall or ceiling systems, and that are specifically manufactured to fit into wall or ceiling construction with accurate fit and adequate support. Refer to general construction drawings and specifications for types of wall and ceiling construction, which will contain each type of wall and ceiling register and grille.

C. Outlets and Inlets Locations: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

D. Install registers and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.3 ADJUSTING

A. After installation, adjust registers and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 233713.23

SECTION 238113.11

PACKAGED TERMINAL AIR-CONDITIONERS, THROUGH-WALL UNITS

PART 1 - GENERAL

1.1 DISCRIPTION

A. Section includes packaged, terminal, through-the-wall air conditioners.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Sustainable Design Submittals:
   1. Product Data: For ventilation equipment, indicating compliance with ASHRAE 62.1, Section 5 - "Systems and Equipment."

C. Shop Drawings: For packaged, terminal air conditioners.
   1. Include plans, elevations, sections, details for wall penetrations, and attachments to other work.
   2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   3. Include diagrams for power, signal, and control wiring.

D. Color Samples: For unit cabinet, discharge grille, and exterior louver, and for each color and texture specified.

1.3 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For packaged, terminal air conditioners, for tests performed by manufacturer and witnessed by a qualified testing agency.

B. Field quality-control reports.

C. Sample Warranty: For special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For packaged, terminal air conditioners to include in emergency, operation, and maintenance manuals.

1.5 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of packaged, terminal air conditioners that fail in materials or workmanship within specified warranty period.
   1. Warranty Period for Sealed Refrigeration System: Manufacturer's standard, but not less than five years from date of Substantial Completion, including components and labor.
   2. Warranty Period for Nonsealed System Parts: Manufacturer's standard, but not less than five years from date of Substantial Completion, including only components and excluding labor.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Amana; a division of Whirlpool Corporation.
   2. Carrier Corporation.
   3. Friedrich Air Conditioning Company.
   4. LG Electronics.
   5. General Electric.

2.2 MANUFACTURED UNITS

A. Description: Factory-assembled and -tested, self-contained, packaged, terminal air conditioner and heat pump with room cabinet, electric refrigeration system, auxiliary electric heating coil, and temperature controls; fully charged with R 454B refrigerant and filled with oil; with hardwired chassis.

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. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 4 - "Outdoor Air Quality," Section 5 - "Systems and Equipment," Section 6 - "Ventilation Rate Procedures," and Section 7 - "Construction and Startup."

D. ASHRAE/IES Compliance: Applicable requirements in ASHRAE/IES 90.1.

E. ASHRAE Thermal Comfort: Applicable requirements in ASHRAE 55.

F. UL listed and ETL performance certified.

2.3 CHASSIS

A. Cabinet: 0.052-inch- thick powder-coated steel with removable front panel with concealed latches.
   1. Mounting: Wall with wall sleeve.
   2. Top: Angled.
   3. Discharge Grille: Extruded-aluminum discharge grille, tamperproof, and carrying a flame test rating in accordance with UL standard 494.
   4. Louvers: Extruded aluminum with enamel finish; color as selected by Engineer.
   5. Finish: Epoxy coating.
   6. Access Door: Hinged door in top of cabinet for access to controls.
   7. Cabinet Extension: Matching cabinet in construction and finish, allowing diversion of airflow to adjoining room; with grille.
   8. Finish of Interior Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
   9. Wall Sleeves: Galvanized steel with polyester finish or Molded fiberglass-reinforced polyester, as Scheduled.

B. Refrigeration System: Direct-expansion heat pump, indoor coil with capillary restrictor and hermetically sealed scroll compressor with vibration isolation and overload protection.
   1. Indoor and Outdoor Coils: Seamless copper tubes mechanically expanded into aluminum fins with capillary tube distributor on indoor coil.
   2. Accumulator.
   3. Constant-pressure expansion valve.
   4. Reversing valve.
   5. Charge: R-454B.

C. Indoor Fan: Forward curved, centrifugal; with two-speed motor and positive-pressure ventilation damper with electric operator.

D. Filters: Washable polyurethane in molded plastic frame.

E. Condensate Drain: Drain pan to direct condensate to outdoor coil for re-evaporation and piping to direct condensate to building waste and vent piping.
   1. Comply with ASHRAE 62.1 for drain pan construction and connections.

F. Outdoor Fan: Forward curved, centrifugal type driven by indoor fan motor.
   1. Indoor and Outdoor Fan Motors: Two speed; comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for

motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."

a. Fan Motors: Permanently lubricated split capacitor.
b. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
c. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in electrical Sections.

2.4 HEATING

A. Electric-Resistance Heating Coil, Supplemental: Nickel-chromium-wire, electric-resistance heating elements with contactor and high-temperature-limit switch. Provide supplemental heat in heat pump mode.

2.5 CONTROLS

A. Control Module: Unit-mounted digital panel with touchpad temperature control and with touchpad for heating, cooling, and fan operation. Include the following features:
   1. Low-Ambient Lockout Control: Prevents cooling-cycle operation below 40 deg F outdoor air temperature.
   2. Temperature-Limit Control: Prevents occupant from exceeding preset setback or setup temperature.
   3. Building Automation System Interface: Allows remote on-off control with setback temperature control.
   4. Reverse-Cycle Defrost: Solid-state sensor monitors frost buildup on outdoor coil and reverses unit to melt frost.

2.6 SOURCE QUALITY CONTROL

A. Sound-Power Level Ratings: Factory test to comply with AHRI 300, "Sound Rating and Sound Transmission Loss of Packaged Terminal Equipment."

B. Unit Performance Ratings: Factory test to comply with AHRI 310/380/CSA C744, "Packaged Terminal Air-Conditioners and Heat Pumps."

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install units level and plumb, maintaining manufacturer's recommended clearances and tolerances.

B. Install wall sleeves in finished wall assembly; seal and weatherproof. Joint-sealant materials and applications are specified in Section 079200 "Joint Sealants."

C. Install and anchor wall sleeves to withstand, without damage to equipment and structure, seismic forces required by building code.

3.2 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:
1. Inspect for and remove shipping bolts, blocks, and tie-down straps.
2. After installing packaged, terminal air conditioners and after electrical circuitry has been energized, test for compliance with requirements.
3. Unit is level on base and is flashed in exterior wall.
4. Unit casing has no visible damage.
5. Compressor, air-cooled condenser coil, and fans have no visible damage.
6. Labels are clearly visible.
7. Controls are connected and operable.
8. Shipping bolts, blocks, and tie-down straps are removed.
9. Filters are installed and clean.
10. Drain pan and drain line are installed correctly.
11. Electrical wiring installation complies with manufacturer's submittal and installation requirements in electrical Sections.
12. Installation: Perform startup checks according to manufacturer's written instructions, including the following:
    a. Lubricate bearings on fan.
    b. Check fan-wheel rotation for correct direction without vibration and binding.
13. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
14. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. After operational test, change filters.

C. Packaged, terminal air conditioners will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.3 ADJUSTING

A. Adjust initial temperature set points.

B. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

3.4 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain packaged, terminal air conditioners.

END OF SECTION 238113.11

SECTION 238239.16

PROPELLER UNIT HEATERS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

1.02 Retain or delete this article in all Sections of Project Manual.

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

1.04 COMPLIANCE

1.05 Comply with the City of Baltimore Standard Specifications 2006 unless otherwise modified herein.

1.06 DESCRIPTION

A. Section includes propeller unit heaters with electric-resistance heating coils.

1.07 SUBMITTALS

A. Shop drawings shall be submitted for all items specified herein in accordance with Section 01 33 00 “SUBMITTAL PROCEDURES”. Shop drawings shall include, but not be limited to, physical characteristics, parts and materials lists, electrical characteristics, operating data, dimensional drawings, wiring diagrams, weights, and installation requirements, such as, but not limited to:

B. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, furnished specialties, and accessories.

C. Shop Drawings:

1. Include plans, elevations, sections, and details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include location and size of each field connection.
4. Include details of anchorages and attachments to structure and to supported equipment.
5. Include equipment schedules to indicate rated capacities, operating characteristics, furnished specialties, and accessories.

6. Include materials of construction of heater components.
7. Indicate location and arrangement of integral controls.
8. Wiring Diagrams: Power, signal, and control wiring.

D. Coordination Drawings: Floor plans, reflected ceiling plans, and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Suspended ceiling components.
2. Structural members to which propeller unit heaters will be attached.
3. Method of attaching hangers to building structure.
4. Size and location of initial access modules for acoustical tile.
5. Items penetrating finished ceiling, including the following:
   a. Lighting fixtures.
   b. Air outlets and inlets.
   c. Speakers.
   d. Sprinklers.
   e. Access panels.

E. Field quality-control reports.

1.08 OPERATION AND MAINTENANCE MANUALS

A. Submit Operation and Maintenance Manuals for propeller unit heaters as specified in Section 01 78 23 “OPERATION AND MAINTENANCE DATA”.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Airtherm; a Mestek company.
2. Chromalox, Inc.
3. INDEECO.
4. Markel Products; TPI Corporation.
5. Marley Engineered Products.
6. QMark; Marley Engineered Products
7. Engineered Air.

8. Trane.

2.02 DESCRIPTION

A. Assembly including casing, coil, fan, and motor in horizontal discharge configuration with adjustable discharge louvers.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with UL 2021.

D. Comply with UL 823.

E. Wash-down/Corrosion Resistant Unit Heaters: With built-in controls, NEMA 4X and UL listed for corrosive areas.

F. Warranty: Five year manufacturer’s standard warranty.

2.03 PERFORMANCE REQUIREMENTS

A. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

B. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

2.04 HOUSINGS

A. Finish: Manufacturer's standard finish applied to factory-assembled and -tested industrial-quality propeller unit heaters before shipping.

B. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

C. Inlet/Discharge Grilles:

1. Vertical unit heaters: Adjustable fin diffuser for horizontal units and conical diffuser for vertical units.

2. Horizontal unit heaters: Type 304 stainless steel louvered outlet grille that can be rotated 90 degrees to direct airflow up, down, left or right. Heavy gauge plated rear grille to protect against accidental contact with the fan blade

D. Wash-down heaters: Heating elements and motor enclosed in a heavy- gauge Type 316 stainless steel enclosure.

2.05 COILS

A. Electric-Resistance Heating Coil: Type 316 stainless steel heating wire, free from expansion noise and 60-Hz hum, embedded in magnesium oxide refractory and sealed in tubular stainless steel sheath with spiral-wound, stainless steel fins no

closer than 0.16 inch. Element ends shall be enclosed in terminal box. Fin surface temperature shall not exceed 550 deg F at any point during normal operation.

1. Circuit Protection: One-time fuses in terminal box for overcurrent protection and limit controls for high-temperature protection of heaters.
2. Wiring Terminations: Stainless-steel or corrosion-resistant material.

2.06 FAN AND MOTOR

A. Fan: Propeller type with aluminum wheel directly mounted on motor shaft in the fan venturi. Inlet grille complying with OSHA requirements for fan blade guard. Wash-down heaters fitted with an epoxy coated, aluminum fan blade suitable for corrosive salt spray environments.

B. Motor: Permanently lubricated, multispeed or variable speed with integral thermal overload protection. Designed to resist moisture and corrosion for wash-down heaters. The minimum operating temperature shall be minus 14 deg F and the minimum storage temperature shall be minus 49 deg F, where scheduled. Comply with requirements in Section 23 05 13 "Common Motor Requirements for HVAC Equipment."

2.07 CONTROLS

A. Control Devices:

1. Wall-mounted, variable fan-speed switch.
2. Wall-mounted thermostat.

B. Control Panel: Unit mounted with disconnecting means and overcurrent protection. Single point, line voltage connection for incoming power. Heater, fan, and control connected to the same branch circuit. Include the following factory built-in controls:

1. Magnetic contactor.
2. “Warning” Pilot Light: To indicate when the thermal cutouts have tripped and the unit heater needs servicing.
3. “Heater On” Pilot Light: To indicate when the electric heating elements are energized.
4. Secondary Manual Reset/Over Temperature Thermal Cutout with Backup Contactor: A pilot duty manual reset thermal cutout with a backup contactor shall be provided for independent secondary over-temperature protection.
5. Thermostat: 2-Stage, adjustable, 40 to 120 degrees F temperature range, and 2.5 degree throttling range. UL Listed with NEMA 4X enclosure suitable for wet and corrosive areas.

6. Selector Switch: Three position switch wired to control circuit: for heater on, heater standby and fan only.
7. Control power transformer with fused secondary and grounded to power all controls. Voltage shall be 120 VAC or 24 VAC.
8. Power disconnect switch: Factory installed on the unit heater above the control enclosure to meet NEC/CEC requirements for a disconnecting means within sight of the heater.
9. 2-Stage controls.
10. Fan Delay Relay.
11. Controlling Contactors.
12. Back-up Safety Contactor.
13. Terminal Blocks, for field wiring.
14. Control Enclosure: Non-metallic NEMA 4X to house both the heating element terminals and built-in controls.

2.08 ACCESSORIES

A. Mounting Brackets: Include a corrosion resistant Type 316 stainless steel swivel-mounting bracket with single point suspension, which can be used either for wall or ceiling mounting. Units shall be wall mounted unless otherwise shown. Use Type 316 stainless steel anchor bolts.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas to receive propeller unit heaters for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for electrical connections to verify actual locations before unit-heater installation.

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

3.02 INSTALLATION

A. Install propeller unit heaters to comply with NFPA 90A.

B. Install propeller unit heaters level and plumb.

C. Suspend propeller unit heaters from structure with all-thread hanger rods and elastomeric hangers. Hanger rods and attachments to structure are specified in Section 23 05 29 "Hangers and Supports for HVAC Piping and Equipment."

Vibration hangers are specified in Section 23 05 48.13 "Vibration Controls for HVAC."

D. Install wall-mounted thermostats and switch controls in electrical outlet boxes at heights to match lighting controls. Verify location of thermostats and other exposed control sensors with Drawings and room details before installation.

3.03 CONNECTIONS

A. Install piping adjacent to machine to allow service and maintenance.

B. Comply with safety requirements in UL 1995.

C. Ground equipment according to Section 26 05 26 "Grounding and Bonding for Electrical Systems."

D. Connect wiring according to Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

3.04 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Operational Test: After electrical circuitry, has been energized, start units to confirm proper motor rotation and unit operation.

2. Retain first subparagraph below for units that have electric-resistance heating coils.

3. Operate electric heating elements through each stage to verify proper operation and electrical connections.

4. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

B. Units will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.05 ADJUSTING

A. Adjust initial temperature set points.

3.06 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain propeller unit heaters.

END OF SECTION 238239.16

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SECTION 238239.19

WALL AND CEILING UNIT HEATERS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Section includes wall and ceiling heaters with propeller fans and electric-resistance heating coils.

1.02 SUBMITTALS

A. Shop drawings shall be submitted for all items specified herein in accordance with Section 01 33 00 “SUBMITTAL PROCEDURES”. Shop drawings shall include, but not be limited to, physical characteristics, parts and materials lists, electrical characteristics, operating data, dimensional drawings, wiring diagrams, weights, and installation requirements, such as, but not limited to:

B. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, furnished specialties, and accessories.

C. Shop Drawings:

1. Include plans, elevations, sections, and details.

2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

3. Include details of anchorages and attachments to structure and to supported equipment.

4. Include equipment schedules to indicate rated capacities, operating characteristics, furnished specialties, and accessories.

5. Wiring Diagrams: Power, signal, and control wiring.

D. Samples: For each exposed product and for each color and texture specified.

1.03 WARRANTY AND GUARANTEE

A. Warranty and guarantee shall be as specified in Section 01 78 36 with the exception that the warranty period shall be as mentioned below:

B. Manufacturer’s standard, but not less than three years from the date of Substantial Completion.

1.04 OPERATION AND MAINTENANCE MANUALS

A. Submit Operation and Maintenance Manuals for wall and ceiling unit heaters as specified in Section 01 78 23 “OPERATION AND MAINTENANCE DATA”.

PART 2 - PRODUCTS

2.01 WALL HEATERS

A. Manufacturers

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. Berko; Marley Engineered Products.

b. Chromalox, Inc.

c. INDEECO.

d. Markel Products; TPI Corporation.

e. Marley Engineered Products.

f. QMark; Marley Engineered Products.

g. Trane.

B. Description

1. Assembly including chassis, electric heating coil, fan, motor, and controls. Comply with UL 2021.

2. 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. Cabinet

1. Three piece design: a back box, wall heater and a front panel.

2. Front Panel: Extruded-aluminum bar grille, with removable panels fastened with tamperproof fasteners.

3. Finish: Baked enamel over baked-on primer with manufacturer's standard color selected by Architect, applied to factory-assembled and -tested wall heaters before shipping.

4. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

5. Surface-Mounted Cabinet Enclosure: Steel with finish to match cabinet.

6. Recessed-Mounting Cabinet Enclosure: Recessed box for a recessed rough-in in either masonry or frame installations, constructed of minimum 20 gauge galvanized steel.

D. Electric-Resistance Heating Coil: Nickel-chromium heating wire, free from expansion noise and 60-Hz hum, embedded in magnesium oxide refractory and sealed in corrosion-resistant metallic sheath. Terminate elements in stainless-steel, machine-staked terminals secured with stainless-steel hardware, and limit controls for high-temperature protection. Provide integral circuit breaker for overcurrent protection.

E. Fan and Motor

1. Fan: Aluminum propeller directly connected to motor.

2. Motor characteristics such as NEMA designation, temperature rating, service factor, enclosure type, and efficiency are specified in Section 23 05 13 "Common Motor Requirements for HVAC Equipment." If different characteristics are required, insert paragraphs below to suit Project.

3. Motor: Permanently lubricated, multispeed. Comply with requirements in Section 23 0513 "Common Motor Requirements for HVAC Equipment."

F. Controls

1. Controls: Unit-mounted thermostat. Low-voltage relay with transformer kit. Comply with the requirements specified in Section 23 09 23.27 "Temperature Instruments."

2. Electrical Connection: Factory wire motors and controls for a single field connection with disconnect switch.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas to receive wall and ceiling unit heaters for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for electrical connections to verify actual locations before unit-heater installation.

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

3.02 INSTALLATION

A. Install wall and ceiling unit heaters to comply with NFPA 90A and UL 1995.

B. Install wall and ceiling unit heaters level and plumb.

C. Suspend ceiling heaters from structure with all-thread hanger rods and elastomeric hangers. Hanger rods and attachments to structure are specified in Section 23 05 29 "Hangers and Supports for HVAC Piping and Equipment." Vibration hangers are specified in Section 23 05 48.13 “Vibration Controls For HVAC.”

D. Install wall boxes in finished wall assembly; seal and weatherproof. Joint-sealant materials and applications are specified in Section 07 92 00 "Joint Sealants."

E. Install wall-mounted thermostats and switch controls in electrical outlet boxes at heights to match lighting controls. Verify location of thermostats and other exposed control sensors with Drawings and room details before installation.

F. Ground equipment according to Section 26 05 26 "Grounding and Bonding for Electrical Systems."

G. Connect wiring according to Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

3.03 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
2. Retain first subparagraph below for units that have electric-resistance heating coils.
3. Operate electric heating elements through each stage to verify proper operation and electrical connections.
4. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

B. Remove and replace malfunctioning units and retest as specified above.

3.04 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain unit heaters.

END OF SECTION 238239.19

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SECTION 260500

BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Drawings and general provisions of the Contract, including General and Supplementary condition and General Requirements, and Division 1 specifications apply to the work specified in specifications of Division 26.

B. This section includes general administrative and procedural requirements for electrical installations. The administrative and procedural requirements such as Submittal, Operating and Maintenance Manuals, Handling, and storage of equipment, etc. are included in this section to expand the requirements specified in Division 1.

1.2 SCOPE

A. The work of all sections of Division 26 includes furnishing and installing the material, equipment and systems complete as specified therein and indicated on drawings. The electrical installation when finished shall be complete and coordinated, whole and ready for satisfactory use.

B. Specifications are intended to include everything necessary for a first-class installation. If mention has been omitted herein of any items of the work or materials usually furnished for, or necessary, for the complete installation of electrical work or if there are conflicting points in the specifications and/or drawings, the attention of the Owner or their representative should be called to such items in sufficient time for a formal addendum to be issued. Any and all conflicting points in the specifications and/or drawings which are not questioned by the Contractor and clarified by a formal addendum prior to opening of bids shall be subject to the interpretation of the Owner or their designated representative after award of the contract and his/her interpretation shall be binding upon the Contractor.

C. All materials and equipment shall be installed and completed in a first-class and workmanlike manner and in accordance with the best modern methods and practices. Any materials installed which do not present an orderly and reasonably neat or workmanlike appearance, or are not installed in accordance with these specifications, or the contract drawings, shall be removed and replaced when so directed in writing by the Owner or their designated representative at the Contractor's expense.

D. Should the Contractor discover any discrepancies between actual conditions and those indicated pertaining to the existing work which may prevent following good practice or the intent of the drawings and specifications, the Contractor

shall notify the construction manager and shall not proceed with the work until instructions have been received from the Owner or their designated representative.

E. The Contractor shall furnish and install all labor, materials, equipment, tools, and services necessary for and reasonably incidental to furnishing and completing the installation of all electrical work, including the installation of conduits, wires, boxes, devices, etc. as shown on the contract drawings and/or called for in the specifications, and deliver it to the Owner in proper working condition.

F. It is intended that the specifications and drawings include everything requisite and necessary to complete the entire work properly, notwithstanding the fact that every item involved may not be specifically mentioned.

G. The specifications outlines, in general manner, the work required to be performed by the Contractor. The Contractor is responsible for work which may be reasonably interpreted from the specifications and/or drawings as necessary for a complete installation ready for service. The words "install" and/or "installation" shall be interpreted as the inclusion of the following work:

1. Setting, plumbing, aligning, and anchoring of equipment on foundations
2. Placing all mounting bolts, base channels, cable clamps and supports
3. Mounting and connecting of electrical items shipped separately and removing and replacing equipment parts to facilitate handling
4. Making internal connections on equipment which were omitted for shipment. Provision of jumpers and local temporary interconnections that may not be listed in the cable tabulations at no additional cost to the Owner
5. Cleaning and checking of electrical equipment and connections
6. Repair to damaged surfaces and equipment shall be made to the satisfaction of the construction manager at no additional cost to the Owner.

H. The Contractor shall protect work in progress from physical damage and against the intrusion of dirt. The work area shall be kept clear of debris to prevent interference with other operations. The Contractor will be solely responsible for all refuse, debris, and trash attributable to this work. Removal shall be in accordance with all applicable ordinances and the Contractor shall pay any and all fees associated with the disposal of rubbish.

1.3 RESPONSIBILITY

A. The general Contractor shall be responsible for all work included in Division 26 and the delegation of work to subcontractors shall not relieve him of his responsibility. The term "contractor" is used throughout this Division and shall mean the General Contractor, although the actual performance of the work may be by a Subcontractor.

B. The Contractor shall carefully examine all plans, specifications, and documents. After careful examination of all documents, the Contractor shall visit the construction site and thoroughly acquaint himself with the conditions under which the work will be executed. Lack of knowledge, and the items, which could have been discovered or detected at the time of field visit will not be considered acceptable for extra work compensation.

1.4 REFERENCES AND DEFINITIONS

A. The following are definitions of the terms and expressions used in Division 26 Sections:

Construction Manager:	Owner's designated representative
Provide:	"furnish and install"
Directed:	"directed by the Engineer or Owner"
Indicated:	"Indicated in contract drawings"
Concealed:	"hidden from normal sight; includes items in shafts, duct spaces (chases), and above ceilings.
Exposed:	"not concealed"

B. Listed: Equipment or device is listed of a kind mentioned which:

1. is published by a nationally recognized laboratory which makes periodic inspections of production of such equipment.
2. states that such equipment meets nationally recognized standards or has been tested and found safe for use in a specified manner.

C. Labeled: Equipment or device is labeled when:

1. It embodies a valid label, symbol, or other identifying mark of a nationally recognized testing laboratory such as Underwriters Laboratories, Inc.
2. The laboratory makes periodic inspections of the production of such equipment.
3. The labeling indicates compliance with nationally recognized standards or tests to determine the safe use in a specified manner.

D. Certified: Equipment or product is certified which:

1. Has been tested and found by a nationally recognized testing laboratory to meet nationally recognized standards or to be safe for use in a specified manner.
2. Production of equipment or product is periodically inspected by a nationally recognized testing laboratory.
3. Bears a label, tag or other record of certification.

E. Nationally recognized testing laboratory: Is a company, which is approved, in accordance with OSHA regulations, by the Secretary of Labor, Federal Government.

1.5 CODES, REGULATIONS AND PERMITS

A. Give all necessary notices and obtain all required permits. Pay all fees and other costs, including utility connections in connection with the work. File all necessary plans, prepare all documents and obtain all necessary permits and approvals from all governmental agencies having jurisdiction. Obtain all required certificates of inspection and deliver same to the construction manager before request for acceptance and payment for the work.

B. All materials furnished, and all work installed, shall comply with the latest editions in effect at the time and date of invitation of bids, of codes, standards, rules and regulations and recommendations of the bodies, such as:

1. American National Standards Institute (ANSI)
2 American Society of Testing and Materials (ASTM)
3. Insulated Power Cable Engineer Association (IPCEA)
4. National Electrical Code (NEC)
5. National Electrical Manufacturers Association (NEMA)
6. National Fire Protection Association (NFPA)
7. Occupational Safety and Health Agency (OSHA)
8. Underwriters Laboratories, Inc. (UL)
9. National Electrical Safety Code (NESC)
10. Institute of Electrical and Electronics Engineers
11. International Building Code (IBC)
12. American Disability Act (ADA)
13. Local Authority Having Jurisdiction

C. Drawings and specifications shall govern in those instances, where the requirements indicated on the construction documents are greater than the requirements required by applicable codes and other standards, rules and regulations.

1.6 SUBMITTALS

A. MATERIALS LIST

1. See Division 1 and General Requirements.

B. SHOP DRAWINGS

1. After receiving approval of the equipment manufacturers, and prior to delivery of any materials to job site, the Contractor shall submit for approval detailed dimensional ship drawings, together with descriptive

specifications and engineering data sheets and catalog cuts showing construction size, arrangement, operating clearances, performance characteristics and capacity of all electrical materials, equipment and systems.

2. Shop drawings, catalog cuts etc. submitted for approval shall be properly labeled indicating: specific service for which material or equipment is to be used; section and article number of specific service for which material or equipment is to be used; section and article number of specifications governing; and Contractors name, Owner project name and number, and the date of submittal. Provide a cover sheet with each submittal.
3. Shop drawings, catalogs, pamphlets, or other documents submitted to describe items on which approval is being requested shall contain detailed and specific information which will demonstrate fully that the material, equipment or system will conform and perform to the contract documents. Each shop drawing, catalog pamphlet, etc. shall be clearly marked in ink and highlighted to identify the specific item submitted. Data of a general nature will not be accepted.
4. Shop drawings shall include plans, elevations, sections, mounting, details of component parts, point to point interconnection diagrams, elementary diagrams, single line diagrams and any other drawings necessary to show the fabrication and connection of the complete item or system.
5. The acceptance of shop drawings shall not relieve the Contractor from his responsibility to furnish material, equipment and systems and perform work required by the contract documents. Neither the Owner nor the architect nor the engineer will be responsible for errors or omissions on shop drawings furnished by the Contractor even though such shop drawings containing errors or omissions are inadvertently accepted.
6. The Contractor is further advised that the Owner, the architect; and/or the engineer will not act as coordinator between suppliers and subcontractors. All required coordination shall be the responsibility of the Contractor. See other sections of these specifications for additional detailed requirements for wiring diagrams, schematic diagrams, interconnection diagrams and similar shop drawings for systems and equipment.
7. Submit drawings and data sheets giving full information as to dimensions, materials, fitness and other pertinent facts.
8. Obtain approval before apparatus involved is ordered, built, or installed. If material of equipment is installed by the Contractor prior to receipt of pertinent shop drawings marked "No Exceptions Taken" or "Comments Noted", the Contractor shall be liable for its removal and replacement at no extra charge to Owner.
9. See other sections of Division 26 and Division 1 for additional detailed requirements of shop drawings.
10. Manufacturer’s model and catalog number change frequently and may not necessarily include specified or required features and may not insure compatibility with supporting systems or intended applications.

Contractor shall be responsible to insure that all materials and equipment delivered to the job site is suitable for the intended application and indicated connections.

11. Review of and/or noted comments on the contractor's submitted shop drawings do not constitute a change order or a waiver of contract requirements. In the event of conflict between submittals or shop drawings and contract documents, the later shall govern. If a waiver of particular requirement is requested by the contractor, a formal written request shall be made to owner as per general conditions.

C. OPERATING AND MAINTENANCE MANUALS

1. Refer to Division 1 Section "Operation and Maintenance Data" for documentation requirements and format of the Building Systems Manuals.
2. Each copy of the Operating and Maintenance Manuals shall be bound in a durable, hardback binder with data sheets individually punched or perforated and entered. Data sheets shall be grouped and separated by dividers. At the Contractor's option, the manual may contain heavy manila tie flap envelopes, punched and bound with data sheets inserted in the envelopes and with a typed label on each envelope to identify its contents.

   The manual shall have an identifying label on the front cover and shall include the following as a minimum:

   a. Index
   b. One copy of the approved materials list
   c. One copy each approved shop drawing and associated data
   d. One copy of each system or equipment manufacturer's recommended preventive maintenance, if any
   e. One copy of the nameplate data for each motor and overload protection device
   f. One copy of a time-current characteristic curve for each type of fuse, overload device, or protection relay
   g. One copy of each system or component operating and recommended preventive maintenance instruction (where applicable)
   h. Copy of each final test report
   i. Copy of manufacturer's installation instructions
   j. List of service locations and local parts suppliers, and spare parts list
   k. Wiring diagrams

1.7 WARRANTY

A. All material and equipment provided under this division shall be free from defects in workmanship and materials for a period of two years after date of

certification of completion and acceptance of work. All defects in workmanship, materials, or performance which appear within the guarantee period shall be corrected by the Contractor on notice from the Owner or their designated representative, without cost to the Owner. In default thereof, Owner may have such work done by others and charge the cost of same to the Contractor.

1.8 SITE VISIT

A. Prior to preparing the bid, the Contractor shall visit the site and familiarize himself with existing conditions, make necessary investigations as to locations of existing equipment, utilities, etc. and all other matters which can affect work under the contract. No additional compensation will be paid to the Contractor as a result of his failure to completely familiarize himself with the existing conditions (under which the work must be performed), which could have been discovered at the site visit.

1.9 DRAWINGS

A. The drawings are diagrammatic and are intended to indicate general arrangement and manner of connections. They are not intended to show all details of construction or exact locations of the work. The exact final location of all electrical items shall be approved by the Engineer and Owner before installation.

B. The Contractor shall carefully examine all contract documents and shall be responsible for the proper fitting of all materials and equipment.

C. Although the location of materials and equipment may be shown on the drawings in a certain place, the construction may develop conditions that render this location inaccessible or impractical. The Contractor shall call the condition to the attention of the Owner or their designated representative for his direction, before fabricating and installing the work. When requested by the Owner or their designated representative, a detailed drawing of the proposed departure due to field conditions or their causes shall be submitted by the Contractor for approval. The Owner, or their designated representative, shall make all final written decisions as to the conditions which require the changing of any work.

D. A reasonable shifting in the locations of outlets before installation is expected and shall be done at no increased cost to the owner.

E. It is the intention and requirement of the specification that proper service be provided to and for all pieces of equipment requiring same. As far as possible, the proper service to each piece of equipment has been indicated on the plans. The Contractor shall verify the service requirements of all pieces of equipment before making final provisions. Shop drawings shall be obtained for check before installation. The Contractor shall also check the exact point of

connection so that service for each piece of equipment may be brought to the proper location.

1.10 TEMPORARY POWER FOR CONSTRUCTION AND LIGHT

A. The Contractor shall provide temporary power for construction and power. All costs associated with temporary power, such as permits, fees, etc. shall be paid by Contractor. Temporary wiring shall be maintained by Contractor in a safe operating condition for all areas where work is in progress.

B. All temporary work shall be in accordance with the latest OSHA, State of Maryland and local authorities having jurisdiction safety requirements and shall be completely removed upon completion of the project.

C. Permanent building power wiring and equipment can be used as temporary power for construction power and light, with the written approval from the County.

1.11 ELECTRICAL SYMBOLS

A. Electrical equipment indicated on plans by symbols shall be taken to mean a complete installed device, including all items as may be required by the NEC, or any other code or standard references and made a part of herein.

PART 2 - PRODUCTS

2.1 RELATED DOCUMENTS

A. All electrical materials and equipment shall be new, shall carry a UL label when such material, equipment, and/or systems are of a type or class listed by UL and shall be suitable for the conditions and duties imposed on them. If a UL label is not available from the manufacturer when requested or required by authorities having jurisdiction, then the equipment shall be tested by an approved electrical testing company in accordance with NEC, at no additional charge to the Owner. Submit data indicating compliance with standards prior to installation. The description, characteristics, and requirements of materials to be used shall be in accordance with qualifying conditions established in the specifications.

B. All component parts of each item of equipment or device shall bear the manufacturer's name plate, giving name of manufacturer, description, size, type, serial or model number, electrical characteristics, etc. in order to facilitate maintenance or replacement. The nameplate of a subcontractor or distributor shall not be acceptable.

C. In specifying materials, three general procedures are used. The three classifications are as follows:

1. Group 1: When the material or equipment is specified by name or other identifying information and one name brand only is used, it is considered that the use of that particular item is essential to the project and the Contractor shall base his proposal on the cost of that item. Where any item of material or equipment is specified by proprietary name, trade name or manufacturer, it is understood that the item named, is intended to be used.
2. Group 2: When the material or equipment is specified with the phrase "or approved equal..." after a brand name and other identifying information, it is intended that the brand name used is for the purpose of establishing a minimum acceptable standard of quality and performance and the Contractor may base his bid proposal on any item which is in all respects equal or better to that specified and presents essentially the same appearance, size, operation, performance, and will fit in the available space.
3. Group 3: When material is specified as complying with the requirements of published "Standard Specification" of trade associations, ANSI, ASTM, government specifications, etc. the Contractor shall base his proposal on any item which can be shown to comply in all respects with the referred "Standard Specification".

D. It is distinctly understood:

1. That the Owner or their designated representative will use his own judgment in determining whether or not any materials, equipment or methods offered for approval as an equal are equal to those specified and will fit the space available.
2. That the decision of the architect/engineer on all such question of equality is final
3. All acceptable material, equipment or methods will be provided at no increase in cost to the Owner

E. Upon receipt of written notice from the Owner or their designated representative that the material, equipment or methods have been reviewed and accepted (no exceptions taken or comments as noted), the Contractor may proceed with the accepted equal material, equipment or methods, providing the Contractor assumes full responsibility for and performs any change or adjustment in construction, such as clearances in accordance with NEC, Article 110 and/or as recommended by equipment manufacturer, that may be required by the use of such materials, equipment or methods, including services provided under other divisions at the Contractor's expense.

F. In the event of adverse decisions by the Owner of their designated representative, no claim of any sort shall be made or allowed against the Architect or the engineer or the Owner.

2.2 INSTALLATION

A. General: Sequence, coordinate, and integrate the various elements of electrical systems, materials, and equipment. Comply with the following requirements:

1. Coordinate electrical systems, equipment, and materials installation with other building components.
2. Verify all dimensions by field measurements.
3. Arrange for concrete pads, chases, slots, and openings in other building components during progress of construction, to allow for electrical installations.
4. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
5. Sequence, coordinate, and integrate installations of electrical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.
6. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.
7. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Engineer and Owner.
8. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.
9. Install electrical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.
10. Install access panel or doors where units are concealed behind finished surfaces.
11. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.

2.3 EQUIPMENT SUPPORTS, FOUNDATIONS AND STANDS

A. The Contractor shall provide all supports, foundations and stands required for the electrical equipment and shall provide, align and set all necessary anchor bolts.

B. Where equipment is indicated or specified to be floor mounted stands shall be constructed of structural steel sections (or steel pipe and fittings braced and fastened with flanges) bolted to the floor.

C. Concrete pads shall be not less than four inches high unless otherwise indicated on drawings and shall extend minimum six (6) inches beyond the equipment base on all sides. Exposed edges and corners shall be chamfered and exposed surfaces shall be finished smooth.

D. All conduit penetrations through floor slabs or other fire rated walls shall be complete with fire seals as manufactured by OZ Gedney "Fire Stop" or equal UL approved.

2.4 NAMEPLATES AND LABELS

A. All transformers, panelboards, circuit breakers, control equipment, and instrumentation, etc. shall be provided with engraved laminated black and white phenolic nameplates with beveled trim. Data and installation shall be approved by the Owner or his designated representative. Nameplate lettering shall be minimum 1/8" high etched letters. All nameplates shall be fastened with screws without altering the NEMA classification of the enclosure.

B. All wiring in junction boxes, pull boxes, etc shall be identified as to point of origin and termination. Tagging of such circuits shall be permanent. Paper or tape tags are not acceptable.

PART 3 - EXECUTION

3.1 COORDINATION OF WORK

A. The Contractor shall have a competent foreman on the premises at all times to check, layout, and superintend the installation of the work shown on the drawings and described in these specifications. He shall provide information regarding location and sizes of chases and openings and shall be responsible for the accuracy of such information. The foreman shall layout and superintend the installation of all hangers, inserts, sleeves and other work in masonry and concrete in advance of and during construction, giving consideration to the work of other trades to prevent interference in the location of other equipment.

B. Exact locations of electrical equipment, conduits, panels, etc. and other electrical work shall be coordinated with all other trades and there will be no interference between the trades. Where conflicts result, they shall be resolved by the Contractor to the satisfaction of the Owner or their designated representative at no expense to the Owner.

3.2 OUTAGES

A. The Contractor shall perform all work with a minimum duration of electrical outages.

B. All outages shall be approved by Owner and shall be scheduled at the convenience of the Owner.

C. Any losses caused by non-coordination outages shall be the responsibility of the Contractor and such loses shall be replaced at the Contractor's expenses.

3.3 WORKMANSHIP

A. Workmanship shall be of the highest quality obtainable in the trade working with the materials specified. Workmanship shall be satisfactory to the Owner or his designated representative and his decision as to acceptable quality is final.

B. All work shall be performed by skilled electricians and mechanics in the trades involved.

3.4 OVERTIME

A. Any work required to be performed at other than normal working hours (nights, holidays, weekends, etc.) shall be taken into consideration by the Contractor when computing the bids. Extra compensation shall not be allowed to the Contractor for any work performed at other than normal working hours.

3.5 HANDLING AND STORAGE OF MATERIALS

A. Paper and suitable tools, equipment and appliances for the safe and convenient handling and placing of all materials and equipment shall be used. During loading, unloading, and placing, care shall be taken in handling the equipment or materials, so that no equipment or materials are damaged.

B. All electrical material and equipment delivered to the job site shall be under roof or other approved covering, on pedestals above ground. All enclosures for equipment shall be weatherproof.

C. Provide physical protection for equipment and materials during storage as follows:

1. Equipment stored outdoors shall be supported at least eight (8) inches above ground.
2. Provide temporary wiring, heat lamps, or heating elements as required to prevent condensation of moisture in equipment, at no additional cost to the Owner.

3. Storage facilities are subject to approval of the Owner or his construction manager.

C. Thoroughly check and list all equipment received and provide the Owner's construction manager with a complete itemized list. The list shall include any damage or missing parts or equipment.

D. The Contractor shall be held accountable for all material and equipment received by him as evidenced by the list prepared by the Contractor and in the event of loss or disappearance of or damage to any such material or equipment, the Contractor shall replace such items without additional cost to the Owner.

E. Storing and maintaining materials and equipment after receipt until the completed installation is accepted by the Owner. Such storage and maintenance shall be in accordance with the manufacturer's recommendations and the requirements of these specifications. The Contractor shall be accountable for any deterioration of materials or equipment occasioned by improper storage or maintenance and shall recondition, repair, or replace any such deteriorated materials or equipment without additional cost to the Owner.

1. Electrical conduit shall be stored so as to provide protection from the weather and accidental damage. Plastic conduit shall be stored on even supports and in locations not subject to direct sun rays or excessive heat.
2. Cables shall be sealed, stored and handled carefully to avoid damage to the outer covering or insulation and damage from moisture and weather.

F. Materials and equipment which are found to be defective or damaged as a result of improper handling and or storage, shall be subject to removal, at the direction of the Owner or his designated representative and replaced with new materials and equipment with no additional cost to the Owner.

3.6 EQUIPMENT CONNECTIONS

A. All equipment requiring electrical service shall be installed and connected in accordance with the latest codes, contract documents, the best engineering practices and in accordance with manufacturer's recommendations.

B. Equipment connections indicated on drawings shall be considered diagrammatic. The actual connections shall be made to best suit the requirements of each case and to minimize the space used.

C. All conduit, outlets, wiring and all necessary fittings or accessories for connections to all electrical equipment shall be provided. All equipment ratings shown on the drawings are for the specified equipment. Should equipment of different ratings be furnished, all circuit components shall be adjusted

accordingly, at the Contractor's expense, after approval by the Owner or his designed representative. The Contractor shall be responsible for confirming the proper size and location of each equipment connection before fabrication and installation of work.

D. The Contractor shall be responsible to reach an agreement as to the limits of responsibility of the various trades when connecting to the outlets provided by others, and when providing outlets to receive connections by others, so that all work and equipment will be provided with the proper services connected and ready for use.

3.7 WATERPROOFING

A. All waterproofing and damp-proofing of the building shall be held unharmed by the installation of work under this division. Wherever any of the work or conduits under this division pierce waterproofing and damp-proofing, including outside walls, such penetrations shall be made only when approved by the Owner or their designated representative and the pierced surface shall be made watertight. Any waterproofing damaged or destroyed shall be replaced at the Contractor's expense.

3.8 CUTTING, PATCHING AND PAINTING

A. All cutting, patching and painting necessary for the installation of the electrical work shall be done under Division 2. Any damage done to work already in place shall be redone at the Contractor's expense. Patching shall be uniform in appearance and shall match surrounding surfaces. Painting, wherever required, shall match existing paint.

B. All exposed equipment, including conduit installed under this Division, shall be cleaned and left in a condition ready for painting. All items not provided with a corrosion-resistant finish shall be painted. All electrical panels, control equipment, and supporting framework, except as indicated otherwise, shall have a light gray enamel finish which may be the manufacturer's standard gray, if acceptable to Owner. Where the finish becomes scratched or marred, it shall be touched up or repainted to match the original finish as directed by the construction manager. Particular caution shall be exercised so as not to obscure the nameplate.

3.9 SLEEVES AND PLATES

A. Sleeves shall be provided by the Contractor for the installation of conduit, etc. The sleeves shall be carefully located in advance of the construction of walls and floors where new construction is involved. Provide all cutting and patching necessary to set sleeves which are not placed prior to construction.

B. Sleeves shall be provided for all conduit, etc. passing through concrete, masonry, construction. Caulk the annular space of sleeves with an elastic fire resistant caulking compound to make installation fire, air and watertight.

C. Fasten sleeves securely in the construction so that they will not become displaced when concrete is poured or when other construction is built around them. Take precautions to prevent concrete, plaster, or other materials being forced into space between conduits, etc. and sleeve during construction.

D. At all sleeves where objectionable noise can be transmitted, at smoke barriers, at walls above ceilings that extend to underside of the structure of floor above, or at fire rated separations, seal all openings between conduit, etc. and corresponding sleeves to prevent sound transmission and to maintain fire rating. Use UL approved resilient sealant for penetration seals. Submit method of sealing for approval. Where watertight sleeves are indicated or required to suite the installation, provide Link Seal rubber seals as manufactured by Thunderline Corporation, between pipes and sleeves.

E. Where conduit motion due to expansion and contraction will occur, make sleeves of sufficient diameter to permit free movement of conduit. Check construction to determine proper length for various locations; make actual lengths to suite conditions.

3.10 GROUNDING

A. The entire electrical installation shall be grounded in accordance with Article 250 of the National Electrical Code, National Electrical Safety Code, IEEE recommendations, and Underwriters Laboratories, Inc., latest editions.

3.11 TESTING AND INSPECTIONS

A. LOW VOLTAGE TESTING (600 VOLT OR LESS)

1. Upon completion of the work, the contractor shall in the presence of the owner, architect and engineer, operate, test, adjust, and retest if necessary, the complete electrical systems. All systems shall function fully and complete as intended in design, and are ready to be occupied.
2. The contractor shall furnish all labor, materials, supplies, equipment, instruments, and power necessary for measurements, testing and settings as required. The measurement, testing and setting shall demonstrate:

    a. That all the lighting, power, and control circuits are continuous and free from short circuits and other defects.
    b. That all the circuits are free from unspecified grounds
    c. That all circuits and equipment are properly connected in accordance with applicable wiring diagrams and are operable by

demonstrating the functioning of each control device not less than ten (10) times and by continuous operation of each circuit for not less than one half hour.

d. Measure the ground resistance of the electrical installations of grounding systems. The ground resistance shall not exceed 3 ohms as specified in Section 26 0526.
e. Any other testing required under other section of Division 26 work.
f. Make tests of each motor provided under Divisions 22 and 23 to measure the actual service parameters while the motor is operating at design duty conditions, including steady state full load amperes (FLA), voltage and power factor.
g. Results of the above tests shall show the all the equipment and wiring meets the requirements of these specifications before being accepted by the engineer and owner. Should any of the above tests indicate defects in materials or workmanship, the faculty installation shall be repaired or replaced at once and the tests be re-conducted at contractor's expense.
h. Operational Tests: the contractor shall note that certain other sections of these specifications require tests of the operation of various items of equipment. He shall familiarize himself with these requirements and where electrical controls are involved, in any of these tests, he shall furnish any services or materials required to make any electrical performance tests required.

3. All defects shall be repaired at once and tests re-conducted at contractor's expense.
4. For the purpose of these tests, normal and emergency conditions may be simulated during these tests if approved by the engineer. The services of the manufacturer's factory trained service engineer shall be provided to inspect the installation of all equipment furnished under this division to assure that is installed in accordance with the manufacturer's instructions, assist with startup and instruct operating personnel in the operation and maintenance of the equipment.

B. INSPECTION

1. All phases of the work shall be inspected by a local authorities having jurisdiction.
2. An electrical certificate from the local authorities having jurisdiction must be submitted to the owner prior to or with the final payment invoice.

3.13 FIELD QUALITY CONTROL

A. Perform indicated tests to demonstrate workmanship, operation, and performance.

1. Conduct tests in presence of Owner or his Representative and, if required, inspectors of agencies having jurisdiction.
2. Arrange date of tests in advance with Owner, manufacturer, and installer.
3. Give all inspectors minimum of one week notice.
4. Furnish all labor and materials required for period of test.

B. Repair or replace equipment and systems found inoperative or defective and retest.

1. If equipment or system fails retest, replace it with products, which conform with Contract Documents.
2. Continue remedial measures and retests until satisfactory results are obtained.

C. Test equipment and systems as indicated for each item, unless otherwise recommended by manufacturer.

D. Coordinate work of this section with work of other sections to insure timely delivery and installation of work.

3.16 ADJUSTING AND CLEANING

A. Inspect all equipment and put in good working order.

B. Clean all exposed and concealed items.

C. Comply with the requirements in Division 1.

3.17 TRAINING

A. Refer to Division 1 Section “Demonstration and Training” for electrical systems & components and electrical equipment.

B. Provide Training as specified in the above referenced specification section and the Division 26 technical specifications.

END OF SECTION 26 0500

SECTION 260519

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Building wires and cables rated 600 V and less.
2. Connectors, splices, and terminations rated 600 V and less.

1.3 SUBMITTALS

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

B. Field quality-control test reports.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association to supervise on-site testing specified in Part 3.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NFPA 70, “National Electrical Code”.

1.5 COORDINATION

A. Set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

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

1. American Insulated Wire Corp.; a Leviton Company.
2. General Cable Corporation
3. Senator Wire & Cable Company.
4. Southwire Company.

B. Copper Conductors: Comply with NEMA WC 70. Flexible, insulated and uninsulated, drawn copper current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.

C. Aluminum conductors are not acceptable.

D. Conductor Insulation: Comply with NEMA WC 70 for Types THHN-THWN, XHHW, UF, USE, and SO.

1. Type USE-2 and Type SE: Comply with UL 854.
2. Type THHN and Type THWN-2: Comply with UL 83.
3. Type UF: Comply with UL 83 and UL 493.
4. Type XHHW-2: Comply with UL 44.

E. Multi-conductor cable: Copper conductors with insulated ground conductor. Comply with NEMA WC 70 for Metal Clad cable type MC.

F. Color Coding: Comply with the requirements in Section 26 0553 “Identification for Electrical Systems.”

2.2 CONNECTORS AND SPLICES

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

1. Hubbell Power Systems, Inc.
2. O-Z/Gedney; EGS Electrical Group LLC.
3. 3M; Electrical Products Division.
4. Thomas & Betts Corporation.
5. Tyco Electronics Corp.

B. Description: Factory-fabricated connectors, splices, and lugs of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

C. Lugs: One piece, seamless, designed to terminate conductors specified in this Section.

1. Material: Copper.
2. Type: One or Two hole with standard or long barrels.
3. Termination: Compression.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Exposed Feeders and Branch Circuits: Type XHHW-2, single conductors in raceway.

B. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Type THHN-THWN-2, single conductors in raceway.

C. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type XHHW-2 single conductors in raceway.

D. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN-2, single conductors in raceway.

E. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN-2, (Type XHHW for computer/nonlinear loads) single conductors in raceway. Use MC Cable only where acceptable to Owner.

1. MC Cable is not allowed for all interior dry locations concealed above ceiling or behind drywall. All wiring shall be run in EMT up to an accessible junction box in the room and MC cable can be run only to the lighting fixtures and motor whips (only for dry locations). Maximum length for MC cable allowed is 72 inches.

2. MC cables will not be allowed for home runs and 3 phase motor branch circuits
3. MC cables will not be allowed in any exposed location such as electrical rooms, mechanical rooms, theatres, performing spaces, studios, communication rooms, dimming rooms, AV rooms, etc. MC cables will not be allowed for any feeder wiring, for any damp and wet location, fire alarm system, security system and other special systems.

F. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type RHW, single conductors in raceway.

G. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.

H. Class 1 Control Circuits: Type THHN-THWN, in raceway.

I. Class 2 Control Circuits: Type THHN-THWN, in raceway.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.

B. Complete raceway installation between conductor and cable termination points according to Section 26 0533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.

C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

F. Support cables according to Section 26 0529 "Hangers and Supports for Electrical Systems."

G. Identify and color-code conductors and cables according to Section 26 0553 “Identification for Electrical Systems."

H. Routing of raceways shall be in accordance with the penetration control plans. Penetrations through acoustically significant construction shall be sealed

airtight in accordance with penetration control plans, resiliently sealed penetration details, and Section 07 9200 – “Joint Sealants”.

I. Low voltage and/or communication cables that penetrate acoustically significant construction, defined by the penetration control plans, should be minimally run in conduits from each room’s back boxes to a stub out in the hallway.

3.4 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 12inches of slack.

3.5 IDENTIFICATION

A. Identify and color-code conductors and cables according to Section 26 0553 "Identification for Electrical Systems."

B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.6 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 26 0544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.7 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Section 07 8413 “Penetration Firestopping."

3.8 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

B. Tests and Inspections:

1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors for compliance with requirements.
2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

C. Cables will be considered defective if they do not pass tests and inspections.

D. Test Reports: Prepare a written report to record the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

E. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION 26 0519

SECTION 260526

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Sections includes grounding and bonding systems and equipment.

1.3 SUBMITTALS

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

B. Other Informational Submittals: Plans showing dimensioned as-built locations of grounding features specified in Part 3 "Field Quality Control" Article, including the following:

1. Ground rods.
2. Grounding arrangements and connections for separately derived systems.
3. Grounding for sensitive electronic equipment.

C. Qualification Data: For testing agency and testing agency's field supervisor.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For grounding to include the following in emergency, operation, and maintenance manuals:

1. Instructions for periodic testing and inspection of grounding features at test wells and ground rings based on NETA MTS and NFPA 70B.

a. Tests shall determine if ground resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if they do not.

b. Include recommended testing intervals for each grounding system including Lightning Protection system.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association to supervise on-site testing specified in Part 3.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 CONDUCTORS

A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:

1. Solid Conductors: ASTM B 3.
2. Stranded Conductors: ASTM B 8.
3. Tinned Conductors: ASTM B 33.
4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
6. Bonding Jumper: Copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

C. Grounding Bus: Predrilled, rectangular bars of annealed copper, 1/4 inch by 4 inches in cross section, with 9/32-inch holes spaced 1-1/8 inch apart.

D. Stand-off insulators shall comply with UL 891 for use in switchboards, switchgear, 600V, Lexan or PVC and impulse tested at 5000 V.

2.2 CONNECTORS

A. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.

B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, bolted pressure-type, with at least two bolts.

1. Pipe Connectors: Clamp type, sized for pipe.

C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

D. Bus-bar connections: Mechanical type, cast silicon bronze, solderless, compression type wire terminals, and long-barrel, two-bolt connections to ground bus bar.

2.3 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel, 3/4 inch in diameter by 10 feet long.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger, unless otherwise indicated.

B. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.

C. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.

3.2 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

C. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.

3.3 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connectors for outdoor locations, but if a disconnect-type connection is required, use a bolted clamp.

C. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install bonding jumper to bond across flexible duct connections to achieve continuity.

3.4 LABELING

A. Comply with requirements in Section 26 0553 "Identification for Electrical Systems" for instruction signs. The label or its text shall be green.

B. Install labels at the telecommunications bonding conductor and grounding equalizer and at the grounding electrode conductor where exposed.

1. Label Text: "If this connector or cable is loose or if it must be removed for any reason, notify the facility manager."

3.5 FIELD QUALITY CONTROL

A. Perform the following tests and inspections and prepare test reports:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, at ground test wells. Make tests at ground rods before any conductors are connected.

    a. Measure ground resistance not less than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
    b. Perform tests by fall-of-potential method according to IEEE 81.

B. Grounding system will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports

D. Report measured ground resistances that exceed the following values:

1. Power and Lighting Equipment or System: 5 ohms.
2. Substations and Pad-Mounted Equipment: 5 ohms.

E. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 26 0526

SECTION 260529

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Hangers and supports for electrical equipment and systems.

1.3 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. IMC: Intermediate metal conduit.

C. RMC: Rigid metal conduit.

1.4 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.

C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.5 QUALITY ASSURANCE

A. Comply with NFPA 70, “National Electrical Code”.

1.6 COORDINATION

A. Coordinate installation of equipment supports, and roof penetrations.

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.

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

a. Allied Tube & Conduit.
b. Cooper B-Line, Inc.; a division of Cooper Industries.
c. ERICO International Corporation
d. Thomas & Betts Corporation.
e. Unistrut; Tyco International, Ltd.

2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
3. Channel Dimensions: Selected for applicable load criteria.

B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

C. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Powder-Actuated Fasteners or Drive pin type fasteners: Not allowed
2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and

pullout capacities appropriate for supported loads and building materials in which used.

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

1) Cooper B-Line, Inc.; a division of Cooper Industries.
2) Empire Tool and Manufacturing Co., Inc.
3) Hilti Inc.
4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
5) MKT Fastening, LLC.

3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Section 05 5000 "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.

B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.

C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

1. Secure raceways and cables to these supports with two-bolt conduit clamps.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.

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.

C. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.
3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To Existing Concrete: Expansion anchor fasteners.
5. Do not use powder actuated fasteners and drive pin type fasteners
6. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
7. To Light Steel: Sheet metal screws.
8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.

D. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Section 05 5000 "Metal Fabrications" for site-fabricated metal supports.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

   1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 26 0529

SECTION 260533

RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Metal conduits and fittings.
2. Surface raceways.
3. Boxes, enclosures, and cabinets.

B. Related Requirements:

1. Section 07 8413 "Penetration Firestopping" for firestopping at conduit and box entrances.

1.3 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. FMC: Flexible metal conduit.

C. GRC: Galvanized rigid steel conduit.

D. IMC: Intermediate metal conduit.

E. LFMC: Liquid flexible metal conduit.

1.4 ACTION SUBMITTALS

A. Product Data: For surface raceways, and fittings, floor boxes, hinged-cover enclosures, and cabinets.

PART 2 - PRODUCTS

2.1 METAL CONDUITS AND FITTINGS

A. Metal Conduit:

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

    a. Allied Tube & Conduit; a part of Atkore International.
    b. Calconduit.
    c. Electri-Flex Company.
    d. NEC, Inc.
    e. Southwire Company.
    f. Thomas & Betts Corporation; A Member of the ABB Group.

2. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
3. GRC: Comply with ANSI C80.1 and UL 6.
4. IMC: Comply with ANSI C80.6 and UL 1242.
5. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.

    a. Comply with NEMA RN 1.
    b. Coating Thickness: 0.040 inch, minimum.

6. EMT: Comply with ANSI C80.3 and UL 797.
7. FMC: Comply with UL 1; zinc-coated steel.
8. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

B. Metal Fittings:

1. Comply with NEMA FB 1 and UL 514B.
2. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
3. Fittings, General: Listed and labeled for type of conduit, location, and use.
4. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 1203 and NFPA 70.
5. Fittings for EMT:

    a. Material: Steel or die cast.
    b. Type: compression.

6. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
7. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch, with overlapping sleeves protecting threaded joints.

C. Joint Compound for IMC or GRC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 SURFACE RACEWAYS

A. Listing and Labeling: Surface raceways shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Surface Metal Raceways: Galvanized steel with snap-on covers complying with UL 5. Manufacturer's standard enamel finish in color selected by Architect.

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

   a. Hubbell Incorporated; Wiring Device-Kellems.
   b. Wiremold / Legrand.

2.3 BOXES, ENCLOSURES, AND CABINETS

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

1. Crouse-Hinds, an Eaton business.
2. Hoffman; a brand of Pentair Equipment Protection.
3. Hubbell Incorporated.
4. Hubbell Incorporated; Wiring Device-Kellems.
5. Kraloy.
6. O-Z/Gedney; a brand of Emerson Industrial Automation.
7. RACO; Hubbell.
8. Thomas & Betts Corporation; A Member of the ABB Group.
9. Wiremold / Legrand.

B. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.

~~C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.~~

~~D.~~C. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.

~~E.~~D. Metal Floor Boxes:

1. Material: Cast metal.
2. Type: Fully adjustable.
3. Shape: Rectangular.
4. Listing and Labeling: Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

~~F.~~E. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb. Outlet boxes designed for attachment of luminaires weighing more than 50 lb shall be listed and marked for the maximum allowable weight.

~~G.~~F. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

~~H.~~G. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, galvanized, cast iron with gasketed cover.

~~I.~~H. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

~~J.~~I. Device Box Dimensions: 4 inches square by 2-1/8 inches deep.

~~K.~~J. Gangable boxes are prohibited.

~~L.~~K. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 1 for indoor, Type 3R for outdoor with continuous-hinge cover with flush latch unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.

~~M.~~L. Cabinets:

1. NEMA 250, Type 1 galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed Conduit: GRC.
2. Concealed Conduit, Aboveground: IMC.
3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
4. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.

B. Indoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: GRC up to 8 feet of finished floor. EMT above 8 feet from finished floor.
2. Exposed, Not Subject to Severe Physical Damage: Surface metal raceway, Wiremold 7000 with minimum two hole straps. EMT only where acceptable to Owner.
3. Exposed and Subject to Severe Physical Damage: GRC. Raceway locations include the following:

    a. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
    b. Mechanical rooms.

4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
6. Damp or Wet Locations: GRC.
7. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel in institutional and commercial kitchens and damp or wet locations.

C. Minimum Raceway Size: 3/4-inch trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and

scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.

3. EMT: Use compression, steel or cast-metal fittings. Comply with NEMA FB 2.10.
4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

E. Do not install aluminum conduits, boxes, or fittings.

F. Install surface raceways only where indicated on Drawings.

3.2 INSTALLATION

A. Comply with requirements in Section 26 0529 "Hangers and Supports for Electrical Systems" for hangers and supports.

B. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.

C. Do not install raceways or electrical items on any "explosion-relief" walls or rotating equipment.

D. Do not fasten conduits onto the bottom side of a metal deck roof.

E. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

F. Complete raceway installation before starting conductor installation.

G. Arrange stub-ups so curved portions of bends are not visible above finished slab.

H. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches of changes in direction.

I. Make bends in raceway using large-radius preformed ells. Field bending shall be according to NFPA 70 minimum radii requirements. Use only equipment specifically designed for material and size involved.

J. Conceal conduit within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

K. Support conduit within 12 inches of enclosures to which attached.

L. Stub-Ups to Above Recessed Ceilings:

1. Use EMT, IMC, or RMC for raceways.
2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

M. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

N. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.

O. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.

P. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch trade size and insulated throat metal bushings on 1-1/2-inch trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.

Q. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.

R. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.

S. Cut conduit perpendicular to the length. For conduits 2-inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.

T. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

U. Surface Raceways:

1. Install surface raceway with a minimum 2-inch radius control at bend points.
2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.

V. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings according to NFPA 70.

W. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Conduit extending from interior to exterior of building.
3. Conduit extending into pressurized duct and equipment.
4. Conduit extending into pressurized zones that are automatically controlled to maintain different pressure set points.
5. Where otherwise required by NFPA 70.

X. Comply with manufacturer's written instructions for solvent welding RNC and fittings.

Y. Expansion-Joint Fittings:

1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F and that has straight-run length that exceeds 25 feet. Install in each run of aboveground EMT conduit that is located where environmental temperature change may exceed 100 deg F and that has straight-run length that exceeds 100 feet.
2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:

    a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.
    b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.
    c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F temperature change.
    d. Attics: 135 deg F temperature change.

3. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F of temperature change for metal conduits.
4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for

conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

Z. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches of flexible conduit for recessed and semirecessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

1. Use LFMC in damp or wet locations subject to severe physical damage.
2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.

AA. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.

BB. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.

CC. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

DD. Locate boxes so that cover or plate will not span different building finishes.

EE. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

FF. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

GG. Set metal floor boxes level and flush with finished floor surface.

3.3 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 26 0544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.4 FIRESTOPPING

A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 07 8413 "Penetration Firestopping."

3.5 PROTECTION

A. Protect coatings, finishes, and cabinets from damage and deterioration.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 26 0533

SECTION 26 0544

SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors.
2. Sleeve-seal systems.
3. Sleeve-seal fittings.
4. Grout.
5. Silicone sealants.

B. Related Requirements:

1. Section 07 8413 "Penetration Firestopping" for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Wall Sleeves:

1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.
2. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.

C. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.

D. Sleeves for Rectangular Openings:

1. Material: Galvanized sheet steel.
2. Minimum Metal Thickness:

a. For sleeve cross-section rectangle perimeter less than 50 inches and with no side larger than 16 inches, thickness shall be 0.052 inch.
b. For sleeve cross-section rectangle perimeter 50 inches or more and one or more sides larger than 16 inches, thickness shall be 0.138 inch.

2.2 SLEEVE-SEAL SYSTEMS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.

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

a. Advance Products & Systems, Inc.
b. CALPICO, Inc.
c. Metraflex Company (The).
d. Pipeline Seal and Insulator, Inc.
e. Proco Products, Inc.

2. Sealing Elements: EPDM rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
3. Pressure Plates: Stainless steel].
4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

2.3 SLEEVE-SEAL FITTINGS

A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.

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

    a. Presealed Systems.

2.4 GROUT

A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.

B. Standard: ASTM C 1107/C 1107M, 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.

2.5 SILICONE SEALANTS

A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.

1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.
2. Sealant shall have VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

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

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

A. Comply with NECA 1, “Standard Practice for Good Workmanship in Electrical Construction”.

B. Comply with NEMA VE 2 for cable tray and cable penetrations.

C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:

1. Interior Penetrations of Non-Fire-Rated Walls and Floors:

    a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section 07 9200 "Joint Sealants."
    b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.

2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
3. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed unless seismic criteria require different clearance.
4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches above finished floor level. Install sleeves during erection of floors.

D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:

1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.

E. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.

B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.3 SLEEVE-SEAL-FITTING INSTALLATION

A. Install sleeve-seal fittings in new walls and slabs as they are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.

C. Secure nailing flanges to concrete forms.

D. Using grout, seal the space around outside of sleeve-seal fittings.

END OF SECTION 26 0544

SECTION 260553

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Identification for raceways.
2. Identification for conductors.
3. Warning labels and signs.
4. Instruction signs.
5. Equipment identification labels.
6. Miscellaneous identification products.

1.3 SUBMITTALS

A. Product Data: For each electrical identification product indicated.

1.4 QUALITY ASSURANCE

A. Comply with ANSI A13.1, “Scheme for Identification of Piping Systems” and ANSI C2, “National Electrical Safety Code”.

B. Comply with NFPA 70, “National Electrical Code”.

C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

D. Comply with ANSI Z535.4 for safety signs and labels.

1.5 COORDINATION

A. Coordinate identification names, abbreviations, colors, and other features with requirements in the Contract Documents, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual, and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

C. Coordinate installation of identifying devices with location of access panels and doors.

D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 POWER RACEWAY IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.

B. Colors for Raceways Carrying Circuits at 600 V or Less:

1. Black letters on an orange field.
2. Legend: Indicate voltage.

C. Snap-Around Labels for Raceways Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

D. Write-On Tags: Polyester tag, 0.010 inch thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.

E. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

2.2 METAL-CLAD CABLE IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

B. Colors for Raceways Carrying Circuits at 600 V and Less:

1. Black letters on an orange field.
2. Legend: Indicate voltage.

C. Colors for Raceways Carrying Circuits at More Than 600 V:

1. Black letters on an orange field.
2. Legend: "DANGER CONCEALED HIGH VOLTAGE WIRING" with 3-inch-high letters on 20-inch centers.

D. Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing ends of legend label.

2.3 WARNING LABELS AND SIGNS

A. Comply with NFPA 70 and 29 CFR 1910.145.

B. Baked-Enamel Warning Signs: Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application. 1/4-inch grommets in corners for mounting. Nominal size, 7 by 10 inches.

C. Metal-Backed, Butyrate Warning Signs: Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch galvanized-steel backing; and with colors, legend, and size required for application. 1/4-inch grommets in corners for mounting. Nominal size, 10 by 14 inches.

D. Warning label and sign shall include, but are not limited to, the following legends:

1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."

E. Tag:

1. Detectable three-layer laminate, consisting of a printed pigmented polyolefin film, a solid aluminum-foil core, and a clear protective film that allows inspection of the continuity of the conductive core, bright-colored, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
2. Overall Thickness: 5 mils.
3. Foil Core Thickness: 0.35 mil.
4. Weight: 28 lb/1000 sq. ft..

5. 3-Inch Tensile According to ASTM D 882: 70 lbf, and 4600 psi.

2.4 INSTRUCTION SIGNS

A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch thick for signs up to 20 sq. in. and 1/8 inch thick for larger sizes.

1. Engraved legend with black letters on white face.
2. Punched or drilled for mechanical fasteners.
3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.5 EQUIPMENT IDENTIFICATION LABELS

A. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. White letters on a black background. Minimum letter height shall be 3/8 inch.

B. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch .

2.6 CABLE TIES

A. General-Purpose Cable Ties: Fungus inert, self extinguishing, one piece, self locking, Type 6/6 nylon.

1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 deg F, According to ASTM D 638: 12,000 psi.
3. Temperature Range: Minus 40 to plus 185 deg F.
4. Color: Black except where used for color-coding.

2.7 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. `Paint: Paint materials and application requirements are specified in Division 09 painting sections.

B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Verify identity of each item before installing identification products.

B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

C. Apply identification devices to surfaces that require finish after completing finish work.

D. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

E. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.

F. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:

1. Outdoors: UV-stabilized nylon.
2. In Spaces Handling Environmental Air: Plenum rated.

G. Painted Identification: Comply with requirements in painting Sections for surface preparation and paint application.

3.2 IDENTIFICATION SCHEDULE

A. Accessible Raceways, Armored and Metal-Clad Cables, More Than 600 V: Snap-around labels. Install labels at 10-foot maximum intervals.

B. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30 A, and 120 V to ground: Identify with self-adhesive vinyl tape applied in bands. Install labels at 10-foot maximum intervals.

C. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels with the wiring system legend and system voltage. System legends shall be as follows:

1. Emergency Power.
2. Power.

D. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.

1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: A color coding system as listed below shall be used throughout the building's network of feeders and circuits and used as a basis of balancing the load. Match the Owner's color coding standard. If no standard color coding system exist, use the following:

a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG, if authorities having jurisdiction permit.
b. All wires used solely for grounding purposes shall have green color if insulated.
c. Colors for 208/120-V Circuits:

1) Phase A: Black.
2) Phase B: Red.
3) Phase C: Blue.

d. Colors for 480/277-V Circuits:

1) Phase A: Brown.
2) Phase B: Orange.
3) Phase C: Yellow.

e. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.
f. Control Wiring: Color coded with wires of colors different from those used to designate phase wires.

E. Power-Circuit Conductor Identification, More than 600 V: For conductors in vaults, pull and junction boxes, manholes, and handholes, use write-on tags.

F. Install instructional sign including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.

G. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source.

H. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.

1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.

2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.

I. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive warning labels.

1. Comply with 29 CFR 1910.145.
2. Identify system voltage with black letters on an orange background.
3. Apply to exterior of door, cover, or other access.
4. For equipment with multiple power or control sources, apply to door or cover of equipment including, but not limited to, the following:

   a. Power transfer switches.
   b. Controls with external control power connections.

J. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.

K. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch-high letters for emergency instructions at equipment used for power transfer.

L. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.

1. Labeling Instructions:

   a. Indoor Equipment: Engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on 1-1/2-inch-high label; where two lines of text are required, use labels 2 inches high.
   b. Outdoor Equipment: Engraved, laminated acrylic or melamine label.
   c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
   d. Fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

2. Devices to be Labeled:

a. Each receptacle outlet. Note that the receptacle labels shall be updated based on the balancing the loads for the panelboards.

3. Equipment to Be Labeled:

a. Identification labeling of some items listed below may be required by individual Sections or by NFPA 70.
b. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be engraved, laminated acrylic or melamine label. Update or replace directory of all existing panelboards affected by the work.
c. Enclosures and electrical cabinets.
d. Access doors and panels for concealed electrical items.
e. Transformers: Label that includes tag designation shown on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.
f. Enclosed switches.
g. Enclosed circuit breakers.
h. Enclosed controllers.
i. Variable-speed controllers.
j. Push-button stations.
k. Power transfer equipment.
l. Contactors.
m. Remote-controlled switches, dimmer modules, and control devices.
n. Monitoring and control equipment.

END OF SECTION 26 0553

SECTION 260573.13

SHORT-CIRCUIT STUDIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes a computer-based, fault-current study to determine the minimum interrupting capacity of circuit protective devices. Contractor shall be responsible to perform the study before ordering electrical equipment such as panel boards, meter stacks, etc.

1.3 DEFINITIONS

A. Field Adjusting Agency: An independent electrical testing agency with full-time employees and the capability to adjust devices and conduct testing indicated and that is a member company of NETA.

B. One-Line Diagram: A diagram that shows, by means of single lines and graphic symbols, the course of an electric circuit or system of circuits and the component devices or parts used therein.

C. Power System Analysis Software Developer: An entity that commercially develops, maintains, and distributes computer software used for power system studies.

D. Power Systems Analysis Specialist: Professional engineer in charge of performing the study and documenting recommendations, licensed in the state where Project is located.

E. Protective Device: A device that senses when an abnormal current flow exists and then removes the affected portion of the circuit from the system.

F. SCCR: Short-circuit current rating.

G. Service: The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.

H. Single-Line Diagram: See "One-Line Diagram."

1.4 ACTION SUBMITTALS

A. Product Data:

1. For computer software program to be used for studies.
2. Submit the following after the approval of system protective devices submittals. Submittals may be in digital form.

a. Short-circuit study input data, including completed computer program input data sheets.

b. Short-circuit study and equipment evaluation report; signed, dated, and sealed by a qualified professional engineer.

1) Submit study report for action prior to receiving final approval of distribution equipment submittals. If formal completion of studies will cause delay in equipment manufacturing, obtain approval from Architect for preliminary submittal of sufficient study data to ensure that selection of devices and associated characteristics is satisfactory.

2) Revised one-line diagram, reflecting field investigation results and results of short-circuit study.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data:

1. For Power Systems Analysis Software Developer.
2. For Power System Analysis Specialist.
3. For Field Adjusting Agency.

B. Product Certificates: For short-circuit study software, certifying compliance with IEEE 399.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data:

1. For overcurrent protective devices to include in emergency, operation, and maintenance manuals.
2. The following are from the Short-Circuit Study Report:

    a. Final one-line diagram.
    b. Final Short-Circuit Study Report.
    c. Short-circuit study data files.

    d. Power system data.

1.7 QUALITY ASSURANCE

A. Study shall be performed using commercially developed and distributed software designed specifically for power system analysis.

B. Software algorithms shall comply with requirements of standards and guides specified in this Section.

C. Manual calculations are unacceptable.

1. Power System Analysis Software Qualifications: Computer program shall be designed to perform short-circuit studies or have a function, component, or add-on module designed to perform short-circuit studies.
2. Computer program shall be developed under the charge of a licensed professional engineer who holds IEEE Computer Society's Certified Software Development Professional certification.

D. Power Systems Analysis Specialist Qualifications: Professional engineer licensed in the state where Project is located. All elements of the study shall be performed under the direct supervision and control of this professional engineer.

E. Short-Circuit Study Certification: Short-Circuit Study Report shall be signed and sealed by Power Systems Analysis Specialist.

F. Field Adjusting Agency Qualifications:

1. Employer of a NETA ETT-Certified Technician Level III or NICET Electrical Power Testing Level III certification responsible for all field adjusting of the Work.
2. A member company of NETA.
3. Acceptable to authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 POWER SYSTEM ANALYSIS SOFTWARE DEVELOPERS

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

1. CGI CYME.
2. EDSA Micro Corporation.
3. ESA Inc.
4. Operation Technology, Inc.
5. Power Analytics, Corporation.
6. SKM Systems Analysis, Inc.

B. Comply with IEEE 399 and IEEE 551.

1. Analytical features of power systems analysis software program shall have capability to calculate "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.

C. Computer software program shall be capable of plotting and diagramming time-current-characteristic curves as part of its output.

2.2 SHORT-CIRCUIT STUDY REPORT CONTENTS

A. Executive summary of study findings.

B. Study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpretation of results.

C. One-line diagram of modeled power system, showing the following:

1. Protective device designations and ampere ratings.
2. Conductor types, sizes, and lengths.
3. Transformer kilovolt ampere (kVA) and voltage ratings.
4. Motor and generator designations and kVA ratings.
5. Switchgear, switchboard, motor-control center, and panelboard designations and ratings.
6. Derating factors and environmental conditions.
7. Any revisions to electrical equipment required by the study.

D. Comments and recommendations for system improvements or revisions in a written document, separate from one-line diagram.

E. Protective Device Evaluation:

1. Evaluate equipment and protective devices and compare to available short-circuit currents. Verify that equipment withstand ratings exceed available short-circuit current at equipment installation locations.
2. Tabulations of circuit breaker, fuse, and other protective device ratings versus calculated short-circuit duties.
3. For 600-V overcurrent protective devices, ensure that interrupting ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.
4. For devices and equipment rated for asymmetrical fault current, apply multiplication factors listed in standards to 1/2-cycle symmetrical fault current.
5. Verify adequacy of phase conductors at maximum three-phase bolted fault currents; verify adequacy of equipment grounding conductors and grounding electrode conductors at maximum ground-fault currents. Ensure that short-circuit withstand ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.

F. Short-Circuit Study Input Data:

1. One-line diagram of system being studied.
2. Power sources available.
3. Manufacturer, model, and interrupting rating of protective devices.
4. Conductors.
5. Transformer data.

G. Short-Circuit Study Output Reports:

1. Low-Voltage Fault Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:

    a. Voltage.
    b. Calculated fault-current magnitude and angle.
    c. Fault-point X/R ratio.
    d. Equivalent impedance.

2. Momentary Duty Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:

    a. Voltage.
    b. Calculated symmetrical fault-current magnitude and angle.
    c. Fault-point X/R ratio.
    d. Calculated asymmetrical fault currents:

1) Based on fault-point X/R ratio.
2) Based on calculated symmetrical value multiplied by 1.6.
3) Based on calculated symmetrical value multiplied by 2.7.

3. Interrupting Duty Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:

a. Voltage.
b. Calculated symmetrical fault-current magnitude and angle.
c. Fault-point X/R ratio.
d. No AC Decrement (NACD) ratio.
e. Equivalent impedance.
f. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a symmetrical basis.
g. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a total basis.

PART 3 - EXECUTION

3.1 POWER SYSTEM DATA

A. Obtain all data necessary for conduct of the study.

1. Verify completeness of data supplied on one-line diagram. Call any discrepancies to Architect's attention.
2. For equipment included as Work of this Project, use characteristics submitted under provisions of action submittals and information submittals for this Project.

B. Gather and tabulate the required input data to support the short-circuit study. Comply with requirements in Section 017839 "Project Record Documents" for recording circuit protective device characteristics. Record data on a Record Document copy of one-line diagram. Comply with recommendations in IEEE 551 as to the amount of detail that is required to be acquired in the field. Field data gathering shall be under direct supervision and control of the engineer in charge of performing the study, and shall be by the engineer or its representative who holds NETA ETT-Certified Technician Level III or NICET Electrical Power Testing Level III certification. Data include, but are not limited to, the following:

1. Product Data for Project's overcurrent protective devices involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
2. Obtain electrical power utility impedance at the service.
3. Power sources and ties.
4. For reactors, provide manufacturer and model designation, voltage rating, and impedance.
5. For circuit breakers and fuses, provide manufacturer and model designation. List type of breaker, type of trip, SCCR, current rating, and breaker settings.
6. Busway manufacturer and model designation, current rating, impedance, lengths, and conductor material.
7. Motor horsepower and NEMA MG 1 code letter designation.
8. Conductor sizes, lengths, number, conductor material and conduit material (magnetic or nonmagnetic).
9. Derating factors.

3.2 SHORT-CIRCUIT STUDY

A. Perform study following the general study procedures contained in IEEE 399.

B. Calculate short-circuit currents according to IEEE 551.

C. Base study on device characteristics supplied by device manufacturer.

D. Extent of electrical power system to be studied is indicated on Drawings.

E. Begin short-circuit current analysis at the service, extending down to system overcurrent protective devices as follows:

1. To normal system low-voltage load buses where fault current is 10 kA or less.

2. Exclude equipment rated 240 V ac or less when supplied by a single transformer rated less than 125 kVA.

F. Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for Project. Study all cases of system-switching configurations and alternate operations that could result in maximum fault conditions.

G. Include the ac fault-current decay from induction motors, synchronous motors, and asynchronous generators and apply to low- and medium-

voltage, three-phase ac systems. Also account for the fault-current dc decrement to address asymmetrical requirements of interrupting equipment.

H. Calculate short-circuit momentary and interrupting duties for a three-phase bolted fault and a single line-to-ground fault at each equipment indicated on one-line diagram.

1. For grounded systems, provide a bolted line-to-ground fault-current study for areas as defined for the three-phase bolted fault short-circuit study.

I. Include in the report identification of any protective device applied outside its capacity.

END OF SECTION 260573.13

SECTION 260573.16

COORDINATION STUDIES

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 computer-based, overcurrent protective device coordination studies to determine overcurrent protective devices and to determine overcurrent protective device settings for selective tripping.

1. Study results shall be used to determine coordination of series-rated devices.

1.3 DEFINITIONS

A. Field Adjusting Agency: An independent electrical testing agency with full-time employees and the capability to adjust devices and conduct testing indicated and that is a member company of NETA.

B. One-Line Diagram: A diagram that shows, by means of single lines and graphic symbols, the course of an electric circuit or system of circuits and the component devices or parts used therein.

C. Power System Analysis Software Developer: An entity that commercially develops, maintains, and distributes computer software used for power system studies.

D. Power System Analysis Specialist: Professional engineer in charge of performing the study and documenting recommendations, licensed in the state where Project is located.

E. Protective Device: A device that senses when an abnormal current flow exists and then removes the affected portion of the circuit from the system.

F. SCCR: Short-circuit current rating.

G. Service: The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.

H. Single-Line Diagram: See "One-Line Diagram."

1.4 ACTION SUBMITTALS

A. Product Data:

1. For computer software program to be used for studies.
2. Submit the following after the approval of system protective devices submittals. Submittals may be in digital form.

a. Coordination-study input data, including completed computer program input data sheets.
b. Study and equipment evaluation reports.

3. Overcurrent protective device coordination study report; signed, dated, and sealed by a qualified professional engineer.

a. Submit study report for action prior to receiving final approval of distribution equipment submittals. If formal completion of studies will cause delay in equipment manufacturing, obtain approval from Architect for preliminary submittal of sufficient study data to ensure that selection of devices and associated characteristics is satisfactory.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data:

1. For Power System Analysis Software Developer.
2. For Power Systems Analysis Specialist.
3. For Field Adjusting Agency.

B. Product Certificates: For overcurrent protective device coordination study software, certifying compliance with IEEE 399.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For overcurrent protective devices to include in emergency, operation, and maintenance manuals.

1. The following are from the Coordination Study Report:

a. Final one-line diagram.
b. Final protective device coordination study.
c. Coordination study data files.
d. List of all protective device settings.
e. Time-current coordination curves.
f. Power system data.

1.7 QUALITY ASSURANCE

A. Studies shall be performed using commercially developed and distributed software designed specifically for power system analysis.

B. Software algorithms shall comply with requirements of standards and guides specified in this Section.

C. Manual calculations are unacceptable.

D. Power System Analysis Software Qualifications:

1. Computer program shall be designed to perform coordination studies or have a function, component, or add-on module designed to perform coordination studies.
2. Computer program shall be developed under the charge of a licensed professional engineer who holds IEEE Computer Society's Certified Software Development Professional certification.

E. Power Systems Analysis Specialist Qualifications: Professional engineer licensed in the state where Project is located. All elements of the study shall be performed under the direct supervision and control of this professional engineer.

F. Field Adjusting Agency Qualifications:

1. Employer of a NETA ETT-Certified Technician Level III responsible for all field adjusting of the Work.
2. A member company of NETA.
3. Acceptable to authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 POWER SYSTEM ANALYSIS SOFTWARE DEVELOPERS

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

1. ESA Inc.
2. Operation Technology, Inc.
3. Power Analytics, Corporation.
4. SKM Systems Analysis, Inc.

B. Comply with IEEE 242 and IEEE 399.

C. Analytical features of device coordination study computer software program shall have the capability to calculate "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.

D. Computer software program shall be capable of plotting and diagramming time-current-characteristic curves as part of its output. Computer software program shall report device settings and ratings of all overcurrent protective devices and shall demonstrate selective coordination by computer-generated, time-current coordination plots.

1. Optional Features:

a. Arcing faults.
b. Simultaneous faults.
c. Explicit negative sequence.
d. Mutual coupling in zero sequence.

2.2 COORDINATION STUDY REPORT CONTENTS

A. Executive summary of study findings.

B. Study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpretation of results.

C. One-line diagram of modeled power system, showing the following:

1. Protective device designations and ampere ratings.
2. Conductor types, sizes, and lengths.
3. Transformer kilovolt ampere (kVA) and voltage ratings
4. .
5. Motor and generator designations and kVA ratings.
6. Switchboard, motor-control center, and panelboard designations.
7. Any revisions to electrical equipment required by the study.
8. Study Input Data: As described in "Power System Data" Article.

a. Short-Circuit Study Output: As specified in "Short-Circuit Study Output Reports" Paragraph in "Short-Circuit Study Report Contents" Article in Section 260573.13 "Short-Circuit Studies."

D. Protective Device Coordination Study:

1. Report recommended settings of protective devices, ready to be applied in the field. Use manufacturer's data sheets for recording the recommended setting of overcurrent protective devices when available.

a. Phase and Ground Relays:

1) Device tag.
2) Relay current transformer ratio and tap, time dial, and instantaneous pickup value.
3) Recommendations on improved relaying systems, if applicable.

b. Circuit Breakers:

1) Adjustable pickups and time delays (long time, short time, and ground).
2) Adjustable time-current characteristic.
3) Adjustable instantaneous pickup.
4) Recommendations on improved trip systems, if applicable.

c. Fuses: Show current rating, voltage, and class.

E. Time-Current Coordination Curves: Determine settings of overcurrent protective devices to achieve selective coordination. Graphically illustrate that adequate time separation exists between devices installed in series, including power utility company's upstream devices. Prepare separate sets of curves for the switching schemes and for emergency periods where the power source is local generation. Show the following information:

1. Device tag and title, one-line diagram with legend identifying the portion of the system covered.
2. Terminate device characteristic curves at a point reflecting maximum symmetrical or asymmetrical fault current to which the device is exposed.
3. Identify the device associated with each curve by manufacturer type, function, and, if applicable, tap, time delay, and instantaneous settings recommended.
4. Plot the following listed characteristic curves, as applicable:

a. Power utility's overcurrent protective device.
b. Medium-voltage equipment overcurrent relays.
c. Medium- and low-voltage fuses including manufacturer's minimum melt, total clearing, tolerance, and damage bands.
d. Low-voltage equipment circuit-breaker trip devices, including manufacturer's tolerance bands.
e. Transformer full-load current, magnetizing inrush current, and ANSI through-fault protection curves.
f. Cables and conductors damage curves.
g. Ground-fault protective devices.
h. Motor-starting characteristics and motor damage points.

i. Generator short-circuit decrement curve and generator damage point.
j. The largest feeder circuit breaker in each motor-control center and panelboard.

5. Maintain selectivity for tripping currents caused by overloads.
6. Maintain maximum achievable selectivity for tripping currents caused by overloads on series-rated devices.
7. Provide adequate time margins between device characteristics such that selective operation is achieved.
8. Comments and recommendations for system improvements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine Project overcurrent protective device submittals for compliance with electrical distribution system coordination requirements and other conditions affecting performance of the Work. Devices to be coordinated are indicated on Drawings.

1. Proceed with coordination study only after relevant equipment submittals have been assembled. Overcurrent protective devices that have not been submitted and approved prior to coordination study may not be used in study.

3.2 POWER SYSTEM DATA

A. Obtain all data necessary for conduct of the overcurrent protective device study.

1. Verify completeness of data supplied in one-line diagram on Drawings. Call any discrepancies to Architect's attention.
2. For equipment included as Work of this Project, use characteristics submitted under provisions of action submittals and information submittals for this Project.

B. Gather and tabulate all required input data to support the coordination study. List below is a guide. Comply with recommendations in IEEE 551 for the amount of detail required to be acquired in the field. Field data gathering shall be under direct supervision and control of the engineer in charge of performing the study, and shall be by the engineer or its representative who holds NETA ETT-Certified Technician Level III or NICET Electrical Power Testing Level III certification. Data include, but are not limited to, the following:

1. Product Data for overcurrent protective devices specified in other Sections and involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
2. Electrical power utility impedance at the service.
3. Power sources and ties.
4. Short-circuit current at each system bus (three phase and line to ground).
5. Full-load current of all loads.
6. Voltage level at each bus.
7. For transformers, include kVA, primary and secondary voltages, connection type, impedance, X/R ratio, taps measured in percent, and phase shift.
8. For reactors, provide manufacturer and model designation, voltage rating, and impedance.
9. For circuit breakers and fuses, provide manufacturer and model designation. List type of breaker, type of trip and available range of settings, SCCR, current rating, and breaker settings.
10. For relays, provide manufacturer and model designation, current transformer ratios, potential transformer ratios, and relay settings.
11. Maximum demands from service meters.
12. Busway manufacturer and model designation, current rating, impedance, lengths, size, and conductor material.
13. Motor horsepower and NEMA MG 1 code letter designation.
14. Low-voltage cable sizes, lengths, number, conductor material, and conduit material (magnetic or nonmagnetic).
15. Data sheets to supplement electrical distribution system one-line diagram, cross-referenced with tag numbers on diagram, showing the following:

    a. Special load considerations, including starting inrush currents and frequent starting and stopping.
    b. Transformer characteristics, including primary protective device, magnetic inrush current, and overload capability.
    c. Motor full-load current, locked rotor current, service factor, starting time, type of start, and thermal-damage curve.
    d. Generator thermal-damage curve.
    e. Ratings, types, and settings of utility company's overcurrent protective devices.
    f. Special overcurrent protective device settings or types stipulated by utility company.
    g. Time-current-characteristic curves of devices indicated to be coordinated.
    h. Manufacturer, frame size, interrupting rating in amperes root mean square (rms) symmetrical, ampere or current sensor

rating, long-time adjustment range, short-time adjustment range, and instantaneous adjustment range for circuit breakers.

i. Manufacturer and type, ampere-tap adjustment range, time-delay adjustment range, instantaneous attachment adjustment range, and current transformer ratio for overcurrent relays.

j. Switchboards, motor-control centers, and panelboards ampacity, and SCCR in amperes rms symmetrical.

k. Identify series-rated interrupting devices for a condition where the available fault current is greater than the interrupting rating of downstream equipment. Obtain device data details to allow verification that series application of these devices complies with NFPA 70 and UL 489 requirements.

3.3 COORDINATION STUDY

A. Comply with IEEE 242 for calculating short-circuit currents and determining coordination time intervals.

B. Comply with IEEE 399 for general study procedures.

C. Base study on device characteristics supplied by device manufacturer.

D. Extent of electrical power system to be studied is indicated on Drawings.

E. Begin analysis at the service, extending down to system overcurrent protective devices as follows:

1. To normal system low-voltage load buses where fault current is 10 kA or less.

2. Exclude equipment rated 240 V ac or less when supplied by a single transformer rated less than 125 kVA.

F. Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for Project. Study all cases of system-switching configurations and alternate operations that could result in maximum fault conditions.

G. Transformer Primary Overcurrent Protective Devices:

1. Device shall not operate in response to the following:

a. Inrush current when first energized.
b. Self-cooled, full-load current or forced-air-cooled, full-load current, whichever is specified for that transformer.

c. Permissible transformer overloads according to IEEE C57.96 if required by unusual loading or emergency conditions.

2. Device settings shall protect transformers according to IEEE C57.12.00, for fault currents.

H. Motor Protection:

1. Select protection for low-voltage motors according to IEEE 242 and NFPA 70.
2. Select protection for motors served at voltages more than 600 V according to IEEE 620.

I. Conductor Protection: Protect cables against damage from fault currents according to ICEA P-32-382, ICEA P-45-482, and protection recommendations in IEEE 242. Demonstrate that equipment withstands the maximum short-circuit current for a time equivalent to the tripping time of the primary relay protection or total clearing time of the fuse. To determine temperatures that damage insulation, use curves from cable manufacturers or from listed standards indicating conductor size and short-circuit current.

J. Include the ac fault-current decay from induction motors, synchronous motors, and asynchronous generators and apply to low- and medium-voltage, three-phase ac systems. Also account for fault-current dc decrement, to address asymmetrical requirements of interrupting equipment.

K. Calculate short-circuit momentary and interrupting duties for a three-phase bolted fault and a single line-to-ground fault at each equipment indicated on one-line diagram.

1. For grounded systems, provide a bolted line-to-ground fault-current study for areas as defined for the three-phase bolted fault short-circuit study.

L. Protective Device Evaluation:

1. Evaluate equipment and protective devices and compare to short-circuit ratings.
2. Adequacy of switchgear, motor-control centers, and panelboard bus bars to withstand short-circuit stresses.

3. Any application of series-rated devices shall be recertified, complying with requirements in NFPA 70.

4. Include in the report identification of any protective device applied outside its capacity.

3.4 LOAD-FLOW AND VOLTAGE-DROP STUDY

A. Perform a load-flow and voltage-drop study to determine the steady-state loading profile of the system. Analyze power system performance two times as follows:

1. Determine load flow and voltage drop based on full-load currents obtained in "Power System Data" Article.
2. Determine load flow and voltage drop based on 80 percent of the design capacity of load buses.
3. Prepare load-flow and voltage-drop analysis and report to show power system components that are overloaded, or might become overloaded; show bus voltages that are less than as prescribed by NFPA 70.

3.5 FIELD ADJUSTING

A. Adjust relay and protective device settings according to recommended settings provided by the coordination study. Field adjustments shall be completed by the engineering service division of equipment manufacturer under the "Startup and Acceptance Testing" contract portion.

B. Make minor modifications to equipment as required to accomplish compliance with short-circuit and protective device coordination studies.

C. Testing and adjusting shall be by a full-time employee of the Field Adjusting Agency, who holds NETA ETT-Certified Technician Level III or NICET Electrical Power Testing Level III certification.

1. Perform each visual and mechanical inspection and electrical test stated in NETA ATS. Certify compliance with test parameters. Perform NETA tests and inspections for all adjustable overcurrent protective devices.

3.6 DEMONSTRATION

A. Engage Power Systems Analysis Specialist to train Owner's maintenance personnel in the following:

1. Acquaint personnel in fundamentals of operating the power system in normal and emergency modes.
2. Hand-out and explain the coordination study objectives, study descriptions, purpose, basis, and scope. Include case

descriptions, definition of terms, and guide for interpreting time-current coordination curves.

3. For Owner's maintenance staff certified as NETA ETT-Certified Technicians Level III or NICET Electrical Power Testing Level III Technicians, teach how to adjust, operate, and maintain overcurrent protective device settings.

END OF SECTION 260573.16

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SECTION 260573.19

ARC-FLASH HAZARD ANALYSIS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes a computer-based, arc-flash study to determine the arc-flash hazard distance and the incident energy to which personnel could be exposed during work on or near electrical equipment.

1.3 DEFINITIONS

A. Field Adjusting Agency: An independent electrical testing agency with full-time employees and the capability to adjust devices and conduct testing indicated and that is a member company of NETA.

B. One-Line Diagram: A diagram that shows, by means of single lines and graphic symbols, the course of an electric circuit or system of circuits and the component devices or parts used therein.

C. Power System Analysis Software Developer: An entity that commercially develops, maintains, and distributes computer software used for power system studies.

D. Power Systems Analysis Specialist: Professional engineer in charge of performing the study and documenting recommendations, licensed in the state where Project is located.

E. Protective Device: A device that senses when an abnormal current flow exists and then removes the affected portion from the system.

F. SCCR: Short-circuit current rating.

G. Service: The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.

H. Single-Line Diagram: See "One-Line Diagram."

1.4 ACTION SUBMITTALS

A. Product Data: For computer software program to be used for studies.

B. Study Submittals: Submit the following submittals after the approval of system protective devices submittals. Submittals may be in digital form:

1. Arc-flash study input data, including completed computer program input data sheets.

2. Arc-flash study report; signed, dated, and sealed by Power Systems Analysis Specialist.

3. Submit study report for action prior to receiving final approval of distribution equipment submittals. If formal completion of studies will cause delay in equipment manufacturing, obtain approval from Architect for preliminary submittal of sufficient study data to ensure that selection of devices and associated characteristics is satisfactory.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data:

1. For Power Systems Analysis Software Developer.
2. For Power System Analysis Specialist.
3. For Field Adjusting Agency.

B. Product Certificates: For arc-flash hazard analysis software, certifying compliance with IEEE 1584 and NFPA 70E.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data:

1. Provide maintenance procedures in equipment manuals according to requirements in NFPA 70E.
2. Operation and Maintenance Procedures: In addition to items specified in Section 017823 "Operation and Maintenance Data," provide maintenance procedures for use by Owner's personnel that comply with requirements in NFPA 70E.

1.7 QUALITY ASSURANCE

A. Study shall be performed using commercially developed and distributed software designed specifically for power system analysis.

B. Software algorithms shall comply with requirements of standards and guides specified in this Section.

C. Manual calculations are unacceptable.

D. Power System Analysis Software Qualifications: An entity that owns and markets computer software used for studies, having performed successful studies of similar magnitude on electrical distribution systems using similar devices.

1. Computer program shall be designed to perform arc-flash analysis or have a function, component, or add-on module designed to perform arc-flash analysis.
2. Computer program shall be developed under the charge of a licensed professional engineer who holds IEEE Computer Society's Certified Software Development Professional certification.

E. Power Systems Analysis Specialist Qualifications: Professional engineer in charge of performing the arc-flash study, analyzing the arc flash, and documenting recommendations, licensed in the state where Project is located. All elements of the study shall be performed under the direct supervision and control of this professional engineer.

F. Arc-Flash Study Certification: Arc-Flash Study Report shall be signed and sealed by Power Systems Analysis Specialist.

G. Field Adjusting Agency Qualifications:

1. Employer of a NETA ETT-Certified Technician Level III or NICET Electrical Power Testing Level III certification responsible for all field adjusting of the Work.
2. A member company of NETA.
3. Acceptable to authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 COMPUTER SOFTWARE DEVELOPERS

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

1. CGI CYME.
2. EDSA Micro Corporation.
3. ESA Inc.
4. Operation Technology, Inc.
5. Power Analytics, Corporation.
6. SKM Systems Analysis, Inc.

B. Comply with IEEE 1584 and NFPA 70E.

C. Analytical features of device coordination study computer software program shall have the capability to calculate "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.

2.2 ARC-FLASH STUDY REPORT CONTENT

A. Executive summary of study findings.

B. Study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpretation of results.

C. One-line diagram, showing the following:

1. Protective device designations and ampere ratings.
2. Conductor types, sizes, and lengths.
3. Motor and generator designations and kVA ratings.
4. Switchboard, panelboard designations, and ratings.

D. Study Input Data: As described in "Power System Data" Article.

E. Short-Circuit Study Output Data: As specified in "Short-Circuit Study Output Reports" Paragraph in "Short-Circuit Study Report Contents" Article in Section 260573.13 "Short-Circuit Studies."

F. Protective Device Coordination Study Report Contents: As specified in "Coordination Study Report Contents" Article in Section 260573.16 "Coordination Studies."

G. Arc-Flash Study Output Reports:

1. Interrupting Duty Report: Three-phase and unbalanced fault calculations, showing the following for each equipment location included in the report:

a. Voltage.
b. Calculated symmetrical fault-current magnitude and angle.
c. Fault-point X/R ratio.
d. No AC Decrement (NACD) ratio.
e. Equivalent impedance.
f. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a symmetrical basis.
g. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a total basis.

H. Incident Energy and Flash Protection Boundary Calculations:

1. Arcing fault magnitude.
2. Protective device clearing time.
3. Duration of arc.
4. Arc-flash boundary.
5. Restricted approach boundary.
6. Limited approach boundary.
7. Working distance.
8. Incident energy.
9. Hazard risk category.
10. Recommendations for arc-flash energy reduction.

I. Fault study input data, case descriptions, and fault-current calculations including a definition of terms and guide for interpretation of computer printout.

2.3 ARC-FLASH WARNING LABELS

A. Comply with requirements in Section 260553 "Identification for Electrical Systems" for self-adhesive equipment labels. Produce a 3.5-by-5-inch self-adhesive equipment label for each work location included in the analysis.

B. Label shall have an orange header with the wording, "WARNING, ARC-FLASH HAZARD," and shall include the following information taken directly from the arc-flash hazard analysis:

1. Location designation.
2. Nominal voltage.
3. Protection boundaries.

a. Arc-flash boundary.
b. Restricted approach boundary.
c. Limited approach boundary.

4. Arc flash PPE category.
5. Required minimum arc rating of PPE in Cal/cm squared.
6. Available incident energy.
7. Working distance.
8. Engineering report number, revision number, and issue date.

C. Labels shall be machine printed, with no field-applied markings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine Project overcurrent protective device submittals. Proceed with arc-flash study only after relevant equipment submittals have been

assembled. Overcurrent protective devices that have not been submitted and approved prior to arc-flash study may not be used in study.

3.2 ARC-FLASH HAZARD ANALYSIS

A. Comply with NFPA 70E and its Annex D for hazard analysis study.

B. Preparatory Studies: Perform the Short-Circuit and Protective Device Coordination studies prior to starting the Arc-Flash Hazard Analysis.

1. Short-Circuit Study Output: As specified in "Short-Circuit Study Output Reports" Paragraph in "Short-Circuit Study Report Contents" Article in Section 260573.13 "Short-Circuit Studies."
2. Coordination Study Report Contents: As specified in "Coordination Study Report Contents" Article in Section 260573.16 "Coordination Studies."

C. Calculate maximum and minimum contributions of fault-current size.

1. Maximum calculation shall assume a maximum contribution from the utility and shall assume motors to be operating under full-load conditions.

2. Calculate arc-flash energy at 85 percent of maximum short-circuit current according to IEEE 1584 recommendations.
3. Calculate arc-flash energy at 38 percent of maximum short-circuit current according to NFPA 70E recommendations.
4. Calculate arc-flash energy with the utility contribution at a minimum and assume no motor contribution.

D. Calculate the arc-flash protection boundary and incident energy at locations in electrical distribution system where personnel could perform work on energized parts.

E. Include medium- and low-voltage equipment locations, except equipment rated 240 V ac or less fed from transformers less than 125 kVA.

F. Calculate the limited, restricted, and prohibited approach boundaries for each location.

G. Incident energy calculations shall consider the accumulation of energy over time when performing arc-flash calculations on buses with multiple sources. Iterative calculations shall take into account the changing current contributions, as the sources are interrupted or decremented with time. Fault contribution from motors shall be decremented as follows:

1. Fault contribution from induction motors shall not be considered beyond three to five cycles.
2. Fault contribution from synchronous motors shall be decayed to match the actual decrement of each as closely as possible (for example, contributions from permanent magnet generators will typically decay from 10 per unit to three per unit after 10 cycles).

H. Arc-flash energy shall generally be reported for the maximum of line or load side of a circuit breaker. However, arc-flash computation shall be performed and reported for both line and load side of a circuit breaker as follows:

1. When the circuit breaker is in a separate enclosure.
2. When the line terminals of the circuit breaker are separate from the work location.

I. Base arc-flash calculations on actual overcurrent protective device clearing time. Cap maximum clearing time at two seconds based on IEEE 1584, Section B.1.2.

3.3 POWER SYSTEM DATA

A. Obtain all data necessary for conduct of the arc-flash hazard analysis.

1. Verify completeness of data supplied on one-line diagram on Drawings and under "Preparatory Studies" Paragraph in "Arc-Flash Hazard Analysis" Article. Call discrepancies to Architect's attention.
2. For new equipment, use characteristics from approved submittals under provisions of action submittals and information submittals for this Project.
3. For existing equipment, whether or not relocated, obtain required electrical distribution system data by field investigation and surveys conducted by qualified technicians and engineers.

B. Electrical Data: Gather and tabulate the following input data to support study. Comply with recommendations in IEEE 1584 and NFPA 70E as to the amount of detail that is required to be acquired in the field. Field data gathering shall be under the direct supervision and control of the engineer in charge of performing the study, and shall be by the engineer or its representative who holds NETA ETT-Certified Technician Level III or NICET Electrical Power Testing Level III certification. Data include, but are not limited to, the following:

1. Product Data for overcurrent protective devices specified in other Sections and involved in overcurrent protective device coordination studies. Use equipment designation tags that are

consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.

2. Obtain electrical power utility impedance or available short circuit current at the service.
3. Power sources and ties.
4. Short-circuit current at each system bus (three phase and line to ground).
5. Full-load current of all loads.
6. Voltage level at each bus.
7. For transformers, include kVA, primary and secondary voltages, connection type, impedance, X/R ratio, taps measured in percent, and phase shift.
8. For reactors, provide manufacturer and model designation, voltage rating and impedance.
9. For circuit breakers and fuses, provide manufacturer and model designation. List type of breaker, type of trip and available range of settings, SCCR, current rating, and breaker settings.
10. For relays, provide manufacturer and model designation, current transformer ratios, potential transformer ratios, and relay settings.
11. Busway manufacturer and model designation, current rating, impedance, lengths, size, and conductor material.
12. Motor horsepower and NEMA MG 1 code letter designation.
13. Low-voltage conductor sizes, lengths, number, conductor material and conduit material (magnetic or nonmagnetic).
14. Medium-voltage conductor sizes, lengths, conductor material, conductor construction and metallic shield performance parameters, and conduit material (magnetic or nonmagnetic).

3.4 LABELING

A. Apply one arc-flash label on the front cover of each section of the equipment for each equipment included in the study. Base arc-flash label data on highest values calculated at each location.

B. Each piece of equipment listed below shall have an arc-flash label applied to it:

1. Motor-control center.
2. Low-voltage switchboard.
3. Switchgear.
4. Medium-voltage switch.
5. Medium voltage transformers
6. Low voltage transformers.
7. Applicable panelboard and safety switch under 250 V.
8. Control panel.

C. Note on record Drawings the location of equipment where the personnel could be exposed to arc-flash hazard during their work.

1. Indicate arc-flash energy.
2. Indicate protection level required.

3.5 APPLICATION OF WARNING LABELS

A. Install arc-flash warning labels under the direct supervision and control of Power System Analysis Specialist.

3.6 DEMONSTRATION

A. Train Owner's maintenance personnel in potential arc-flash hazards associated with working on energized equipment and the significance of arc-flash warning labels.

END OF SECTION 260573.19

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SECTION 260923

LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following lighting control devices:

1. Indoor occupancy sensors.
2. Switchbox-mounted occupancy sensors.
3. Lighting contactors.
4. Emergency shunt relays.

B. Related Sections include the following:

1. Section 26 2726 "Wiring Devices" for wall-box dimmers, and manual light switches.

1.3 DEFINITIONS

A. LED: Light-emitting diode.

B. PIR: Passive infrared.

1.4 SUBMITTALS

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

B. Shop Drawings: Show installation details for occupancy and light-level sensors.

1. Interconnection diagrams showing field-installed wiring.

C. Field quality-control test reports.

D. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association to supervise on-site testing specified in Part 3.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.6 COORDINATION

A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.1 INDOOR OCCUPANCY SENSORS

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

1. Hubbell Lighting.
2. Leviton Mfg. Company Inc.
3. NSi Industries LLC. (TORK)
4. Watt Stopper (The).

B. General Description: Wall- or ceiling-mounting, solid-state units with a separate relay unit.

1. Operation: Unless otherwise indicated, turn lights on when covered area is occupied and off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.

2. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor shall be powered from the power pack/relay unit.
3. Power Pack/Relay Unit: Dry contacts rated for 20-A ballast or LED load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Power supply to sensor shall be 24-V dc, 150-mA, Class 2 power source as defined by NFPA 70.
4. Mounting:

    a. Sensor: Suitable for mounting in any position on a standard outlet box.
    b. Relay: Externally mounted through a 1/2-inch knockout in a standard electrical enclosure.
    c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.

5. Indicator: Digital display, to show when motion is being detected during testing and normal operation of the sensor.
6. Bypass Switch: Override the “on” function in case of sensor failure.
7. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc; keep lighting off when selected lighting level is present.

C. Dual-Technology Type: Detect occupancy by using a combination of PIR and ultrasonic detection methods in area of coverage. Particular technology or combination of technologies that controls on-off functions shall be selectable in the field by operating controls on unit.

1. Sensitivity Adjustment: Separate for each sensing technology.
2. Detector Sensitivity: Detect occurrences of 6-inch-minimum movement of any portion of a human body that presents a target of not less than 36 sq. in., and detect a person of average size and weight moving not less than 12 inches in either a horizontal or a vertical manner at an approximate speed of 12 inches/s.
3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. when mounted on a 96-inch-high ceiling.
4. Detection Coverage (Room, Wall Mounted): Detect occupancy anywhere within a 180-degree pattern centered on the sensor over an area of 1000 square feet when mounted 48 inches above finished floor.

2.2 SWITCHBOX-MOUNTED OCCUPANCY SENSORS

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

1. Cooper Industries, Inc.
2. Hubbell Building Automation, Inc.

3. Leviton Manufacturing Co., Inc.
4. NSi Industries LLC.
5. Square D.
6. WattStopper; a Legrand® Group brand.

B. General Requirements for Sensors: Automatic-wall-switch occupancy sensor with manual on-off switch, suitable for mounting in a single gang switchbox using hardwired connection.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Occupancy Sensor Operation: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn lights off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
3. Operating Ambient Conditions: Dry interior conditions, 32 to 120 deg F.
4. Switch Rating: Not less than 800-VA LED load at 120 V, 1200-VA LED load at 277 V, and 800-W incandescent.

C. Wall-Switch Sensor:

1. Standard Range: 180-degree field of view, field adjustable from 180 to 40 degrees; with a minimum coverage area of 900 sq. ft..
2. Sensing Technology: Dual technology - PIR and ultrasonic.
3. Switch Type: SP, dual circuit. SP, manual "on," automatic "off." SP, field-selectable automatic "on," or manual "on," automatic "off."
4. Capable of controlling load in three-way application.
5. Voltage: Match the circuit voltage.
6. Ambient-Light Override: Concealed, field-adjustable, light-level sensor from 10 to 150 fc. The switch prevents the lights from turning on when the light level is higher than the set point of the sensor.
7. Concealed, field-adjustable, "off" time-delay selector at up to 30 minutes.
8. Concealed, "off" time-delay selector at 30 seconds and 5, 10, and 20 minutes.
9. Adaptive Technology: Self-adjusting circuitry detects and memorizes usage patterns of the space and helps eliminate false "off" switching.
10. Color: White.
11. Faceplate: Color matched to switch.

2.3 LIGHTING CONTACTORS

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

1. Allen-Bradley/Rockwell Automation.

2. ASCO: a brand of Vertiv.
3. Eaton.
4. General Electric Company.
5. Square D.

B. Description: Electrically operated and mechanically held, combination type lighting contactors with nonfused disconnect, complying with NEMA ICS 2 and UL 508.

1. Current Rating for Switching: Listing or rating consistent with type of load served, including tungsten filament, inductive, and high-inrush ballast (ballast with 15 percent or less total harmonic distortion of normal load current).
2. Fault Current Withstand Rating: Equal to or exceeding the available fault current at the point of installation.
3. Enclosure: Comply with NEMA 250.
4. Provide with control and pilot devices as indicated on Drawings, matching the NEMA type specified for the enclosure.

C. Interface with HVAC: Provide hardware interface to enable the control system for HVAC to control lighting contactors and HVAC equipment for all ceiling mounted occupancy sensors.

1. Control: On-off operation.
2. Control: HVAC equipment

2.4 EMERGENCY SHUNT RELAY

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

1. Lighting Control and Design, Inc.

B. Description: Normally closed, electrically held relay, arranged for wiring in parallel with manual or automatic switching contacts; complying with UL 924.

1. Coil Rating: 120 and/or 277 V.

2.5 CONDUCTORS AND CABLES

A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Section 26 0519 "Low-Voltage Electrical Power Conductors and Cables."

B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Section 26 0519 "Low-Voltage Electrical Power Conductors and Cables."

C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 16 AWG. Comply with requirements in Section 26 0519 "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine lighting control devices before installation. Reject lighting control devices that are wet, moisture damaged, or mold damaged.

B. Examine walls and ceilings for suitable conditions where lighting control devices will be installed.

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

3.2 SENSOR INSTALLATION

A. Comply with NECA 1.

B. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression systems, and partition assemblies.

C. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

3.3 CONTACTOR INSTALLATION

A. Comply with NECA 1.

B. Mount electrically held lighting contactors with elastomeric isolator pads, to eliminate structure-borne vibration, unless contactors are installed in an enclosure with factory-installed vibration isolators.

3.4 WIRING INSTALLATION

A. Comply with NECA 1.

B. Wiring Method: Comply with Section 26 0519 "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size shall be 3/4 inch.

C. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.

D. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.

E. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.5 IDENTIFICATION

A. Identify components and power and control wiring according to Section 26 0553 "Identification for Electrical Systems."

1. Identify controlled circuits in lighting contactors.
2. Identify circuits or luminaries controlled by photoelectric and occupancy sensors at each sensor.

B. Label time switches and contactors with a unique designation.

3.6 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. After installing time switches and sensors, and after electrical circuitry has been energized, adjust and test for compliance with requirements.
2. Operational Test: Verify operation of each lighting control device, and adjust time delays.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Lighting control devices that fail tests and inspections are defective work.

C. Prepare test and inspection reports.

3.7 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting sensors to suit occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.8 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain lighting control devices. Provide one (1) 2-hour training sessions to train the maintenance staff.

END OF SECTION 26 0923

SECTION 262416

PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Lighting and appliance branch-circuit panelboards.

1.3 DEFINITIONS

A. ATS: Acceptance testing specification.

B. GFCI: Ground-fault circuit interrupter.

C. GFEP: Ground-fault equipment protection.

D. MCCB: Molded-case circuit breaker.

E. SPD: Surge protective device.

F. SVR: Suppressed voltage rating.

G. TVSS: Transient voltage surge suppressor.

1.4 SUBMITTALS

A. Product Data: For each type of panelboard, switching and overcurrent protective device, transient voltage suppression device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each panelboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details.
2. Show tabulations of installed devices with nameplates, conductor termination sizes, equipment features, and ratings.
3. Detail enclosure types and details for types other than NEMA 250, Type 1.
4. Detail bus configuration, current, and voltage ratings.
5. Short-circuit current rating of panelboards and overcurrent protective devices.
6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
7. Include wiring diagrams for power, signal, and control wiring.
8. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device. Include an Internet link for electronic access to downloadable PDF of the coordination curves.

C. Field Quality-Control Reports:

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

D. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.

E. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. Include the following:

1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association to supervise on-site testing specified in Part 3.

B. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Comply with NEMA PB 1, “Panelboards.”

E. Comply with NFPA 70, “National Electrical Code.”

F. Manufacturer Qualifications: ISO 9001 or 9002 certified.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.

B. Handle and prepare panelboards for installation according to NEMA PB 1.

1.7 PROJECT CONDITIONS

A. Environmental Limitations:

1. Do not deliver or install panelboards until spaces are enclosed and weather-tight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:

   a. Ambient Temperature: Not exceeding 23 deg F to plus 104 deg F.
   b. Altitude: Not exceeding 6600 feet.

B. Service Conditions: NEMA PB 1, usual service conditions, as follows:

1. Ambient temperatures within limits specified.
2. Altitude not exceeding 6600 feet.

1.8 COORDINATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

1.9 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Keys: Two spares for each type of panelboard cabinet lock.
2. Circuit Breakers Including GFCI and Ground Fault Equipment Protection (GFEP) Types and shunt trip devices: Two spares for each panelboard.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

A. Enclosures: Flush and surface-mounted, dead-front cabinets.

1. Rated for environmental conditions at installed location.

a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
b. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
c. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.

2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.
3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover. Trims shall cover all live parts and shall have no exposed hardware.
4. Skirt for Surface-Mounted Panelboards: Same gage and finish as panelboard front with flanges for attachment to panelboard, wall, and ceiling or floor.

5. Gutter Extension and Barrier: Same gage and finish as panelboard enclosure; integral with enclosure body. Arrange to isolate individual panel sections.
6. Finishes:

    a. Panels and Trim: Steel, factory finished immediately after cleaning and pre-treating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
    b. Back Boxes: Same finish as panels and trim.

7. Directory Card: Inside panelboard door, mounted in metal frame with transparent protective cover.

B. Incoming Mains:

1. Location: Convertible between top and bottom.
2. Main Breaker: Main lug interiors up to 400 amperes shall be field convertible to main breaker.

C. Phase, Neutral, and Ground Buses:

1. Material: Hard-drawn copper, 98 percent conductivity.
2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
3. Isolated Ground Bus: Adequate for branch-circuit isolated ground conductors; insulated from box.
4. Extra-Capacity Neutral Bus: As suitable for nonlinear loads where indicated on the drawings.

D. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Material: Hard-drawn copper, 98 percent conductivity.
2. Main and Neutral Lugs: Mechanical type.
3. Ground Lugs and Bus-Configured Terminators: Mechanical type.
4. Feed-Through Lugs: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
5. Sub feed (Double) Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
6. Gutter-Tap Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
7. Extra-Capacity Neutral Lugs: Rated 200 percent of phase lugs mounted on extra-capacity neutral bus.

E. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

F. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals. Series rated panelboards will not be accepted.

1. Panelboards and overcurrent protective devices rated 240 V or less shall have short-circuit ratings as shown on Drawings, but not less than 22,000 A rms symmetrical.
2. Panelboards and overcurrent protective devices rated above 240 V and less than 600 V shall have short-circuit ratings as shown on Drawings, but not less than 14,000 A rms symmetrical.

2.2 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

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

1. Square D; a brand of Schneider Electric.

B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

C. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

D. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

E. Column-Type Panelboards: Narrow gutter extension, with cover, to overhead junction box equipped with ground and neutral terminal buses.

2.3 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
2. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:

a. Standard frame sizes, trip ratings, and number of poles.
b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.

d. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
e. Shunt Trip: 120 -V trip coil energized from separate circuit, set to trip at 75 percent of rated voltage.
f. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.

2.4 IDENTIFICATION

A. Panelboard Label: Manufacturer's name and trademark, voltage, amperage, number of phases, and number of poles shall be located on the interior of the panelboard door.

B. Breaker Labels: Faceplate shall list current rating, UL and IEC certification standards, and AIC rating.

C. Circuit Directory: Directory card inside panelboard door, mounted in metal frame with transparent protective cover.

1. Circuit directory shall identify specific purpose with detail sufficient to distinguish it from all other circuits.

D. Circuit Directory: Computer-generated circuit directory mounted inside panelboard door with transparent plastic protective cover.

1. Circuit directory shall identify specific purpose with detail sufficient to distinguish it from all other circuits.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify actual conditions with field measurements prior to ordering panelboards to verify that equipment fits in allocated space in, and comply with, minimum required clearances specified in NFPA 70.

B. Receive, inspect, handle, and store panelboards according to NEMA PB 1.1.

C. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.

D. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.

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

3.2 INSTALLATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Comply with NECA 1.

C. Install panelboards and accessories according to NEMA PB 1.1.

D. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.

E. Mount top of trim 78 inches above finished floor unless otherwise indicated.

F. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.

G. Install overcurrent protective devices and controllers not already factory installed.

H. Install filler plates in unused spaces.

I. For all recessed panelboards, stub minimum of six (6) 1-inch empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future.

3.3 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Section 26 0553 “Identification for Electrical Systems."

B. Create a directory to indicate installed circuit loads; incorporate Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.

C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 26 0553 “Identification for Electrical Systems."

D. Panelboard directories shall be corrected and re-created after balancing the loads to meet the specifications requirements and shall match with the actual loads in the field. A copy of the panelboard schedule from the construction documents will not be acceptable.

E. Install warning signs complying with requirements in Section 26 0553 "Identification for Electrical Systems" identifying source of remote circuit.

3.4 FIELD QUALITY CONTROL

A. Acceptance Testing Preparation:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

B. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

C. Panelboards will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

E. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes.

1. Measure as directed during period of normal system loading.
2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

F. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scanning of each panelboard. Remove panel fronts so joints and connections are accessible to portable scanner.

1. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each panelboard 11 months after date of Substantial Completion.
2. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
3. Record of Infrared Scanning: Prepare a certified report that identifies panelboards checked and describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 DEMONSTRATION

A. Train Owner’s maintenance personnel to program, monitor, adjust, and operate the equipment.

3.6 ADJUSTING

A. Adjust moving parts and operable component to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges.

3.7 PROTECTION

A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions.

END OF SECTION 26 2416

SECTION 262726

WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Receptacles, receptacles with integral GFCI, and associated device plates.
2. Tamper-resistant receptacles.
3. Weather-resistant receptacles.
4. Snap switches and wall-box dimmers.
5. Wall-switch

1.3 DEFINITIONS

A. EMI: Electromagnetic interference.

B. GFCI: Ground-fault circuit interrupter.

C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

D. RFI: Radio-frequency interference.

E. TVSS: Transient voltage surge suppressor.

F. UTP: Unshielded twisted pair.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Receptacles for Owner-Furnished Equipment: Match plug configurations.
2. Cord and Plug Sets: Match equipment requirements.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: List of legends and description of materials and process used for pre-marking wall plates.

1.6 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing-label warnings and instruction manuals that include labeling conditions.

1.8 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Floor Service-Outlet Assemblies: One for every 10, but no fewer than one.
2. Poke-Through, Fire-Rated Closure Plugs: One for every five floor service outlets installed, but no fewer than two.
3. TVSS Receptacles: One for every 10 of each type installed, but no fewer than two of each type

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:

1. Cooper Wiring Devices; Division of Cooper Industries, Inc. (Cooper).

2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
3. Leviton Mfg. Company Inc. (Leviton).
4. Pass & Seymour/Legrand (Pass & Seymour).

B. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.2 GENERAL WIRING-DEVICE REQUIREMENTS

A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70, “National Electrical Code”.

C. RoHS compliant.

D. Comply with NEMA WD 1.

E. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:

1. Connectors shall comply with UL 2459 and shall be made with stranding building wire.
2. Devices shall comply with the requirements in this Section.

F. Devices for Owner-Furnished Equipment:

1. Receptacles: Match plug configurations.
2. Cord and Plug Sets: Match equipment requirements.

G. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.3 STRAIGHT-BLADE RECEPTACLES

A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.

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

a. Cooper
b. Hubbell
c. Leviton
d. Pass & Seymour

B. Isolated-Ground, Duplex Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.

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

a. Cooper
b. Hubbell
c. Leviton
d. Pass & Seymour

2. Description: Straight blade; equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

C. Tamper-Resistant Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498 Supplement sd, and FS W-C-596.

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

a. Cooper
b. Hubbell
c. Leviton
d. Pass & Seymour

2.4 GFCI RECEPTACLES

A. General Description:

1. Straight blade, feed-through type.
2. Comply with NEMA WD 1, NEMA WD 6, UL 498, UL 943 Class A, and FS W-C-596.
3. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.

B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:

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

a. Cooper
b. Hubbell

c. Pass & Seymour
d. Leviton

C. Tamper-Resistant GFCI Convenience Receptacles, 125 V, 20 A:

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

a. Hubbell
b. Pass & Seymour

2.5 TWIST-LOCKING RECEPTACLES

A. Single Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration L5-20R, and UL 498.

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

a. Cooper
b. Hubbell
c. Leviton
d. Pass & Seymour

B. Isolated-Ground, Single Convenience Receptacles, 125 V, 20 A:

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

a. Cooper
b. Hubbell
c. Leviton
d. Pass & Seymour

2. Description:

a. Comply with NEMA WD 1, NEMA WD 6 Configuration L5-20R, and UL 498.
b. Equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

2.6 TOGGLE SWITCHES

A. Comply with NEMA WD 1, UL 20, and FS W-S-896.

B. Switches, 120/277 V, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Single Pole:
      1) Cooper
      2) Hubbell.
      3) Leviton
      4) Pass & Seymour
   b. Two Pole:
      1) Cooper
      2) Hubbell
      3) Leviton
      4) Pass & Seymour
   c. Three Way:
      1) Cooper
      2) Hubbell
      3) Leviton
      4) Pass & Seymour

C. Single-Pole, Double-Throw, Momentary-Contact, Center-off Switches: 120/277 V, 20 A; for use with mechanically held lighting contactors.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Cooper
   b. Hubbell
   c. Leviton
   d. Pass & Seymour

2.7 WALL PLATES

A. Single and combination types shall match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material for Finished Spaces 0.035-inch- thick, satin-finished, Type 302 stainless steel
3. Material for Unfinished Spaces: Galvanized
4. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.

B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant, die-cast aluminum with lockable cover.

2.8 NONSYSTEM SMOKE DETECTORS

A. General Requirements for Nonsystem Smoke Detectors:

B. Nonsystem smoke detectors shall be listed as compatible with the fire-alarm equipment installed or shall have a contact closure interface listed for the connected load.
   1. Nonsystem smoke detectors shall meet the monitoring for integrity requirements in NFPA 72.

C. Single-Station Smoke Detectors:

   1. Comply with UL 217; suitable for NFPA 101, residential occupancies; operating at 120-V ac with 9-V dc battery as the secondary power source. Provide with "low" or "missing" battery chirping-sound device.
   2. Auxiliary Relays: One Form C, rated at 0.5 A.
   3. Audible Notification Appliance: Piezoelectric sounder rated at 90 dBA at 10 feet according to UL 464.
   4. Visible Notification Appliance: 177-cd strobe.
   5. Heat sensor, 135 deg F combination rate-of-rise and fixed temperature.
   6. Test Switch: Push to test; simulates smoke at rated obscuration.
   7. Tandem Connection: Allow tandem connection of number of indicated detectors; alarm on one detector shall actuate notification on all connected detectors.
   8. Plug-in Arrangement: Detector and associated electronic components shall be mounted in a plug-in module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
   9. Self-Restoring: Detectors shall not require resetting or readjustment after actuation to restore them to normal operation.
   10. Integral Visual-Indicating Light: LED type, indicating detector has operated and power-on status.

2.9 FINISHES

A. Device Color:

   1. Wiring Devices Connected to Normal Power System: White in color unless otherwise indicated or required by NFPA 70 or directed by the architect at the time of shop drawings.
   2. Wiring Devices Connected to Emergency Power System: Red.
   3. TVSS Devices: Blue.
   4. Isolated-Ground Receptacles: Orange with orange triangle on face.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1, “Standard Practice for Good Workmanship in Electrical Construction”, including mounting heights listed in that standard, unless otherwise indicated.

B. Coordination with Other Trades:

1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:

1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.

D. Device Installation:

1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.

6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
7. When conductors larger than No. 12 AWG are installed on 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles up or down as directed in the field, and on horizontally mounted receptacles to the right or left as directed in the field.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Dimmers:

1. Install dimmers within terms of their listing.
2. Verify that dimmers used for fan speed control are listed for that application.
3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.

H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

I. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.2 GFCI RECEPTACLES

A. Install non-feed-through-type GFCI receptacles where protection of downstream receptacles is not required.

3.3 INSTALLATION OF FIRE DETECTION EQUIPMENT

A. Comply with NFPA 72, NFPA 101, and requirements of authorities having jurisdiction for installation and testing of fire-alarm equipment. Install all electrical wiring to comply with requirements in NFPA 70 including, but not limited to, Article 760, "Fire Alarm Systems."

B. Connecting to Existing Equipment: Verify that existing fire-alarm system is operational before making changes or connections.

1. Connect new equipment to the existing control panel in the existing part of the building.
2. Connect new equipment to the existing monitoring equipment at the supervising station.
3. Expand, modify, and supplement the existing control and monitoring equipment as necessary to extend the existing control and monitoring functions to the new points. New components shall be capable of merging with the existing configuration without degrading the performance of either system.

C. Smoke- or Heat-Detector Spacing:

1. Comply with the "Smoke-Sensing Fire Detectors" section in the "Initiating Devices" chapter in NFPA 72, for smoke-detector spacing.
2. Comply with the "Heat-Sensing Fire Detectors" section in the "Initiating Devices" chapter in NFPA 72, for heat-detector spacing.
3. Smooth ceiling spacing shall not exceed 30 feet.
4. Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas shall be determined according to Annex A or Annex B in NFPA 72.
5. HVAC: Locate detectors not closer than 36 inches from air-supply diffuser or return-air opening.
6. Luminaires: Locate detectors not closer than 12 inches from any part of a luminaire and not directly above pendant mounted or indirect lighting.

D. Install a cover on each smoke detector that is not placed in service during construction. Cover shall remain in place, except during system testing. Remove cover prior to system turnover.

E. Single-Station Smoke Detectors: Where more than one smoke alarm is installed within a sleeping area, they shall be connected so that the operation of any smoke alarm causes the alarm in all smoke alarms to sound.

3.4 IDENTIFICATION

A. Comply with Section 26 0553 "Identification for Electrical Systems."

B. Identify each receptacle with panelboard identification and circuit number. Use hot, stamped, or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.
1. For all other receptacles, provide a clear self-adhesive label with BLACK letters indicating circuit number and panelboard. Example: 4(RP2).

3.5 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Test Instruments: Use instruments that comply with UL 1436.
2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.

B. Tests for Convenience Receptacles:

1. Line Voltage: Acceptable range is 105 to 132 V.
2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
3. Ground Impedance: Values of up to 2 ohms are acceptable.
4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
5. Using the test plug, verify that the device and its outlet box are securely mounted.
6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

C. Wiring device will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

END OF SECTION 26 2726

SECTION 262813

FUSES

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. Cartridge fuses rated 600-V ac and less for use in control circuits, enclosed switches, enclosed controllers and motor-control centers.
2. Spare-fuse cabinets.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material, dimensions, descriptions of individual components, and finishes for spare-fuse cabinets. Include the following for each fuse type indicated:

1. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.
2. Current-limitation curves for fuses with current-limiting characteristics.
3. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse.
4. Coordination charts and tables and related data.

B. Operation and Maintenance Data: For fuses to include in emergency, operation, and maintenance manuals. Include the following:

1. Ambient temperature adjustment information.
2. Current-limitation curves for fuses with current-limiting characteristics.
3. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse.

4. Coordination charts and tables and related data.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain fuses, for use within a specific product or circuit, from single source from single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with NEMA FU 1 for cartridge fuses.

D. Comply with NFPA 70, “National Electrical Code.”

1.5 PROJECT CONDITIONS

A. Where ambient temperature to which fuses are directly exposed is less than 40 deg F or more than 100 deg F, apply manufacturer's ambient temperature adjustment factors to fuse ratings.

1.6 COORDINATION

A. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit current levels.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Cooper Bussmann, Inc.
2. Edison Fuse, Inc.
3. Ferraz Shawmut, Inc. / Mersen.
4. Littelfuse, Inc.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fuses before installation. Reject fuses that are moisture damaged or physically damaged.

B. Examine holders to receive fuses for compliance with installation tolerances and other conditions affecting performance, such as rejection features.

C. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.

D. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.

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

3.2 FUSE APPLICATIONS

A. Cartridge Fuses:

1. Motor Branch Circuits: Class RK1, time delay.
2. Other Branch Circuits: Class RK1, time delay.
3. Control Circuits: Class CC, fast acting.

3.3 INSTALLATION

A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

B. Install spare-fuse cabinet(s).

3.4 IDENTIFICATION

A. Install labels complying with requirements for identification specified in Section 26 0553 “Identification for Electrical Systems" and indicating fuse replacement information on inside door of each fused switch and adjacent to each fuse block, socket, and holder.

END OF SECTION 26 2813

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SECTION 262816

ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Fusible switches.
2. Non-fusible switches.
3. Molded-case circuit breakers (MCCBs).
4. Enclosures.

1.3 DEFINITIONS

A. NC: Normally closed.

B. NO: Normally open.

C. SPDT: Single pole, double throw.

1.4 SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

1. Enclosure types and details for types other than NEMA 250, Type 1.
2. Current and voltage ratings.
3. Short-circuit current ratings (interrupting and withstand, as appropriate).
4. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.

B. Shop Drawings: For enclosed switches and circuit breakers. Include plans, elevations, sections, details, and attachments to other work.

1. Wiring Diagrams: For power, signal, and control wiring.

C. Qualification Data: For qualified testing agency.

D. Field quality-control reports.

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

E. Manufacturer's field service report.

F. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section “Closeout Submittals” include the following:

1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
2. Time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association to supervise on-site testing specified in Part 3.

B. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.

C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

E. Comply with NFPA 70, “National Electrical Code.”

F. Series rated circuit breakers not acceptable.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:

1. Ambient Temperature: Not less than minus 22 deg F and not exceeding 104 deg F.
2. Altitude: Not exceeding 6600 feet.

1.7 COORDINATION

A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

1.8 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
2. Fuse Pullers: Two for each size and type.

PART 2 - PRODUCTS

2.1 FUSIBLE SWITCHES

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

1. Square D; a brand of Schneider Electric – Basis of Design
2. Eaton Electrical Inc.; Cutler-Hammer Business Unit.

3. General Electric Company; GE Consumer & Industrial - Electrical Distribution.

B. Type HD, Heavy Duty, Single Throw, 600 V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper neutral conductors.
3. Isolated Ground Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper neutral conductors.
4. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
5. Auxiliary Contract Kit: One N.O./N.C. (Form C) auxiliary contact, arranged to activate before switch blades open.
6. Lugs: Mechanical type, suitable for number, size, and conductor material.

2.2 NON-FUSIBLE SWITCHES

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

1. Square D; a brand of Schneider Electric – Basis of Design
2. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
3. General Electric Company; GE Consumer & Industrial - Electrical Distribution.

B. Type HD, Heavy Duty, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper neutral conductors.
3. Isolated Ground Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper neutral conductors.
4. Auxiliary Contract Kit: One N.O./N.C. (Form C) auxiliary contact, arranged to activate before switch blades open.

5. Lugs: Mechanical type, suitable for number, size, and conductor material.

2.3 MOLDED-CASE CIRCUIT BREAKERS

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

1. Square D; a brand of Schneider Electric.
2. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
3. General Electric Company; GE Consumer & Industrial - Electrical Distribution.

B. General Requirements: Comply with UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents.

C. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

D. Molded-Case Circuit-Breaker Features and Accessories:

1. Standard frame sizes, trip ratings, and number of poles.
2. Lugs: Mechanical style with compression lug kits suitable for number, size, trip ratings, and conductor material.
3. Application Listing: Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.
4. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 75 percent of rated voltage.
5. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage with field-adjustable 0.1- to 0.6-second time delay.
6. Auxiliary Switch: Two SPDT switches with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.

2.4 ENCLOSURES

A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.

1. Indoor, Dry and Clean Locations: NEMA 250, Type 1
2. Outdoor Locations: NEMA 250, Type 4
3. Other Wet or Damp, Indoor Locations: NEMA 250, Type 3R or 4X.
4. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.

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

C. All enclosed circuit breakers (400 A and higher) shall be electronic trip unit circuit breakers, and shall have metering.

3.2 INSTALLATION

A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

C. Install fuses in fusible devices.

D. Comply with NECA 1, “Standard Practice for Good Workmanship in Electrical Construction.”

3.3 IDENTIFICATION

A. Comply with requirements in Section 26 0553 “Identification for Electrical Systems."

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.4 FIELD QUALITY CONTROL

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

B. Acceptance Testing Preparation:

1. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

C. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
3. Perform the following infrared scan tests and inspections and prepare reports:

   a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each enclosed switch and circuit breaker. Remove front panels so joints and connections are accessible to portable scanner.
   b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each enclosed switch and circuit breaker 11 months after date of Substantial Completion.
   c. Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

4. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

D. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

3.5 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges.

3.6 CLEANING

A. On completion of installation, vacuum dirt and debris from interiors; do not use compressed air to assist in cleaning.

B. Inspect exposed surfaces and repair damaged finishes.

END OF SECTION 26 2816

SECTION 262913.03

MANUAL AND MAGNETIC MOTOR CONTROLLERS

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. Manual motor controllers.
2. Enclosed full-voltage magnetic motor controllers.
3. Combination full-voltage magnetic motor controllers.
4. Enclosures.
5. Accessories.
6. Identification.

1.3 DEFINITIONS

A. CPT: Control power transformer.

B. MCCB: Molded-case circuit breaker.

C. MCP: Motor circuit protector.

D. NC: Normally closed.

E. OCPD: Overcurrent protective device.

F. SCCR: Short-circuit current rating.

G. SCPD: Short-circuit protective device.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For each type of magnetic controller.

1. Include plans, elevations, sections, and mounting details.
2. Indicate dimensions, weights, required clearances, and location and size of each field connection.
3. Wire Termination Diagrams and Schedules: Include diagrams for signal, and control wiring. Identify terminals and wiring designations and color-codes to facilitate installation, operation, and maintenance. Indicate recommended types, wire sizes, and circuiting arrangements for field-installed wiring, and show circuit protection features. Differentiate between manufacturer-installed and field-installed wiring.
4. Include features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

C. Product Schedule: List the following for each enclosed controller:

1. Each installed magnetic controller type.
2. NRTL listing.
3. Factory-installed accessories.
4. Nameplate legends.
5. SCCR of integrated unit.
6. For each combination magnetic controller include features, characteristics, ratings, and factory setting of the SCPD and OCPD.
    a. Listing document proving Type 2 coordination.
7. For each series-rated combination state the listed integrated short-circuit current (withstand) rating of SCPD and OCPDs by an NRTL acceptable to authorities having jurisdiction.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For magnetic controllers to include in operation and maintenance manuals.

1. In addition to items specified in Section 01 7823 "Operation and Maintenance Data," include the following:
    a. Routine maintenance requirements for magnetic controllers and installed components.
    b. Manufacturer's written instructions for testing and adjusting circuit breaker and MCP trip settings.
    c. Manufacturer's written instructions for setting field-adjustable overload relays.

d. Load-Current and Overload-Relay Heater List: Compile after motors have been installed, and arrange to demonstrate that selection of heaters suits actual motor nameplate full-load currents.

e. Load-Current and List of Settings of Adjustable Overload Relays: Compile after motors have been installed, and arrange to demonstrate that switch settings for motor-running overload protection suit actual motors to be protected.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store controllers indoors in clean, dry space with uniform temperature to prevent condensation. Protect controllers from exposure to dirt, fumes, water, corrosive substances, and physical damage.

B. If stored in areas subject to weather, cover controllers to protect them from weather, dirt, dust, corrosive substances, and physical damage. Remove loose packing and flammable materials from inside controllers; install temporary electric heating, with at least 50 Wper controller.

1.7 FIELD CONDITIONS

A. Ambient Environment Ratings: Rate equipment for continuous operation under the following conditions unless otherwise indicated:

1. Ambient Temperature: Not less than23 deg F and not exceeding 104 deg F.

2. Altitude: Not exceeding 6600 feet for electromagnetic and manual devices.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

B. UL Compliance: Fabricate and label magnetic motor controllers to comply with UL 508 and UL 60947-4-1.

C. NEMA Compliance: Fabricate motor controllers to comply with ICS 2.

2.2 MANUAL MOTOR CONTROLLERS

A. Motor-Starting Switches (MSS): "Quick-make, quick-break" toggle or push-button action; marked to show whether unit is off or on.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Square D; by Schneider Electric; or a comparable product by one of the following:

a. Eaton.

b. General Electric Company.

c. Rockwell Automation, Inc.

d. SIEMENS Industry, Inc.; Energy Management Division.

2. Standard: Comply with NEMA ICS 2, general purpose, Class A.

3. Configuration: Nonreversing.

4. Surface mounting as shown on drawings.

5. Red and Green pilot lights.

B. Fractional Horsepower Manual Controllers (FHPMC): "Quick-make, quick-break" toggle or push-button action; marked to show whether unit is off, on, or tripped.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Square D; by Schneider Electric; or a comparable product by one of the following:

a. Eaton.

b. General Electric Company.

c. Rockwell Automation, Inc.

d. SIEMENS Industry, Inc.; Energy Management Division.

2. Configuration: Nonreversing or Two speed to match with mechanical equipment requirement.

3. Overload Relays: Inverse-time-current characteristics; NEMA ICS 2, Class 10 tripping characteristics; heaters matched to nameplate full-load current of actual protected motor; external reset push button.

4. Pilot Light: Red.

2.3 COMBINATION FULL-VOLTAGE MAGNETIC MOTOR CONTROLLER

A. Description: Factory-assembled, combination full-voltage magnetic motor controller consisting of the controller described in this article, indicated disconnecting means, SCPD and OCPD, in a single enclosure.

B. Basis-of-Design Product: Subject to compliance with requirements, provide Square D; by Schneider Electric; or a comparable product by one of the following:

1. Eaton.
2. General Electric Company.
3. Rockwell Automation, Inc.
4. SIEMENS Industry, Inc.; Energy Management Division.

C. Standard: Comply with NEMA ICS 2, general purpose, Class A.

D. Configuration: Nonreversing.

E. Contactor Coils: Pressure-encapsulated type with coil transient suppressors when indicated.

1. Operating Voltage: Manufacturer's standard, unless indicated.

F. Control Power:

1. For on-board control power, obtain from line circuit or from integral CPT. The CPT shall have capacity to operate integral devices and remotely located pilot, indicating, and control devices.
    a. Spare CPT Capacity as Indicated on Drawings: 50 VA.

G. Overload Relays:

1. Thermal Overload Relays:
    a. Inverse-time-current characteristic.
    b. Class 10 tripping characteristic.
    c. Heaters in each phase shall be matched to nameplate full-load current of actual protected motor and with appropriate adjustment for duty cycle.
    d. Ambient compensated.
    e. Automatic resetting.
2. Solid-State Overload Relay:

a. Switch or dial selectable for motor-running overload protection.

b. Sensors in each phase.

c. Class 20 tripping characteristic selected to protect motor against voltage and current unbalance and single phasing.

H. Class II ground-fault protection shall comply with UL 1053 to interrupt low-level ground faults. The ground-fault detection system shall include circuitry that will prevent the motor controller from tripping when the fault current exceeds the interrupting capacity of the controller. Equip with start and run delays to prevent nuisance trip on starting, and a trip indicator.

I. Nonfusible Disconnecting Means:

1. NEMA KS 1, heavy-duty, horsepower-rated, nonfusible switch.

2. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.

2.4 ENCLOSURES

A. Comply with NEMA 250, type designations as indicated on Drawings, complying with environmental conditions at installed location.

B. The construction of the enclosures shall comply with NEMA ICS 6.

C. Controllers in hazardous (classified) locations shall comply with UL 1203.

2.5 ACCESSORIES

A. General Requirements for Control Circuit and Pilot Devices: NEMA ICS 5; factory installed in controller enclosure cover unless otherwise indicated.

1. Push Buttons, Pilot Lights, and Selector Switches: Standard-duty, except as needed to match enclosure type. Heavy-duty or oil-tight where indicated in the controller schedule.

a. Push Buttons: As indicated in the controller schedule.

b. Pilot Lights: As indicated in the controller schedule.

B. Motor protection relays shall be with solid-state sensing circuit and isolated output contacts for hardwired connections.

1. Phase-failure.

2. Phase-reversal, with bicolor LED to indicate normal and fault conditions. Automatic reset when phase reversal is corrected.

3. Under/overvoltage, operate when the circuit voltage reaches a preset value, and drop out when the operating voltage drops to a level below the preset value. Include adjustable time-delay setting.

C. Breather assemblies, to maintain interior pressure and release condensation in Type 4 enclosures installed outdoors or in unconditioned interior spaces subject to humidity and temperature swings.

D. Space heaters, with NC auxiliary contacts, to mitigate condensation in Type 3R enclosures installed outdoors or in unconditioned interior spaces subject to humidity and temperature swings.

E. Sun shields installed on fronts, sides, and tops of enclosures installed outdoors and subject to direct and extended sun exposure.

2.6 IDENTIFICATION

A. Controller Nameplates: Laminated acrylic or melamine plastic signs, as described in Section 26 0553 "Identification for Electrical Systems," for each compartment, mounted with corrosion-resistant screws.

B. Arc-Flash Warning Labels:

1. Comply with requirements in Section 26 0573.19 "Arc-Flash Hazard Analysis." Produce a 3.5-by-5-inch self-adhesive equipment label for each work location included in the analysis.

2. Comply with requirements in Section 26 0553 "Identification for Electrical Systems." Produce a 3.5-by-5-inch self-adhesive equipment label for each work location included in the analysis. Labels shall be machine printed, with no field-applied markings.

a. The label shall have an orange header with the wording, "WARNING, ARC-FLASH HAZARD," and shall include the following information taken directly from the arc-flash hazard analysis:

1) Location designation.

2) Nominal voltage.

3) Flash protection boundary.

4) Hazard risk category.

5) Incident energy.

6) Working distance.

7) Engineering report number, revision number, and issue date.

b. Labels shall be machine printed, with no field-applied markings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and space conditions for compliance with requirements for motor controllers, their relationship with the motors, and other conditions affecting performance of the Work.

3.2 INSTALLATION

A. Comply with NECA 1.

B. Wall-Mounted Controllers: Install magnetic controllers on walls with tops at uniform height indicated, and by bolting units to wall or mounting on lightweight structural-steel channels bolted to wall. For controllers not at walls, provide freestanding racks complying with Section 26 0529 "Hangers and Supports for Electrical Systems" unless otherwise indicated.

C. Maintain minimum clearances and workspace at equipment according to manufacturer's written instructions and NFPA 70.

D. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

E. Setting of Overload Relays: Select and set overloads on the basis of full-load current rating as shown on motor nameplate. Adjust setting value for special motors as required by NFPA 70 for motors that are high-torque, high-efficiency, and so on.

3.3 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 26 0553 "Identification for Electrical Systems."

3.4 SYSTEM FUNCTION TESTS

A. System function tests shall prove the correct interaction of sensing, processing, and action devices. Perform system function tests after field quality control tests have been completed and all components have passed specified tests.

1. Develop test parameters and perform tests for the purpose of evaluating performance of integral components and their functioning as a complete unit within design requirements and manufacturer's published data.
2. Verify the correct operation of interlock safety devices for fail-safe functions in addition to design function.
3. Verify the correct operation of sensing devices, alarms, and indicating devices.

B. Motor controller will be considered defective if it does not pass the system function tests and inspections.

C. Prepare test and inspection reports.

END OF SECTION 26 2913.03

SECTION 265151

INTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Interior LED lighting fixtures, and lamps.
2. Lighting fixture supports.

B. Related Sections:

1. Section 260923 "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.
2. Section 262726 "Wiring Devices" for manual wall-box dimmers.

1.3 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color-rendering index.

C. Fixture: See "Luminaire."

D. IP: International Protection or Ingress Protection Rating.

E. LED: Light-emitting diode.

F. LER: Luminaire efficacy rating.

G. Lumen: Measured output of lamp and luminaire, or both.

H. Luminaire: Complete lighting unit, including lamp, reflector, and housing if provided.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:

1. Physical description of lighting fixture including dimensions.
2. Energy-efficiency data.
3. Life, output (lumens, CCT, and CRI), and energy-efficiency data for lamps.
4. Photometric data and adjustment factors based on laboratory tests, complying with IESNA Lighting Measurements Testing & Calculation Guides, of each lighting fixture type. The adjustment factors shall be for lamps, and accessories identical to those indicated for the lighting fixture as applied in this Project.

    a. Testing Agency Certified Data: For indicated fixtures, photometric data certified by a qualified independent testing agency. Photometric data for remaining fixtures shall be certified by manufacturer.
    b. Manufacturer Certified Data: Photometric data certified by a manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.

B. Shop Drawings: For nonstandard or custom lighting fixtures. Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location a

2. nd size of each field connection.
3. Wiring Diagrams: For power, signal, and control wiring.
4. Lamps, installed.
5. Cords and plugs.
6. Pendant support system.

C. Installation instructions.

D. Product Schedule: For luminaires and lamps. Use same designations indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified agencies providing photometric data for lighting fixtures.

B. Product Certificates: For each type of fixtures.

C. Field quality-control reports.

D. Warranty: Sample of special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals.

1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Lamps: 10 for every 100 of each type and rating installed. Furnish at least one of each type.
2. Diffusers and Lenses: One for every 100 of each type and rating installed. Furnish at least one of each type.

1.8 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910, complying with the IESNA Lighting Measurements Testing & Calculation Guides.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with NFPA 70.

D. FM Global Compliance: Lighting fixtures for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.

E. Provide luminaires from a single manufacturer for each luminaire type.

F. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.

1.9 COORDINATION

A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

1.10 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the products indicated on Drawings.

2.2 PERFORMANCE REQUIREMENTS

A. Ambient Temperature: 41 to 104 deg F.

1. Relative Humidity: Zero to 95 percent.

B. Altitude: Sea level to 1000 feet.

C. Listed catalog number is for first named manufacturer. This manufacturer and fixture constitutes the "basis of design". Listing of alternate manufacturer's names does not imply acceptance of their standard product. Manufacturers are responsible for providing fixtures that are equal in all respects to the "basis of design" fixtures. Intent is to allow for competitively bid lighting package, for fixtures with multiple named manufacturers.

1. If the contractor opts to use the fixture of alternate manufacturer, the contractor shall be responsible to provide point-to-point calculations for all areas as directed by the Engineer at the time of shop drawing submission.

D. Substitutions of fixtures only allowed when approved in advance before shop drawings submittal and request for substitution is submitted in accordance with specifications requirements.

2.3 GENERAL REQUIREMENTS FOR LIGHTING FIXTURES AND COMPONENTS

A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.

B. Metal Parts: Free of burrs and sharp corners and edges.

C. Sheet Metal Components: Steel unless otherwise indicated. Form and support to prevent warping and sagging.

D. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

E. Diffusers and Globes:

1. Acrylic Lighting Diffusers: 100 percent virgin acrylic pl

2. astic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

    a. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.
    b. UV stabilized.

3. Glass: Annealed crystal glass unless otherwise indicated.

F. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Locate labels where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

1. Label shall include the following lamp characteristics:

    a. "USE ONLY" and include specific lamp type.
    b. Lamp type, shape, size, wattage, and coating.
    c. CCT and CRI.

2.4 DOWNLIGHT

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Cooper Lighting, an Eaton business.
2. GE Lighting Solutions.
3. OSRAM SYLVANIA.

B. Lamp:

1. Minimum allowable efficacy of 78 lm/W.
2. Rated lamp life of 35,000 hours to L70.
3. Dimmable from 100 percent to 0 percent of maximum light output.
4. Internal driver.
5. User-Replaceable Lamps:

    a. Bulb shape complying with ANSI C78.79.
    b. Lamp base complying with ANSI C81.61 or IEC 60061-1.

6. Lens Thickness: At least 0.125-inch minimum unless otherwise indicated.

C. Housings:

1. Extruded-aluminum housing and heat sink.
2. Powder-coat or painted finish.
3. Universal mounting bracket.
4. Integral junction box with conduit fittings.

D. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

E. Diffusers and Globes:

1. Fixed lens.
2. Medium light distribution.
3. Clear, UV-stabilized acrylic.
4. Acrylic Diffusers: One hundred percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
5. Glass: Annealed crystal glass unless otherwise indicated.
6. Lens Thickness: At least 0.125-inch minimum unless otherwise indicated.

F. Standards:

1. ENERGY STAR certified.
2. RoHS compliant.
3. UL Listing: Listed for damp location.
4. Recessed luminaires shall comply with NEMA LE 4.

2.5 RECESSED, LINEAR.

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Cooper Lighting, an Eaton business.
2. GE Lighting Solutions.
3. OSRAM SYLVANIA.

B. Lamp:

1. Minimum 4000 lm.
2. Minimum allowable efficacy of 120 lm/W.
3. CRI of minimum 80. CCT of 3500 K.
4. Rated lamp life of 50,000 hours to L90.
5. Dimmable from 100 percent to 0 percent of maximum light output.
6. Internal driver.
7. User-Replaceable Lamps:

    a. Bulb shape complying with ANSI C78.79.
    b. Lamp base complying with ANSI C81.61 or IEC 60061-1.

8. Lens Thickness: At least 0.125-inch minimum unless otherwise indicated.

C. Housings:

1. Extruded-aluminum housing and heat sink.
2. Powder-coat or painted finish.
3. With integral mounting provisions.

D. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Components are designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

E. Diffusers and Globes:

1. Prismatic acrylic.
2. Acrylic Diffusers: One hundred percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
3. Glass: Annealed crystal glass unless otherwise indicated.
4. Lens Thickness: At least 0.125-inch minimum unless otherwise indicated.

F. Standards:

1. ENERGY STAR certified.
2. RoHS compliant.
3. UL Listing: Listed for damp location.
4. NEMA LE 4.

2.6 MATERIALS

A. Metal Parts:

1. Free of burrs and sharp corners and edges.
2. Sheet metal components shall be steel unless otherwise indicated.
3. Form and support to prevent warping and sagging.

B. Steel:

1. ASTM A 36/A 36M for carbon structural steel.
2. ASTM A 568/A 568M for sheet steel.

C. Stainless Steel:

1. 1. Manufacturer's standard grade.
2. 2. Manufacturer's standard type, ASTM A 240/240 M.

D. Galvanized Steel: ASTM A 653/A 653M.

E. Aluminum: ASTM B 209.

F. Doors, Frames, and Other Internal Access:

1. Smooth operating, free of light leakage under operating conditions.
2. Designed to permit relamping without use of tools.
3. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

2.7 METAL FINISHES

A. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

2.8 LIGHTING FIXTURE SUPPORT COMPONENTS

A. Comply with Section 260529 "Hangers and Supports for Electrical Systems" for channel- and angle-iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.

C. Twin-Stem Hangers: Two, 1/2-inch steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.

D. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage.

E. Wires for Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, 12 gage

F. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.

G. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for conditions affecting performance of luminaires.

B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before luminaire installation.

C. Examine walls, floors, roofs, and ceilings for suitable conditions where luminaires will be installed.

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

3.2 INSTALLATION

A. Comply with NECA 1.

B. Install luminaires Set level, plumb, and square with ceilings and walls unless otherwise indicated.

C. Install lamps in each luminaire.

D. Supports:

1. Sized and rated for luminaire weight.

2. Able to maintain luminaire position after cleaning and relamping.
3. Provide support for luminaire without causing deflection of ceiling or wall.
4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.

E. Temporary Lighting: If it is necessary, and approved by Architect/Owner, to use permanent luminaires for temporary lighting, install and energize the minimum number of luminaires necessary. When construction is sufficiently complete, remove the temporary luminaires, disassemble, clean thoroughly, install new lamps, and reinstall.

F. Lay-in Ceiling Lighting Fixtures Supports: Use grid as a support element.

1. Install ceiling support system rods or wires, independent of the ceiling suspension devices, for each fixture. Locate not more than 6 inches from lighting fixture corners.
2. Support Clips: Fasten to lighting fixtures and to ceiling grid members at or near each fixture corner with clips that are UL listed for the application.
3. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch metal channels spanning and secured to ceiling tees.
4. Install at least one independent support rod or wire from structure to a tab on lighting fixture. Wire or rod shall have breaking strength of the weight of fixture at a safety factor of 3.

G. Flush-Mounted Luminaires:

1. Secured to outlet box.
2. Attached to ceiling structural members at four points equally spaced around circumference of luminaire.
3. Trim ring flush with finished surface.

H. Suspended Lighting Fixture Support:

1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.
4. Do not use grid as support for pendant luminaires. Connect support wires or rods to building structure.

I. Wall-Mounted Luminaires:

1. Attached to a minimum 20 gauge backing plate attached to wall structural members.
2. Do not attach luminaires directly to gypsum board.

J. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.3 IDENTIFICATION

A. Install labels with panel and circuit numbers on concealed junction and outlet boxes. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.4 FIELD QUALITY CONTROL

A. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

3.5 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting aimable luminaires to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose. Some of this work may be required after dark.

1. During adjustment visits, inspect all luminaires. Replace lamps or luminaires that are defective.
2. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
3. Adjust aimable luminaires in the presence of Owner’s Representative.

END OF SECTION 26 5151

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SECTION 265219

EMERGENCY AND EXIT LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Emergency lighting units.
2. Exit signs.
3. Luminaire supports.

1.3 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color Rendering Index.

C. Emergency Lighting Unit: A lighting unit with internal or external emergency battery powered supply and the means for controlling and charging the battery and unit operation.

D. Fixture: See "Luminaire" Paragraph.

E. Lumen: Measured output of lamp and luminaire, or both.

F. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of emergency lighting unit, exit sign, and emergency lighting support.

1. Include data on features, accessories, and finishes.

2. Include physical description of the unit and dimensions.
3. Battery and charger for light units.
4. Include life, output of luminaire (lumens, CCT, and CRI), and energy-efficiency data.
5. Include photometric data and adjustment factors based on laboratory tests, complying with IES LM-45, for each luminaire type.

    a. Testing Agency Certified Data: For indicated luminaires and signs, photometric data certified by a qualified independent testing agency. Photometric data for remaining luminaires and signs shall be certified by manufacturer.
    b. Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.

B. Shop Drawings: For nonstandard or custom luminaires.

1. Include plans, elevations, sections, and mounting and attachment details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

C. Sustainable Design Submittals:

1. Product Data: Indicating luminaire is certified by Design Lights Consortium.
2. Product Data: For lamps, indicating mercury content and lamp life.

D. Product Schedule:

1. For emergency lighting units. Use same designations indicated on Drawings.
2. For exit signs. Use same designations indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing laboratory providing photometric data for luminaires.

B. Product Certificates: For each type of luminaire.

C. Product Test Reports: For each luminaire for tests performed by a qualified testing agency.

D. Sample Warranty: For manufacturer's special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For luminaires and lighting systems to include in emergency, operation, and maintenance manuals.

1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Lamps: 10 for every 100 of each type and rating installed. Furnish at least one of each type.
2. Luminaire-mounted, emergency battery pack: One for every 20 emergency lighting units. Furnish at least one of each type.
3. Diffusers and Lenses: One for every 100 of each type and rating installed. Furnish at least one of each type.

1.8 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturer's laboratory that is accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.

B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7, accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products, and complying with the applicable IES testing standards.

C. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

1.10 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five year(s) from date of Substantial Completion.

B. Special Warranty for Emergency Lighting Batteries: Manufacturer's standard form in which manufacturer of battery-powered emergency lighting unit agrees to repair or replace components of rechargeable batteries that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Emergency Power Unit Batteries: Five years from date of Substantial Completion. Full warranty shall apply for the entire warranty period.
2. Warranty Period for Self-Powered Exit Sign Batteries: Two years from date of Substantial Completion. Full warranty shall apply for the entire warranty period.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR EMERGENCY LIGHTING

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. NRTL Compliance: Fabricate and label emergency lighting units, exit signs, and batteries to comply with UL 924.

C. Comply with NFPA 70 and NFPA 101.

D. Comply with NEMA LE 4 for recessed luminaires.

E. Internal Type Emergency Power Unit: Self-contained, modular, battery-inverter unit, factory mounted within luminaire body and compatible with ballast.

1. Emergency Connection: Operate one lamp(s) continuously at an output of 1100 lumens each upon loss of normal power. Connect unswitched circuit to battery-inverter unit and switched circuit to luminaire ballast.
2. Operation: Relay automatically turns lamp on when power-supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects

lamps from battery, and battery is automatically recharged and floated on charger.

3. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:

    a. Ambient Temperature: Less than 0 deg F or exceeding 104 deg F, with an average value exceeding 95 deg F over a 24-hour period.
    b. Ambient Storage Temperature: Not less than minus 4 deg F and not exceeding 140 deg F.
    c. Humidity: More than 95 percent (condensing).
    d. Altitude: Exceeding 3300 feet.

4. Test Push-Button and Indicator Light: Visible and accessible without opening luminaire or entering ceiling space.

    a. Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
    b. Indicator Light: LED indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.

5. Battery: Sealed, maintenance-free, nickel-cadmium type.
6. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.
7. Remote Test: Switch in handheld remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.
8. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

2.2 EMERGENCY LIGHTING

A. General Requirements for Emergency Lighting Units: Self-contained units.

B. Emergency Luminaires:

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

    a. Cooper Lighting, an Eaton business.
    b. Lithonia Lighting; Acuity Brands Lighting, Inc.
    c. Philips Lighting Company.

2. Emergency Luminaires: as indicated on Interior Luminaire Schedule Drawings, with the following additional features:

    a. Operating at nominal voltage of 120 V ac.
    b. Internal emergency power unit.
    c. Rated for installation in damp locations, and for sealed and gasketed luminaires in wet locations.

3. Manufacturer to match that of normal lighting fixtures in same area. Emergency lighting model to match area lighting fixtures in appearance.

C. Emergency Lighting Unit:

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

    a. Cooper Lighting, an Eaton business.
    b. Dual-Lite.
    c. Lithonia Lighting; Acuity Brands Lighting, Inc.

2. Emergency Lighting Unit: as indicated on Interior Luminaire Schedule Drawings.
3. Operating at nominal voltage of 120 V ac.
4. Wall with universal junction box adaptor.
5. UV stable thermoplastic housing, rated for damp locations.
6. Two LED lamp heads.
7. Internal emergency power unit.

2.3 EXIT SIGNS

A. General Requirements for Exit Signs: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.

B. Internally Lighted Signs:

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

    a. Cooper Lighting, an Eaton business.
    b. Lithonia Lighting; Acuity Brands Lighting, Inc.
    c. Philips Lighting Company.

2. Operating at nominal voltage of 120 V ac.
3. Lamps for AC Operation: LEDs; 50,000 hours minimum rated lamp life.

4. Self-Powered Exit Signs (Battery Type): Internal emergency power unit.

2.4 MATERIALS

A. Metal Parts:

1. Free of burrs and sharp corners and edges.
2. Sheet metal components shall be steel unless otherwise indicated.
3. Form and support to prevent warping and sagging.

B. Doors, Frames, and Other Internal Access:

1. Smooth operating, free of light leakage under operating conditions.
2. Designed to permit relamping without use of tools.
3. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

C. Diffusers and Globes:

1. Tempered Fresnel glass.
2. Glass: Annealed crystal glass unless otherwise indicated.
3. Acrylic: 100 percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
4. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.

D. Housings:

1. Extruded aluminum housing and heat sink.
2. Clear anodized finish.

E. Conduit: Electrical metallic tubing, minimum 3/4 inch in diameter.

2.5 METAL FINISHES

A. 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.

2.6 LUMINAIRE SUPPORT COMPONENTS

A. Comply with requirements in Section 26 05 29 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

B. Support Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage (2.68 mm).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for conditions affecting performance of luminaires.

B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before luminaire installation.

C. Examine walls, floors, roofs, and ceilings for suitable conditions where emergency lighting luminaires will be installed.

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

3.2 INSTALLATION

A. Comply with NECA 1.

B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.

C. Install lamps in each luminaire.

D. Supports:

1. Sized and rated for luminaire and emergency power unit weight.
2. Able to maintain luminaire position when testing emergency power unit.
3. Provide support for luminaire and emergency power unit without causing deflection of ceiling or wall.
4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire and emergency power unit weight and vertical force of 400 percent of luminaire weight.

E. Wall-Mounted Luminaire Support:

1. Attached to structural members in walls or attached to a minimum 20-gage backing plate attached to wall structural members or attached using through bolts and backing plates on either side of wall.
2. Do not attach luminaires directly to gypsum board.

F. Suspended Luminaire Support:

1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
2. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
3. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.

G. Ceiling Grid Mounted Luminaires:

1. Secure to any required outlet box.
2. Secure emergency power unit using approved fasteners in a minimum of four locations, spaced near corners of emergency power unit.
3. Use approved devices and support components to connect luminaire to ceiling grid and building structure in a minimum of four locations, spaced near corners of luminaire.

3.3 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.

B. Luminaire will be considered defective if it does not pass operation tests and inspections.

C. Prepare test and inspection reports.

3.5 STARTUP SERVICE

A. Perform startup service:

1. Charge emergency power units and batteries minimum of one hour and depress switch to conduct short-duration test.
2. Charge emergency power units and batteries minimum of 24 hours and conduct one-hour discharge test.

3.6 ADJUSTING

A. Adjustments: Within 12 months of date of Substantial Completion, provide on-site visit to do the following:

1. Inspect all luminaires. Replace lamps, emergency power units, batteries, signs, or luminaires that are defective.

    a. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

2. Conduct short-duration tests on all emergency lighting.

END OF SECTION 26 5219

SECTION 265619

LED EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Exterior solid-state luminaires that are designed for and exclusively use LED lamp technology.

B. Related Requirements:
   1. Section 26 0923"Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, and occupancy sensors.

1.3 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color rendering index.

C. Fixture: See "Luminaire."

D. IP: International Protection or Ingress Protection Rating.

E. Lumen: Measured output of lamp and luminaire, or both.

F. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of luminaire.
   1. Arrange in order of luminaire designation.

2. Include data on features, accessories, and finishes.
3. Include physical description and dimensions of luminaire.
4. Lamps, include life, output (lumens, CCT, and CRI), and energy-efficiency data.
5. LED Drivers: Include information as to input watts. Indicate mounting distance limitation and standard wire sizes for remote drivers.
6. Photometric data and adjustment factors based on laboratory tests, complying with IES Lighting Measurements Testing and Calculation Guides, of each luminaire type. The adjustment factors shall be for lamps and accessories identical to those indicated for the luminaire as applied in this Project.
   a. Manufacturer's Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the NVLAP for Energy Efficient Lighting Products.
   b. Testing Agency Certified Data: For indicated luminaires, photometric data certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer.
7. Wiring diagrams for power, control, and signal wiring.
8. Means of attaching luminaires to supports and indication that the attachment is suitable for components involved.

B. Shop Drawings: For nonstandard or custom luminaires.
   1. Include plans, elevations, sections, and mounting and attachment details.
   2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   3. Include diagrams for power, signal, and control wiring.

C. Sustainable Design Submittals:
   1. Product Data: BUG ratings.
   2. Product Data: Luminaire calculations. For Light Pollution Reduction for both uplight and light trespass.
   3. Product Data: Indicating luminaire is certified by ENERGY STAR and/or Design Lights Consortium.

D. Samples: For each luminaire and for each color and texture indicated with factory-applied finish.

E. Product Schedule: For luminaires and lamps. Use same designations indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
   1. Luminaires.
   2. Structural members to which luminaires will be attached.
   3. Underground utilities and structures.
   4. Existing underground utilities and structures.
   5. Above-grade utilities and structures.
   6. Existing above-grade utilities and structures.
   7. Building features.
   8. Vertical and horizontal information.

B. Qualification Data: For testing laboratory providing photometric data for luminaires.

C. Product Certificates: For each type of the following:
   1. Luminaire.

D. Product Test Reports: For each luminaire, for tests performed by manufacturer and witnessed by a qualified testing agency.

E. Source quality-control reports.

F. Sample warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For luminaires to include in operation and maintenance manuals.
   1. Provide a list of all lamp types used on Project. Use ANSI and manufacturers' codes.
   2. Provide a list of all photoelectric relay types used on Project; use manufacturers' codes.

1.7 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7, accredited under the NVLAP for Energy Efficient Lighting Products and complying with applicable IES testing standards.

B. Provide luminaires from a single manufacturer for each luminaire type.

C. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering prior to shipping.

1.9 FIELD CONDITIONS

A. Verify existing and proposed utility structures prior to the start of work associated with luminaire installation.

B. Mark locations of exterior luminaires for approval by Architect prior to the start of luminaire installation.

1.10 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures, including luminaire support components.
      b. Faulty operation of luminaires and accessories.
      c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
   2. Warranty Period: 2 year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 LUMINAIRE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. NRTL Compliance: Luminaires shall be listed and labeled for indicated class and division of hazard by an NRTL.

C. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.

D. UL Compliance: Comply with UL 1598 and listed for wet location.

E. Lamp base complying with ANSI C81.61.

F. Bulb shape complying with ANSI C79.1.

G. CRI of minimum 80 unless otherwise shown on Drawings. CCT of minimum 3000K unless otherwise shown on Drawings.

H. L70 lamp life of minimum 50,000 hours.

I. Lamps dimmable from 100 percent to 0 percent of maximum light output unless otherwise shown on Drawings.

J. Internal driver.

K. Nominal Operating Voltage: 120 V ac or 240 V ac.

L. In-line Fusing: On the primary for each luminaire.

M. Lamp Rating: Lamp marked for outdoor use and in enclosed locations.

N. Lateral Light Distribution Patterns: Comply with IESNA RP-8 for parameters of lateral light distribution patterns indicated for luminaires.

O. Source Limitations: For luminaires, obtain each color, grade, finish, type, and variety of luminaire from single source with resources to provide products of consistent quality in appearance and physical properties.

P. Uplight: Exterior lighting shall have maximum luminaire uplight rating of U2 for Lighting Zone 2. Uplight ratings (U) as defined by IESNA TM-15-07 Addendum A.

Q. Light Trespass and Glare: Maximum Glare Rating of G2 and Backlight Rating of B0 or B2 or B3 or B4 based on horizontal distance to lighting boundary (HLB) for Lighting Zone 2. Backlight (B) and Glare (G) ratings as defined by IESNA TM-15-07 Addendum A.

2.2 LUMINAIRE TYPES

A. Refer to lighting fixture schedule on drawings.

B. The manufacturer's fixture catalog numbers specified in the Light Fixture Schedule or as indicated on the drawings, describing the various types of fixtures, do not include all the required accessories or hardware that may be required for a complete installation. Furnish and install a complete complement of Luminaires, as required, and all associated appurtenances including, but not necessarily limited to, all lamps, ballasts, reflectors, pendants, canopies, recessing boxes, plaster frames, brackets etc., completely wired, assembled, installed and tested as specified and in the manner indicated.

2.3 LED DRIVERS

A. LED drivers shall be factory provided by the respective luminaire manufacturers, and shall be suitable for their intended use, to operate the designated LED modules listed in the Luminaire Schedule, and as specified herein, to their full light output.

B. Comply with the requirements of the Federal Communications Commission (FCC) rules and regulations, Title 47 CFR part 18, Non-Consumer (Class A) for EMI/RFI (conducted and radiated).

C. Provide complete connection to LED-type luminaries through both integrally installed and remote electronic drivers.

D. Shall be totally enclosed within a metallic enclosure, and shall be provided with integral leads color coded per ANSI C82.11, or with poke-in style wire retaining connectors.

E. Provide identical drivers within each luminaire type.

F. Provide UL listed and labeled drivers. Provide drivers with temperature ratings appropriate to the installation.

G. Fixtures intended to be dimmed shall have dimming driver compatible with the specified dimmer controls.

2.4 MATERIALS

A. Metal Parts: Free of burrs and sharp corners and edges.

B. Sheet Metal Components: Corrosion-resistant aluminum. Form and support to prevent warping and sagging.

C. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without

use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses.

D. Diffusers and Globes:
   1. Acrylic Diffusers: 100 percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
   2. Glass: Annealed crystal glass unless otherwise indicated.
   3. Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless otherwise indicated.

E. Lens and Refractor Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.

F. Reflecting surfaces shall have minimum reflectance as follows unless otherwise indicated:
   1. White Surfaces: 85 percent.
   2. Specular Surfaces: 83 percent.
   3. Diffusing Specular Surfaces: 75 percent.

G. Housings:
   1. Rigidly formed, weather- and light-tight enclosure that will not warp, sag, or deform in use.
   2. Provide filter/breather for enclosed luminaires.

H. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.
   1. Label shall include the following lamp characteristics:
      a. "USE ONLY" and include specific lamp type.
      b. Lamp diameter, shape, size, wattage and coating.
      c. CCT and CRI for all luminaires.

2.5 FINISHES

A. Variations in Finishes: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

B. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and support materials.

C. Factory-Applied Finish for Aluminum Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
   1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
   2. Natural Satin Finish: Provide fine, directional, medium satin polish (AA-M32); buff complying with AA-M20 requirements; and seal aluminum surfaces with clear, hard-coat wax.
   3. Class I, Clear-Anodic Finish: AA-M32C22A41 (Mechanical Finish: Medium satin; Chemical Finish: Etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.
   4. Class I, Color-Anodic Finish: AA-M32C22A42/A44 (Mechanical Finish: Medium satin; Chemical Finish: Etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker), complying with AAMA 611.
      a. Color: Refer to schedule on drawings.

2.6 LUMINAIRE SUPPORT COMPONENTS

A. Comply with requirements in Section 26 0529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for luminaire electrical conduit to verify actual locations of conduit connections before luminaire installation.

C. Examine walls, roofs, and canopy ceilings and overhang ceilings for suitable conditions where luminaires will be installed.

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

3.2 TEMPORARY LIGHTING

A. Do not use permanent luminaires for temporary lighting.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Comply with NECA 1.

B. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.

C. Install lamps in each luminaire.

D. Fasten luminaire to structural support.

E. Supports:
   1. Sized and rated for luminaire weight.
   2. Able to maintain luminaire position after cleaning and relamping.
   3. Support luminaires without causing deflection of finished surface.
   4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.

F. Wall-Mounted Luminaire Support:
   1. Attached to structural members in walls.
   2. Attached to a minimum 1/8 inch backing plate attached to wall structural members, where required.

G. Wiring Method: Install cables in raceways. Conceal raceways and cables.

H. Install luminaires level, plumb, and square with finished grade unless otherwise indicated. Install luminaires at height and aiming angle as indicated on Drawings or as directed by Architect.

I. Coordinate layout and installation of luminaires with other construction.

J. Comply with requirements in Section 26 0519 "Low-Voltage Electrical Power Conductors and Cables" and Section 26 0533 "Raceways and Boxes for Electrical Systems" for wiring connections and wiring methods.

3.4 CORROSION PREVENTION

A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.

B. Steel Conduits: Comply with Section 26 0533 "Raceways and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch-thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

3.5 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 26 0553 "Identification for Electrical Systems."

3.6 FIELD QUALITY CONTROL

A. Inspect each installed luminaire for damage. Replace damaged luminaires and components.

B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
   1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.

C. Luminaire will be considered defective if it does not pass tests and inspections.

3.7 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain luminaires.

END OF SECTION 26 5619

SECTION 311000

SITE CLEARING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Baltimore County Department of Public Works and Transportation Standard Specifications for Construction and Materials, Latest Edition

1.2 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, and removing site utilities.
7. Temporary erosion and sedimentation control.

B. Related Requirements:

1. Section 015000 "Temporary Facilities and Controls" for temporary erosion- and sedimentation-control measures.

1.3 DEFINITIONS

A. Subsoil: Soil beneath the level of subgrade; soil beneath the topsoil layers of a naturally occurring soil profile, typified by less than 1 percent organic matter and few 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.

D. 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.

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

F. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction and indicated on Drawings and according to requirements in Section 015639 "Temporary Tree and Plant Protection.".

G. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 MATERIAL OWNERSHIP

A. Except for materials indicated to be stockpiled or otherwise remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.6 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.

1.7 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.

1.8 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 Architect.

C. Salvageable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated.

D. Utility Locator Service: Notify Miss Utility 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."

G. Soil Stripping, Handling, and Stockpiling: Perform only when the soil is dry or slightly moist.

PART 2 - PRODUCTS

Refer to Baltimore County Standard Specifications for Construction and Materials, Section 101 – Clearing and Grubbing

PART 3 - EXECUTION

Refer to Baltimore County Standard Specifications for Construction and Materials, Section 101 – Clearing and Grubbing

END OF SECTION 311000

SECTION 312000

EARTH MOVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Baltimore County Department of Public Works and Transportation Standard Specifications for Construction and Materials, Latest Edition.

C. “Geotechnical Subsurface Investigation Report” prepared by AB Consultants dated September 12, 2024.

1.2 SUMMARY

A. Section Includes:

1. Excavating and filling for rough grading the Site.
2. Preparing subgrades for walks, pavements, turf and grasses, and plants.
3. Drainage course for concrete slabs-on-grade.
4. Subbase course for concrete walks and pavements.
5. Subbase course and base course for asphalt paving.
6. Subsurface drainage backfill for walls and trenches.
7. Excavating and backfilling trenches for utilities and pits for buried utility structures.

B. Related Requirements:

1. Section 311000 "Site Clearing" for site stripping, grubbing, stripping and stockpiling topsoil, and removal of above- and below-grade improvements and utilities.
2. Section 329200 "Turf and Grasses" for finish grading in turf and grass areas, including preparing and placing planting soil for turf areas.
3. Section 329300 "Plants" for finish grading in planting areas and tree and shrub pit excavation and planting.

1.3 DEFINITIONS

A. Backfill: Soil material or controlled low-strength material used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: Aggregate layer placed between the subbase course and hot-mix asphalt paving.

C. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.

D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

E. Drainage Course: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.

F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Engineer/Owner. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.

G. Fill: Soil materials used to raise existing grades.

H. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

I. Subbase Course: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.

J. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.

K. Utilities: On-site underground pipes, conduits, ducts, and cables as well as underground services within buildings.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct preexcavation conference at Project site.

1. Review methods and procedures related to earthmoving, including, but not limited to, the following:

a. Personnel and equipment needed to make progress and avoid delays.
b. Coordination of Work with utility locator service.

c. Coordination of Work and equipment movement with the locations of tree- and plant-protection zones.
d. Extent of trenching by hand or with air spade.
e. Field quality control.

1.5 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 as follows:

1. Classification according to ASTM D2487.
2. Laboratory compaction curve according to ASTM D698.

C. Geotechnical Testing Reports

1.6 QUALITY ASSURANCE

A. Geotechnical Testing Agency Qualifications: Qualified according to ASTM E329 and ASTM D3740 for testing indicated.

1.7 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 authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.

B. Utility Locator Service: Notify “Miss Utility" for area where Project is located before beginning earth-moving operations.

C. Do not commence earth-moving operations until temporary site fencing and erosion- and sedimentation-control measures specified in Section 015000 "Temporary Facilities and Controls" and Section 311000 "Site Clearing" are in place.

D. Do not commence earth-moving operations until plant-protection measures specified in Section 015639 "Temporary Tree and Plant Protection" are in place.

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 unless otherwise indicated.
7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

F. Do not direct vehicle or equipment exhaust towards protection zones.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

A. Satisfactory Soils: Refer to “Geotechnical Subsurface Investigation Report” prepared by AB Consultants dated September 12, 2024.

A. Subbase Material: Per Baltimore County Standard Specifications Section 916.

B. Base Course: Per Baltimore County Standard Specifications Section 916.

C. Engineered Fill: Per Baltimore County Standard Specifications Section 916.

D. Bedding Course: Per Baltimore County Standard Specifications Section 916.

E. Drainage Course: Per Baltimore County Standard Specifications Section 916.

F. Filter Material: Per Baltimore County Standard Specifications Section 916.

G. Sand: ASTM C33/C33M; fine aggregate.

H. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

2.2 GEOTEXTILES

A. Subsurface Drainage Geotextile: Per Baltimore County Standard Specifications Section 92.

2.3 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. Blue: Water systems.
3. Green: Sewer systems.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth-moving operations.

B. Protect and maintain erosion and sedimentation controls during earth-moving operations.

C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.2 DEWATERING

A. Provide 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.

B. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

C. 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.

D. 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.

3.3 EXPLOSIVES

A. Explosives: Do not use explosives.

3.4 EXCAVATION, GENERAL

A. 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 cross sectioned by Architect. The Contract Sum will be adjusted for rock excavation according to unit prices included in 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; and 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 is earth excavation.

2. Rock excavation includes removal and disposal of rock. Remove rock to lines and subgrade elevations indicated to permit installation of permanent construction without exceeding the following dimensions:
    a. 6 inches beneath bottom of concrete slabs-on-grade.
    b. 6 inches beneath pipe in trenches and the greater of 24 inches than pipe or 42 inches wide.

3.5 EXCAVATION FOR STRUCTURES

A. Excavations at Edges of Tree- and Plant-Protection Zones:

1. Excavate by hand or with an air spade to indicated lines, cross sections, elevations, and subgrades. If excavating by hand, use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
2. Cut and protect roots according to requirements in Section 015639 "Temporary Tree and Plant Protection."

3.6 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades. Any tree stumps or roots should be reduced to the required depth below sidewalks.

3.7 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.

1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.

B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit unless otherwise indicated.

1. Clearance: 12 inches each side of pipe or conduit.

C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.

1. For pipes and conduit less than 6 inches in nominal diameter, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.
2. For pipes and conduit 6 inches or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe or conduit circumference. Fill depressions with tamped sand backfill.
3. For flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support conduit on an undisturbed subgrade.
4. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

D. Trench Bottoms: Excavate trenches 4 inches deeper than bottom of pipe and conduit elevations to allow for bedding course. Hand-excavate deeper for bells of pipe.

1. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

E. Trenches in Tree- and Plant-Protection Zones:

1. Hand-excavate to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
2. Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities.
3. Cut and protect roots according to requirements in Section 015639 "Temporary Tree and Plant Protection."

3.8 SUBGRADE INSPECTION

A. Notify Engineer when excavations have reached required subgrade.

B. If Engineer determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.

C. Proof-roll subgrade below pavements with a pneumatic-tired and loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons 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. 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.

D. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.

E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, without additional compensation.

3.9 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.10 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, bracing, and sheeting.
7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.11 UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

C. Backfill voids with satisfactory soil while removing shoring and bracing.

D. Initial Backfill:

1. Soil Backfill: Place and compact initial backfill of **subbase material** free of particles larger than **1 inch** in any dimension, to a height of 12 inches over the pipe or conduit.

a. 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.

2. Controlled Low-Strength Material: Place initial backfill of controlled low-strength material to a height of 12 inches over the pipe or conduit. Coordinate backfilling with utilities testing.

E. Final Backfill:

1. Soil Backfill: Place and compact final backfill of satisfactory soil to final subgrade elevation.
2. Controlled Low-Strength Material: Place final backfill of controlled low-strength material to final subgrade elevation.

F. Warning Tape: Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.12 SOIL FILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

B. Place and compact fill material in layers to required elevations as follows:

1. Under grass and planted areas, use satisfactory soil material.
2. Under walks and pavements, use satisfactory soil material.
3. Under steps and ramps, use engineered fill.
4. Under building slabs, use engineered fill.
5. Under footings and foundations, use engineered fill.

C. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.13 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.

1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.14 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Per Baltimore County Standard Specifications Categories 200 and 500.

B. Per Baltimore County Standard Specifications 300.03.04, in unimproved areas outside the existing or proposed road right-of-way, unless trench compaction as used within road right-of-way is specified on the Contract Drawings, compaction shall be accomplished as follows for the remaining depth of trench. Backfill material shall be placed in 12-inch layers and compacted in such a manner that a completely dense refill is obtained which is free of voids and not susceptible to settlement.

3.15 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

1. Provide a smooth transition between adjacent existing grades and new grades.
2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to elevations required to achieve indicated finish elevations, within the following subgrade tolerances:

1. Turf or Unpaved Areas: Plus or minus 1 inch.
2. Walks: Plus or minus 1 inch.
3. Pavements: Plus or minus 1/2 inch.

3.16 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. 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.
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.
6. Compact subbase course and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 of maximum dry unit weight according to ASTM D698.

3.17 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. 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 D698.

3.18 FIELD QUALITY CONTROL

A. Special Inspections: Owner or contractor will engage a qualified special inspector to perform the following special inspections:

1. Determine prior to placement of fill that site has been prepared in compliance with requirements.
2. Determine that fill material classification and maximum lift thickness comply with requirements.
3. Determine, during placement and compaction, that in-place density of compacted fill complies with requirements.

B. Testing Agency: Owner or contractor will engage a qualified geotechnical engineering testing agency to perform tests and inspections per requirements outlined in Baltimore County Specifications Categories 200 and 500.

C. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.

D. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Architect.

E. Testing agency will test compaction of soils in place according to ASTM D1556, ASTM D2167, ASTM D2937, and ASTM D6938, as applicable. Tests will be performed at the following locations and frequencies:

1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2000 sq. ft. or less of paved area or building slab but in no case fewer than three tests.
2. Trench Backfill: At each compacted initial and final backfill layer, at least one test for every 150 feet or less of trench length but no fewer than two tests.

F. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

3.19 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace soil material to depth as directed by Architect; reshape and recompact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.20 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

B. Transport surplus satisfactory soil to designated storage areas on Owner's property. Stockpile or spread soil as directed by Architect.

1. Remove waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION 312000

SECTION 321216

ASPHALT PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Baltimore County Department of Public Works and Transportation Standard Specifications for Construction and Materials, Latest Edition

1.2 SUMMARY

A. Section Includes:

1. Hot-mix asphalt paving.
2. Hot-mix asphalt patching.
3. Asphalt surface treatments.

B. Related Requirements:

1. Section 024119 "Selective 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.

1.3 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.

1.4 ACTION SUBMITTALS

A. Product Data: Include technical data and tested physical and performance properties.

1. Paving geotextile.
2. Joint sealant.

B. Hot-Mix Asphalt Designs:

1. Certification, by SHA and MDOT, of approval of each hot-mix asphalt design proposed for the Work.
2. For each hot-mix asphalt design proposed for the Work.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For paving-mix manufacturer and testing agency.

B. Material Certificates:

1. Aggregates.
2. Asphalt binder.
3. Asphalt cement.
4. Cutback prime coat.
5. Emulsified asphalt prime coat.
6. Tack coat.
7. Fog seal.
8. Undersealing asphalt.

C. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: A paving-mix manufacturer registered with and approved by SHA or MDOT.

B. Testing Agency Qualifications: Qualified in accordance with ASTM D3666 for testing indicated.

C. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of Baltimore County Standard Specifications for Construction and Materials, Section 504 for asphalt paving work.

PART 2 - PRODUCTS

Refer to Baltimore County Standard Specifications for Construction and Materials, Section 504 – Hot Mix Asphalt Pavement

PART 3 - EXECUTION

Refer to Baltimore County Standard Specifications for Construction and Materials, Section 504 – Hot Mix Asphalt Pavement

END OF SECTION 321216

SECTION 321313

CONCRETE PAVING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes concrete paving

1. Curbs
2. Walks

B. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for general building applications of concrete.
2. Section 321373 "Concrete Paving Joint Sealants" for joint sealants in expansion and contraction joints within concrete paving and in joints between concrete

1.2 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.

1.3 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.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Initial Selection: For each type of product, ingredient, or admixture requiring color selection.

C. 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.

D. 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.

1.5 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.

1.6 QUALITY ASSURANCE

A. Concrete Standards: Comply with provisions of the following standards, except where

more stringent requirements are indicated.

1. American Concrete Institute (ACI) 301, “Specifications for Structural Concrete for Buildings.”
2. ACI 318, “Building Code Requirements for Reinforced Concrete.”
3. Concrete Reinforcing Steel Institute (CRSI) “Manual of Standard Practice.”

B. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M 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 C1077 and ASTM E329 for testing indicated.

1. Personnel conducting field tests must 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. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage a qualified independent testing agency to perform preconstruction testing on concrete paving mixtures.

1.8 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 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 (ACI 301M) 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.

PART 2 - PRODUCTS

- Refer to Baltimore County Standard Specifications for Construction and Materials. Section 609 – Concrete Curb
- Refer to Baltimore County Standard Specifications for Construction and Materials Section 520 – Plain and Reinforced Portland Cement Concrete Pavements.

PART 3 - EXECUTION

- Refer to Baltimore County Standard Specifications for construction and Materials. Section 609 – Concrete Curb
- Refer to Baltimore County Standard Specifications for Construction and Materials Section 520 – Plain and Reinforced Portland Cement Concrete Pavements.

END OF SECTION 321313

SECTION 321316

DECORATIVE CONCRETE PAVING

PART 1 - GENERAL

1.1 SUMMARY

A. Scored concrete paving with integral color (P2) – Splash Pad

B. Scored concrete paving with integral color (P2) – Add Alternate #1

C. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete"
2. Category 500 "Paving" (Baltimore County Standard Specifications and Details for Construction).
3. Section 321313 "Concrete Paving" for cast-in-place concrete paving with other finishes, curbs and gutters, and stamped detectable warnings.
4. Section 321373 "Concrete Paving Joint Sealants" for joint sealants in expansion and contraction joints within decorative concrete paving and in joints between decorative concrete paving and other paving or adjacent construction.

1.2 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.

1.3 PREINSTALLATION MEETINGS

A. Pre-installation Conference: Conduct conference at Project site.

1. Review methods and procedures related to decorative concrete paving, including but not limited to, the following:

a. Concrete mixture design.
b. Quality control of concrete materials and decorative concrete paving construction practices.

2. Require representatives of each entity directly concerned with decorative 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. Decorative concrete paving Installer.
    e. Manufacturer's representative of decorative concrete paving system.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Initial Selection: For each type of product, ingredient, or admixture requiring color, pattern, or texture selection.

C. Samples for Verification: For each type of exposed color, pattern, or texture indicated.

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

E. LEED Submittals: Submit documentation for MRc4, MRc5

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer and 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.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer of decorative concrete paving systems.

Chevy Chase Contractors – 301-588-8090, http://chevychasecontractors.com/

Hyde Concrete – 410-349-0008, www.hydeconcrete.com

Hunt Valley Contractor – Jason Sparks (443-334-4948) https://www.huntvalleycontractors.com/

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 and Samples: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
1. Samples: contractor to submit samples for approval showing texture, pattern, and color combinations prior to approval of specified colors.
2. Build mockups of full-thickness sections of decorative concrete paving to demonstrate typical joints; surface color, pattern, and texture; curing; and standard of workmanship.
3. Build mockups of decorative concrete paving in the location and of the size indicated or, if not indicated, build mockups where directed by Architect and not less than 96 inches by 96 inches.
4. Mock-ups to include approved colors and stamp pattern for each area.
5. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
6. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage a qualified independent testing agency to perform preconstruction testing on decorative concrete paving mixtures.

1.8 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 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.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

A. ACI Publications: Comply with ACI 301 unless otherwise indicated.

2.2 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 of a radius of 100 feet or less. Do not use notched and bent forms.

B. Forms for Textured Finish Concrete: Units of face design, size, arrangement, and configuration indicated. Provide solid backing and form supports to ensure stability of textured form liners.

C. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and that will not impair subsequent treatments of concrete surfaces.

2.3 STEEL REINFORCEMENT

A. Plain-Steel Welded-Wire Reinforcement: ASTM A 1064/A 1064M, fabricated from as-drawn steel wire into flat sheets.

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

C. Steel Bar Mats: ASTM A 184/A 184M; with ASTM A 615/A 615M, Grade 60 deformed bars; assembled with clips.

D. Plain-Steel Wire: ASTM A 1064/A 1064M, as drawn.

E. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 plain-steel bars. Cut bars true to length with ends square and free of burrs.

F. 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.

2.4 CONCRETE MATERIALS

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

B. Cementitious Materials:

1. Portland Cement: ASTM C 150/C 150M, gray Portland cement Type I/II
2. Fly Ash: ASTM C 618, Class C or F.
3. Slag Cement: ASTM C 989/C 989M, Grade 100 or 120.

C. Normal-Weight Aggregates: ASTM C 33/C 33M, Class 4S, 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: 3/4-inch nominal.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

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

E. Chemical Admixtures: Admixtures certified by manufacturer to be compatible with other admixtures and to contain no 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. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
3. Water-Reducing and Accelerating Admixture: ASTM C 494/C 494M, Type E.

F. Color Pigment: ASTM C 979/C 979M, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, free of carbon black, nonfading, and resistant to lime and other alkalis.

G. Water: Potable and complying with ASTM C 94/C 94M.

2.5 SURFACE COLORING MATERIALS

A. Liquid Release Agent: Manufacturer's standard, clear, evaporating formulation that facilitates release of stamp mats and texture rollers.

2.6 SCORED CONCRETE WITH INTEGRAL COLOR (P2)

A. P2 (scored concrete)

Color: Sika SikaColor-100 P Gull Gray (U18)

2.7 CURING AND SEALING MATERIALS

A. Curing Paper: Non-staining, waterproof paper, consisting of two layers of kraft paper cemented together and reinforced with fiber, and complying with ASTM C 171.

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

C. Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type I, Class B, manufactured for colored concrete.

1. For integrally colored concrete, curing compound shall be pigmented type approved by coloring admixture manufacturer.
2. For concrete indicated to be sealed, curing compound shall be compatible with sealer.

D. Clear, Solvent-Borne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type I, Class A, manufactured for use with colored concrete.

E. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type I, Class A, manufactured for use with colored concrete.

F. Clear Acrylic Sealer: Manufacturer's standard, waterborne, non-yellowing and UV-resistant, membrane-forming, medium-gloss, acrylic copolymer emulsion solution, manufactured for colored concrete, containing not less than 15 percent solids by volume.

G. Slip-Resistance-Enhancing Additive: Manufacturer's standard finely graded aggregate or polymer additive, designed to be added to clear acrylic sealer to enhance slip resistance of sealed paving surface.

2.8 RELATED MATERIALS

A. Joint Fillers: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork in preformed strips.

B. Bonding Agent: ASTM C 1059/C 1059M, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

C. 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 IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

D. Polyethylene Film: ASTM D 4397, 1 mil thick, clear.

2.9 CONCRETE MIXTURES

A. Obtain each color, size, type, and variety of concrete mixture from single manufacturer with resources to provide concrete of consistent quality in appearance and physical properties.

B. 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.

C. 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.

D. 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: 5-1/2 percent plus or minus 1.5 percent for 1-1/2-inch nominal maximum aggregate size.
2. Air Content: 6 percent plus or minus 1.5 percent for 1-inch nominal maximum aggregate size.
3. Air Content: 6 percent plus or minus 1.5 percent for 3/4-inch nominal maximum aggregate size.

E. Limit water-soluble, chloride-ion content in hardened concrete to 0.05 percent by weight of cement.

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

1. Use water-reducing admixture /water-reducing and retarding admixture /water-reducing and accelerating 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.

G. Color Pigment: Add color pigment to concrete mixture according to manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.

H. Concrete Mixtures: Normal-weight concrete.

1. Compressive Strength (28 Days): 5000 psi (or as specified by civil engineer for vehicular concrete)
2. Maximum W/C Ratio at Point of Placement: 0.40
3. Slump Limit: 4 inches, plus or minus 1 inch.

2.10 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

3.1 EXAMINATION

A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.

B. Proof-roll prepared subbase surface below decorative 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.

3.2 PREPARATION

A. Remove loose material from compacted subbase surface immediately before placing concrete.

B. Protect adjacent construction from discoloration and spillage during application of color hardeners, release agents, stains, curing compounds, and sealers.

3.3 EDGE FORMS AND SCREED CONSTRUCTION

A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.

B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.4 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. 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 to adjacent mats.

3.5 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. Butt Joints: Use epoxy-bonding adhesive at joint locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
3. 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.
4. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.

C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, walks, 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 indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows, to match jointing of existing adjacent decorative concrete paving:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with grooving tool to a 1/4-inch radius. Repeat grooving of contraction joints after applying surface finishes. Eliminate grooving-tool marks on concrete surfaces.

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 in both directions 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 1/4-inch radius. Repeat tooling of edges after applying surface finishes. Eliminate edging-tool marks on concrete surfaces.

3.6 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 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 bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.

3.7 FLOAT FINISHING

A. General: Do not add water to concrete surfaces during finishing operations.

B. Float Finish: Begin the second floating operation when bleed water 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.

3.8 INTEGRALLY COLORED CONCRETE FINISH

A. Integrally Colored Concrete Finish: After final floating, apply the following finish:

1. 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.

3.9 STAMPING

A. Mat Stamping: After floating and while concrete is plastic, apply mat-stamped finish.

1. Pigmented Powder Release Agent: Uniformly distribute onto concrete at a rate of 3 to 4 lb/100 sq. ft..
2. Liquid Release Agent: Apply liquid release agent to the concrete surface and the stamp mat. Uniformly mist surface of concrete at a rate of 5 gal/1000 sq. ft..
3. After application of release agent, accurately align and place stamp mats in sequence.
4. Uniformly load mats and press into concrete to produce required imprint pattern and depth of imprint on concrete surface. Gently remove stamp mats. Hand stamp edges and surfaces unable to be imprinted by stamp mats.
5. Remove residual release agent according to manufacturer's written instructions, but no fewer than three days after stamping concrete. High-pressure-wash surface and joint patterns, taking care not to damage stamped concrete. Control, collect, and legally dispose of runoff.

3.10 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 Compound: Apply immediately after final finishing. 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.

1. Cure integrally colored concrete with a pigmented curing compound.
2. Cure concrete finished with pigmented mineral dry-shake hardener with a pigmented curing compound.

F. Curing and Sealing 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. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating, and repair damage during curing period.

G. Curing Paper: Cure with unwrinkled curing paper in pieces large enough to cover the entire width and edges of slab. Do not lap sheets. Fold curing paper down over paving edges and secure with continuous banks of earth to prevent displacement or billowing due to wind. Immediately repair holes or tears in paper.

3.11 SEALER APPLICATION

A. Clear Acrylic Sealer: Apply uniformly in two coats in continuous operations according to manufacturer's written instructions. Allow first coat to dry before applying second coat, at 90 degrees to the direction of the first coat, using same application methods and rates.

1. Begin sealing dry surface no sooner than 14 days after concrete placement.
2. Allow stained concrete surfaces to dry before applying sealer.

3. Thoroughly mix slip-resistance-enhancing additive into sealer before applying sealer according to manufacturer's written instructions. Stir sealer occasionally during application to maintain even distribution of additive.

3.12 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-foot-long, unleveled straightedge not to exceed 1/2 inch.
4. Lateral Alignment and Spacing of Dowels: 1 inch.
5. Vertical Alignment of Dowels: 1/4 inch.
6. Alignment of Dowel-Bar End Relative to Line Perpendicular to Paving Edge: 1/4 inch per 12 inches of dowel.
7. Joint Spacing: 3 inches.
8. Contraction Joint Depth: Plus 1/4 inch, no minus.
9. Joint Width: Plus 1/8 inch, no minus.

3.13 FIELD QUALITY CONTROL

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

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

1. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. 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. Decorative 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.

3.14 REPAIR AND PROTECTION

A. Remove and replace decorative concrete paving that is broken or damaged or does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by Architect.

B. Protect decorative concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.

C. Maintain decorative concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 321316

SECTION 321373

CONCRETE PAVING JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cold-applied joint sealants.
2. Hot-applied joint sealants.
3. Joint-sealant backer materials.
4. Primers.

B. Related Requirements:

1. Section 033000 "Cast-in-Place-Concrete”.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site

1.3 ACTION SUBMITTALS

A. Product Data:

1. Concrete pavement joint sealants.
2. Joint-sealant backer materials.

B. Samples for Initial Selection: Manufacturer's standard color sheets, showing full range of available colors for each type of joint sealant.

C. Samples for Verification: Actual sample of finished products for each kind and color of joint sealant required.

1. Size: 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.

D. 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.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Statements: For Installer

1.5 QUALITY ASSURANCE

A. Qualifications:

1. Installers: Entity that employs installers and supervisors who are trained and approved by manufacturer.

1.6 PRECONSTRUCTION TESTING

A. Preconstruction Testing: Performed by a qualified testing agency.

1.7 FIELD CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

PART 2 - PRODUCTS

- Manufacturer: Tremco
  Product: Vulkem 445SSL
  Submit manufacturer's standard range of color for selection

- Refer to Baltimore County Standard Specifications for Construction and Materials. Section 523 – Joint Sealing of Portland Cement Concrete Pavements

PART 3 - EXECUTION

- Refer to Baltimore County Standard Specifications for Construction and Materials. Section 523 – Joint Sealing of Portland Cement Concrete Pavements

END OF SECTION 321373

SECTION 321723

PAVEMENT MARKINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Baltimore County Department of Public Works and Transportation Standard Specifications for Construction and Materials, Latest Edition

1.2 SUMMARY

A. Section Includes:

1. Painted markings applied to asphalt paving.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to marking asphalt paving or concrete surfaces including, but not limited to, the following:

a. Asphalt-paving or concrete-surface aging period before application of pavement markings.
b. Review requirements for protecting pavement markings, including restriction of traffic during installation period.

1.4 ACTION SUBMITTALS

A. Product Data: Include technical data and tested physical and performance properties.

1. Pavement-marking paint, alkyd.
2. Pavement-marking paint, solvent-borne.
3. Pavement-marking paint, acrylic.
4. Pavement-marking paint, latex.
5. Glass beads.

B. Shop Drawings:

1. Indicate pavement markings, colors, lane separations, defined parking spaces, and dimensions to adjacent work.
2. Indicate, with international symbol of accessibility, spaces allocated for people with disabilities.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of SHA and MDOT for pavement-marking work.

1. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F for alkyd materials, 55 deg F for water-based materials, and not exceeding 95 deg F.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain pavement-marking paints from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Accessibility Standard: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design".

2.3 PAVEMENT-MARKING PAINT

A. Pavement-Marking Paint, Alkyd: Alkyd-resin type, lead and chromate free, ready mixed, complying with AASHTO M 248; colors complying with FS TT-P-1952F.

1. Color: As indicated.

B. Pavement-Marking Paint, Solvent-Borne: MPI #32, solvent-borne traffic-marking paint.

1. Color: As indicated.

C. Pavement-Marking Paint, Acrylic: Acrylic, waterborne emulsion, lead and chromate free, ready mixed, complying with FS TT-P-1952F, Type II, with drying time of less than 45 minutes.

1. Color: As indicated.

D. Pavement-Marking Paint, Latex: MPI #97, latex traffic-marking paint.

1. Color: As indicated.

E. Glass Beads: AASHTO M 247, Type 1 or FS TT-B-1325D, Type 1.

1. Roundness: Minimum 75 percent true spheres by weight.

PART 3 - EXECUTION

3.1 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.

3.2 PAVEMENT MARKING

A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.

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.

3.3 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 321723

SECTION 323119

DECORATIVE METAL FENCES AND GATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. 8’ ht. fence with swing gates (F1 & G1)

B. Related Requirements:

   1. Section 033000 "Cast-in-Place Concrete."
   2. Category 500 "Paving" (Baltimore County Standard Specifications and Details for Construction).

1.3 PREINSTALLATION MEETINGS

A. Pre-installation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each fence material and for each color specified.

   1. Provide Samples 12 inches in length for linear materials.

   2. Shop drawings for all fence and gates. Drawings should be signed and sealed by contractor’s structural engineer.

1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.

1. Include 10-foot length of fence complying with requirements.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Lightning-Protection System: Maximum grounding-resistance value of 25 ohms under normal dry conditions.

2.2 DECORATIVE STEEL FENCES WITH SWING GATES

8’ ht. fence with swing gates (F1 & G1)

A. Basis of Design Manufacturer: Ameristar Perimeter Security Fence

B. Type: Montage II, industrial and security steel fence

C. Style: Majestic, 3 rail panels

D. 96” height, posts at 8’-0 O.C. spacing.

E. 2.75” W x 14GA Pales; 1.75”x1.75”x12 GA rails, 2.5” SQx12 GA posts

F. Swing gate – to match fence.

2.3 MISCELLANEOUS MATERIALS

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

1. For aluminum, provide type and alloy as recommended by producer of metal to be welded and as required for strength and compatibility in fabricated items.

B. Concrete: Normal-weight, air-entrained, ready-mix concrete complying with requirements in Section 033000 "Cast-in-Place Concrete" with a minimum 28-day compressive strength of 3000 psi, 3-inch slump, and 1-inch maximum aggregate size or dry, packaged, normal-weight concrete mix complying with ASTM C 387/C 387M mixed with potable water according to manufacturer's written instructions.

C. Non-shrink Grout: Factory-packaged, non-staining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M and specifically recommended by manufacturer for exterior applications.

2.4 GROUNDING MATERIALS

A. Grounding Conductors: Bare, solid wire for No. 6 AWG and smaller; stranded wire for No. 4 AWG and larger.

1. Material above Finished Grade: Copper.
2. Material on or below Finished Grade: Copper.
3. Bonding Jumpers: Braided copper tape, 1 inch wide, woven of No. 30 AWG bare copper wire, terminated with copper ferrules.

B. Grounding Connectors and Grounding Rods: Comply with UL 467.

1. Connectors for Below-Grade Use: Exothermic-welded type.
2. Grounding Rods: Copper-clad steel.

a. Size: 5/8 by 96 inches.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, pavement work, construction layout, and other conditions affecting performance of the Work.

B. Do not begin installation before final grading is completed unless otherwise permitted by Architect.

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

3.2 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.

1. Construction layout and field engineering are specified in Section 017300 "Execution."

3.3 DECORATIVE FENCE INSTALLATION

A. Install fences according to manufacturer's written instructions.

B. Install fences by setting posts as indicated and fastening rails and infill panels to posts. Peen threads of bolts after assembly to prevent removal.

C. Post Excavation: Drill or hand-excavate holes for posts in firm, undisturbed soil. Excavate holes to a diameter of not less than 4 times post size and a depth of not less than 24 inches plus 3 inches for each foot or fraction of a foot that fence height exceeds 4 feet.

D. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil.

1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
2. Concrete Fill: Place concrete around posts and sleeves and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.

    a. Exposed Concrete: Extend 1 inch above grade. Finish and slope top surface to drain water away from post.
    b. Concealed Concrete: Top 2 inch below grade to allow covering with surface material. Slope top surface of concrete to drain water away from post.

3. Posts Set in Concrete: Extend post to within 6 inches of specified excavation depth, but not closer than 3 inches to bottom of concrete.
4. Posts Set into Concrete in Sleeves: Use galvanized-steel pipe sleeves with inside diameter at least 3/4 inch larger than outside diagonal dimension of post, preset and anchored into concrete for installing posts.

    a. Extend posts at least 5 inches into sleeve.
    b. After posts have been inserted into sleeves, fill annular space between post and sleeve with non-shrink grout, mixed and placed to comply with grout manufacturer's written instructions; shape and smooth to shed water. Finish and slope top surface of grout to drain water away from post.

5. Posts Set into Voids in Concrete: Form or core drill holes not less than 3/4 inch larger than outside diagonal dimension of post.

    a. Extend posts at least 5 inches into concrete.
    b. Clean holes of loose material, insert posts, and fill annular space between post and concrete with non-shrink grout, mixed and placed to comply with grout manufacturer's written instructions. Finish and slope top surface of grout to drain water away from post.
6. Space posts uniformly at 5 feet o.c.

3.4 GATE INSTALLATION

A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.

3.5 GROUNDING AND BONDING

A. Fence Grounding: Install at maximum intervals of 1500 feet except as follows:

    1. Fences within 100 Feet of Buildings, Structures, Walkways, and Roadways: Ground at maximum intervals of 750 feet.

B. Protection at Crossings of Overhead Electrical Power Lines: Ground fence at location of crossing and at a maximum distance of 150 feet on each side of crossing.

C. Fences Enclosing Electrical Power Distribution Equipment: Ground as required by IEEE C2 unless otherwise indicated.

D. Grounding Method: At each grounding location, drive a grounding rod vertically until the top is 6 inches below finished grade. Connect rod to fence with No. 6 AWG conductor. Connect conductor to each fence component at grounding location.

E. Connections: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact are galvanically compatible.

    1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer in order of galvanic series.
    2. Make connections with clean, bare metal at points of contact.
    3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
    4. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.

5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

F. Bonding to Lightning-Protection System: If fence terminates at lightning-protected building or structure, ground the fence and bond the fence grounding conductor to lightning-protection down conductor or lightning-protection grounding conductor, complying with NFPA 780.

3.6 FIELD QUALITY CONTROL

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

1. Grounding-Resistance Tests: Subject completed grounding system to a megger test at each grounding location. Measure grounding resistance not less than two full days after last trace of precipitation, without soil having been moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural grounding resistance. Perform tests by two-point method according to IEEE 81.
2. Excessive Grounding Resistance: If resistance to grounding exceeds specified value, notify Architect promptly. Include recommendations for reducing grounding resistance and a proposal to accomplish recommended work.
3. Report: Prepare test reports of grounding resistance at each test location certified by a testing agency. Include observations of weather and other phenomena that may affect test results.

3.7 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. Lubricate hardware and other moving parts.

END OF SECTION 323119

SECTION 323300

SITE FURNISHINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1. Area Drain Grate (AD)
2. Artificial Turf (AT)
3. Bike Rack (BR)
4. Trash and Recycle Receptacles (LR & RR)
5. Bench (B)
6. Picnic Table Type 1 (PT1)
7. Picnic Table Type 2 (PT2)
8. Umbrella (U)
9. Drinking Fountain (DF)
10. Trench Drain Grate (TD)
11. Trellis (TR)
12. Shower/Foot Wash Station (SH)
13. Camera Pole (CP)
14. Life Floor (P4)

B. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for installing pipe sleeves cast, formed voids in concrete footings.
2. Section 312000 "Earth Moving" for excavation for installing concrete footings.
3. Division 26 Electrical and Division 23 – Plumbing

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and texture specified.

C. Samples for Initial Selection: For units with factory-applied finishes.

D. Samples for Verification: For each type of exposed finish, not less than 6-inch-long linear components and 4-inch-square sheet components.

E. Product Schedule: For site furnishings. Use same designations indicated on Drawings.

F. Shop Drawings: Submit manufacturer's shop drawings, including plans and elevations, indicating overall dimensions and materials.

1.4 INFORMATIONAL SUBMITTALS

A. Material Certificates: For site furnishings.

1. Wood Preservative Treatment: Include certification by treating plant stating type of preservative solution and pressure process used, net amount of preservative retained, and compliance with applicable standards.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For site furnishings to be included in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer has been regularly engaged in manufacture of site furnishings since last 25 years. Provide a minimum of five similar reference projects with direct contact information.

B. Product Support: Products are supported with complete engineering drawings.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Bench Replacement Slats: No fewer than 10 full-size units for each size indicated.
2. Trash Receptacle Inner Containers: Five full-size units for each size indicated, but no fewer than two units.
3. Anchors: 15 of each size.

PART 2 - PRODUCTS

2.1 AREA DRAIN GRATE (AD)

A. Basis of Design Manufacturer: NDS

B. Model: 6” Round Grate w/ Locking Mechanism

C. Material: UV Protected High Density Polyethylene (HDPE)

D. ADA Compliant & Heel Proof

E. Color: Gray (in concrete), Green (in artificial turf)

2.2 ARTIFICIAL TURF (AT)

A. Basis of Design Manufacturer: ForeverLawn

B. Model: Playground Grass – Apex

C. Underlayment Padding: Brock PowerBase – 25mm thick

D. To be compliant with local weather and building codes. Manufacturer to provide details and assembly based on various paving conditions.

2.3 BIKE RACK (BR)

A. Basis of Design Manufacturer: Landscape Forms

B. Model: Flo Bike Rack

C. Color & Finish: Stainless Steel

D. Installation Method: Embedded – refer to contract drawings.

2.4 LITTER AND RECYCLE RECEPTACLES (LR & RR)

LR

A. Basis of Design Manufacturer: Victor Stanley

B. Model: S-42 Litter Receptacle with Standard Tapered Lid

C. Color & Finish: Black Powder coat

D. Installation Method: Installed in concrete – refer to contract drawings.

E. Contractor to submit order form as part of submittal for landscape architect to select accessories.

RR

F. Basis of Design Manufacturer: Victor Stanley

G. Model: S-42 Litter Receptacle with Standard Tapered Lid

H. Color & Finish: Black Powder coat w/ Recycle Decals

I. Installation Method: Installed in concrete – refer to contract drawings.

J. Contractor to submit order form as part of submittal for landscape architect to select accessories.

2.5 BENCH (B)

A. Basis of Design Manufacturer: Little Tikes Commercial

B. Model: 6’ Contemporary Bench with Back

C. Color & Finish: Steel with Black Plastisol Coated Seat

D. Installation Method: Surface mounted – refer to contract drawings.

2.6 PICNIC TABLE TYPE 1 (PT1) – ADD ALTERNATE #2

A. Basis of Design Manufacturer: Forms + Surfaces

B. Model: Tangent Table Ensemble with Backless Seats – Four Seats w/ Umbrella Hole

C. Configuration: Backless

D. Slat/Seat Material: Extruded Aluminum Slats

E. Color & Finish: Powder Coat, Clay Texture

F. Installation Method: Surface mounted – refer to contract drawings.

2.7 PICNIC TABLE TYPE 2 (PT2) – ADD ALTERNATE #3

A. Basis of Design Manufacturer: Forms + Surfaces

B. Model: Tangent Table Ensemble with Backless Seats – Six Seats

C. Configuration: Backless

D. Slat/Seat Material: Extruded Aluminum Slats

E. Color & Finish: Powder Coat, Clay Texture

F. Installation Method: Surface mounted – refer to contract drawings.

2.8 UMBRELLA (U) – ADD ALTERNATE #4

A. Basis of Design Manufacturer: Forms + Surfaces

B. Model: Soleris Sun Shade – Slat Perforation Pattern

C. Color & Finish: Stainless Steel Pole (Satin Finish), Powder coated Aluminum Shade Panels, Clay Texture

D. Installation Method: Surface mounted – refer to contract drawings.

2.9 DRINKING FOUNTAIN (DFA & DFB)

DFA

A. Basis of Design Manufacturer: Elkay

B. Model: LK4420BF1UFRK, Outdoor ezH2O® Upper Bottle Filling Station Bi-Level Pedestal Non-Filtered Non-Refrigerated Freeze Resistant

C. Color & Finish: Black

D. Installation Method: See contract drawings

E. Ensure accessibility per 2012 ADA Accessibility Guidelines

DFB

F. Basis of Design Manufacturer: Elkay

G. Model: LK4420BF1UDBFRK, Outdoor ezH2O® Upper Bottle Filling Station Bi-Level Pedestal with Pet Station Non-Filtered Non-Refrigerated Freeze Resistant

H. Color & Finish: Black

I. Installation Method: See contract drawings

J. Ensure accessibility per 2012 ADA Accessibility Guidelines

2.10 TRENCH DRAIN GRATE (TD)

A. Basis of Design Manufacturer: ACO

B. Model: 448Q Longitudinal Stainless Steel Grate

C. Size: 4.85” x 19.69” (to be coordinated with civil selected drain body)

D. ADA compliant & heel proof

E. Finish: Stainless steel

F. Refer to Civil drawings for drain body, size and compatibility.

2.11 SHADE STRUCTURE (SS) – ADD ALTERNATE #5

A. Basis of Design Manufacturer: USA SHADE

B. Model: Pegasus Shade Structure

C. Size: 16’ x 12’

D. Color & Finish: Shadesure Navy Blue Fabric, Powder Coat Tele Grey Posts

E. Installation Method: See contract drawings

2.12 SHOWER/FOOT WASH STATION (SH)

A. Basis of Design Manufacturer: Stern-Williams

B. Model: 6835, 6-5/8” Dia. x 80” Ht.

C. Color & Finish: Powder Coat Blue

D. Installation Method: See contract drawings

2.13 CAMERA POLE (CP)

A. Basis of Design Manufacturer: Lithonia Lighting

B. Model: SSS Pole

C. Size: 4” x 4” x 20’ Ht.

D. Color & Finish: Black Architectural Style

E. Installation Method: See Contract Drawings

2.14 LIFE FLOOR (P4) – ADD ALTERNATE #6

A. Basis of Design Manufacturer: Life Floor

B. Pattern: See Contract Drawings for Basis of Design Pattern.

C. Texture: Ripple.

D. Color: Bluebird, Aqua, Submariner, Aviator

2.15 MATERIALS

A. Aluminum: Alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated; free of surface blemishes and complying with the following:

1. Rolled or Cold-Finished Bars, Rods, and Wire: ASTM B 211.
2. Extruded Bars, Rods, Wire, Profiles, and Tubes: ASTM B 221.
3. Structural Pipe and Tube: ASTM B 429/B 429M.
4. Sheet and Plate: ASTM B 209.
5. Castings: ASTM B 26/B 26M.

B. Steel and Iron: Free of surface blemishes and complying with the following:

1. Plates, Shapes, and Bars: ASTM A 36/A 36M.
2. Steel Pipe: Standard-weight steel pipe complying with ASTM A 53/A 53M, or electric-resistance-welded pipe complying with ASTM A 135/A 135M.
3. Tubing: Cold-formed steel tubing complying with ASTM A 500/A 500M.
4. Mechanical Tubing: Cold-rolled, electric-resistance-welded carbon or alloy steel tubing complying with ASTM A 513, or steel tubing fabricated from steel complying with ASTM A 1011/A 1011M and complying with dimensional tolerances in ASTM A 500/A 500M; zinc coated internally and externally.
5. Sheet: Commercial steel sheet complying with ASTM A 1011/A 1011M.
6. Expanded Metal: Carbon-steel sheets, deburred after expansion, and complying with ASTM F 1267.
7. Malleable-Iron Castings: ASTM A 47/A 47M, grade as recommended by fabricator for type of use intended.
8. Gray-Iron Castings: ASTM A 48/A 48M, Class 200.

C. Stainless Steel: Free of surface blemishes and complying with the following:

1. Sheet, Strip, Plate, and Flat Bars: ASTM A 666.
2. Pipe: Schedule 40 steel pipe complying with ASTM A 312/A 312M.
3. Tubing: ASTM A 554.

D. Anchors, Fasteners, Fittings, and Hardware: Stainless steel Manufacturer's standard, corrosion-resistant-coated or non-corrodible materials; commercial quality, tamperproof, vandal and theft resistant, concealed, recessed, and capped or plugged.

1. Angle Anchors: For inconspicuously bolting legs of site furnishings to below-grade substrate; one per leg.
2. Antitheft Hold-Down Brackets: For securing site furnishings to substrate; two per unit extent as indicated on Drawings.

E. Non-shrink, Nonmetallic Grout: Premixed, factory-packaged, non-staining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M; recommended in writing by manufacturer, for exterior applications.

F. Erosion-Resistant Anchoring Cement: Factory-packaged, non-shrink, non-staining, hydraulic-controlled expansion cement formulation for mixing with potable water at Project site to create pourable anchoring, patching, and grouting compound; resistant to erosion from water exposure without needing protection by a sealer or waterproof coating; recommended in writing by manufacturer, for exterior applications.

G. Galvanizing: Where indicated for steel and iron components, provide the following protective zinc coating applied to components after fabrication:

1. Zinc-Coated Tubing: External, 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, polymer film. Internal, same as external or consisting of 81 percent zinc pigmented coating, not less than 0.3 mil thick.
2. Hot-Dip Galvanizing: According to ASTM A 123/A 123M, ASTM A 153/A 153M, or ASTM A 924/A 924M.

2.16 WOOD-PRESERVATIVE-TREATED MATERIALS

A. Preservative Treatment: Pressure-treat wood according to AWPA U1 and the following:

1. Use preservative chemicals acceptable to authorities having jurisdiction and containing no arsenic or chromium. Use chemical formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants to distinguish treated materials from untreated materials.
2. Kiln-dry lumber and plywood after treatment to a maximum moisture content, respectively, of 19 and 15 percent. Do not use materials that are warped or do not comply with requirements for untreated materials.

2.17 FABRICATION

A. Metal Components: Form to required shapes and sizes with true, consistent curves, lines, and angles. Separate metals from dissimilar materials to prevent electrolytic action.

B. Welded Connections: Weld connections continuously. Weld solid members with full-length, full-penetration welds and hollow members with full-circumference welds. At exposed connections, finish surfaces smooth and blended so no roughness or unevenness shows after finishing and welded surface matches contours of adjoining surfaces.

C. Pipes and Tubes: Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain cylindrical cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of handrail and railing components.

D. Preservative-Treated Wood Components: Complete fabrication of treated items before treatment if possible. If cut after treatment, apply field treatment complying with AWPA M4 to cut surfaces.

E. Exposed Surfaces: Polished, sanded, or otherwise finished; all surfaces smooth, free of burrs, barbs, splinters, and sharpness; all edges and ends rolled, rounded, or capped.

F. Factory Assembly: Assemble components in the factory to greatest extent possible to minimize field assembly. Clearly mark units for assembly in the field.

2.18 GENERAL FINISH REQUIREMENTS

A. 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.

2.19 ALUMINUM FINISHES

A. Baked-Enamel, Powder-Coat Finish: Manufacturer's standard, baked, polyester, powder-coat finish complying with finish manufacturer's written instructions for surface preparation, including pretreatment, application, baking, and minimum dry film thickness.

2.20 STEEL AND GALVANIZED-STEEL FINISHES

A. Baked-Enamel, Powder-Coat Finish: Manufacturer's standard, baked, polyester, powder-coat finish complying with finish manufacturer's written instructions for surface preparation, including pretreatment, application, baking, and minimum dry film thickness.

B. PVC Finish: Manufacturer's standard, UV-light stabilized, mold-resistant, slip-resistant, matte-textured, dipped or sprayed-on, PVC-plastisol finish, with flame retardant added; complying with coating manufacturer's written instructions for pretreatment, application, and minimum dry film thickness.

2.21 IRON FINISHES

A. Baked-Enamel, Powder-Coat Finish: Manufacturer's standard, baked, polyester, powder-coat finish complying with finish manufacturer's written instructions for surface preparation, including pretreatment, application, baking, and minimum dry film thickness.

2.22 STAINLESS-STEEL FINISHES

A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.

B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.

1. Run directional finishes with long dimension of each piece.
2. Dull Satin Finish: No. 6

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for correct and level finished grade, mounting surfaces, installation tolerances, and other conditions affecting performance of the Work.

B. Notify architect of conditions that would adversely affect installation or subsequent use.

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

3.2 INSTALLATION, GENERAL

A. Comply with manufacturer's written installation instructions unless more stringent requirements are indicated. Complete field assembly of site furnishings where required.

B. Unless otherwise indicated, install site furnishings after landscaping and paving have been completed.

C. Install site furnishings level, plumb, true, and securely anchored and positioned at locations indicated on Drawings.

D. Finish and repair any damages caused to finish or product in accordance with manufacturer’s instructions and as approved by Landscape Architect.

E. Component Damage: Remove and replace damaged components that cannot be successfully repaired as determined by Landscape Architect.

F. Clean products promptly after installation in accordance with manufacturer's instructions. Do not use harsh cleaning materials or methods that could damage finish.

G. Post Setting: Set cast-in support posts in concrete footing with smooth top, shaped to shed water. Protect portion of posts above footing from concrete splatter. Verify that posts are set plumb or at correct angle and are aligned and at correct height and spacing. Hold posts in position during placement and finishing operations until concrete is sufficiently cured.

H. Posts Set into Voids in Concrete: Form or core-drill holes for installing posts in concrete to depth recommended in writing by manufacturer of site furnishings 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 non-shrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions, with top smoothed and shaped to shed water.

I. Pipe Sleeves: Use steel pipe sleeves preset and anchored into concrete for installing posts. After posts have been inserted into sleeves, fill annular space between post and sleeve with non-shrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions, with top smoothed and shaped to shed water.

END OF SECTION 323300

SECTION 329115

SOIL PREPARATION

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

Section includes planting soils and layered soil assemblies specified according to performance requirements of the mixes.

A. Planting Soil

B. Topsoil (screened)

C. Related Requirements:
1. Category 200 "Grading" (Baltimore County Standard Specifications and Details for Construction).
2. Section 329200 "Turf and Grasses" for placing planting soil for turf and grasses.
3. Section 329300 "Plants" for placing planting soil for plantings.
4. Category 700 “Landscaping” (Baltimore County Standard Specifications and Details for Construction).

1.3 DEFINITIONS

A. AAPFCO: Association of American Plant Food Control Officials.

B. Backfill: The earth used to replace or the act of replacing earth in an excavation. This can be amended or unamended soil as indicated.

C. CEC: Cation exchange capacity.

D. Compost: The product resulting from the controlled biological decomposition of organic material that has been sanitized through the generation of heat and stabilized to the point that it is beneficial to plant growth.

E. Duff Layer: A surface layer of soil, typical of forested areas, that is composed of mostly decayed leaves, twigs, and detritus.

F. Imported Soil: Soil that is transported to Project site for use.

G. Layered Soil Assembly: A designed series of planting soils, layered on each other, that together produce an environment for plant growth.

H. Manufactured Soil: Soil produced by blending soils, sand, stabilized organic soil amendments, and other materials to produce planting soil.

I. NAPT: North American Proficiency Testing Program. An SSSA program to assist soil-, plant-, and water-testing laboratories through interlaboratory sample exchanges and statistical evaluation of analytical data.

J. Organic Matter: The total of organic materials in soil exclusive of undecayed plant and animal tissues, their partial decomposition products, and the soil biomass; also called "humus" or "soil organic matter."

K. Planting Soil: Existing, on-site soil; imported soil; or manufactured soil that has been modified as specified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.

L. RCRA Metals: Hazardous metals identified by the EPA under the Resource Conservation and Recovery Act.

M. SSSA: Soil Science Society of America.

N. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.

O. Subsoil: Soil beneath the level of subgrade; soil beneath the topsoil layers of a naturally occurring soil profile, typified by less than 1 percent organic matter and few soil organisms.

P. 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.

Q. USCC: U.S. Composting Council.

1.4 PREINSTALLATION MEETINGS

A. Pre-installation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

A. Product Data: Contractor to provide for each type of product.

1. Include recommendations for application and use.
2. Include test data substantiating that products comply with requirements.
3. Include sieve analyses for aggregate materials.
4. Material Certificates: For each type of imported soil and soil amendment and fertilizer before delivery to the site, according to the following:

a. Manufacturer's qualified testing agency's certified analysis of standard products.
b. Analysis of fertilizers, by a qualified testing agency, made according to AAPFCO methods for testing and labeling and according to AAPFCO's SUIP #25.
c. Analysis of nonstandard materials, by a qualified testing agency, made according to SSSA methods, where applicable.

B. Samples: For each bulk-supplied material, 1-quart volume of each in sealed containers labeled with content, source, and date obtained. Each Sample shall be typical of the lot of material to be furnished; provide an accurate representation of composition, color, and texture.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For each testing agency.

B. Preconstruction Test Reports: For preconstruction soil analyses specified in "Preconstruction Testing" Article.

C. Field quality-control reports.

1.7 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent, state-operated, or university-operated laboratory; experienced in soil science, soil testing, and plant nutrition; with the experience and capability to conduct the testing indicated; and that specializes in types of tests to be performed.

1. Laboratories: Subject to compliance with requirements, provide testing by one the following:

a. Penn State Agricultural Analytical Services Lab

b. Turf Diagnostics LLC – Iowa

1.8 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction soil analyses on existing, on-site soil.

1. Notify Architect seven days in advance of the dates and times when laboratory samples will be taken.

1.9 TESTING REQUIREMENTS

A. General: Perform tests on soil samples according to requirements in this article.

B. Physical Testing:

1. Soil Texture: Soil-particle, size-distribution analysis by one of the following methods according to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods":

a. Sieving Method: Report sand-gradation percentages for very coarse, coarse, medium, fine, and very fine sand; and fragment-gradation (gravel) percentages for fine, medium, and coarse fragments; according to USDA sand and fragment sizes.
b. Hydrometer Method: Report percentages of sand, silt, and clay.

2. Bulk Density: Analysis according to core method and clod method of SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods."
3. Total Porosity: Calculate using particle density and bulk density according to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods."
4. Water Retention: According to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods."
5. Saturated Hydraulic Conductivity: According to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods"; at 85% compaction according to ASTM D 698 (Standard Proctor).

C. Fertility Testing: Soil fertility analysis according to standard laboratory protocol of SSSA NAPT NCR-13, including the following:

1. Percentage of organic matter.
2. CEC, calcium percent of CEC, and magnesium percent of CEC.
3. Soil reaction (acidity/alkalinity pH value).
4. Buffered acidity or alkalinity.
5. Nitrogen ppm.
6. Phosphorous ppm.
7. Potassium ppm.
8. Manganese ppm.
9. Manganese-availability ppm.

10. Zinc ppm.
11. Zinc availability ppm.
12. Copper ppm.
13. Sodium ppm.
14. Soluble-salts ppm.
15. Presence and quantities of problem materials including salts and metals cited in the Standard protocol. If such problem materials are present, provide additional recommendations for corrective action.
16. Other deleterious materials, including their characteristics and content of each.

D. Organic-Matter Content: Analysis using loss-by-ignition method according to SSSA's "Methods of Soil Analysis - Part 3-Chemical Methods."

E. Lab test results to be submitted directly from testing labs to the landscape architect

F. Soil reports to not be more than 60 days old.

G. Recommendations: Based on the test results, state recommendations for soil treatments and soil amendments to be incorporated to produce satisfactory planting soil suitable for healthy, viable plants indicated. Include, at a minimum, recommendations for nitrogen, phosphorous, and potassium fertilization, and for micronutrients.

1. Fertilizers and Soil Amendment Rates: State recommendations in weight per 1000 sq. ft. for 6-inchdepth of soil.
2. Soil Reaction: State the recommended liming rates for raising pH or sulfur for lowering pH according to the buffered acidity or buffered alkalinity in weight per 1000 sq. ft. for 6-inch depth of soil.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and compliance with state and Federal laws if applicable.

B. Bulk Materials:

1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
3. Do not move or handle materials when they are wet or frozen.

4. Accompany each delivery of bulk fertilizers and soil amendments with appropriate certificates.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Imported soils: Comply with the following criteria:

Original function is comparable to reuse function

Not classified as prime farmland, unique farmland or farmland of statewide or local importance

Not extracted from a greenfield site

Does not include sphagnum peat moss

A. Planting soil for at-grade conditions and in tree pits

Imported soil or manufactured soil that has been modified as specified with soil amendments to produce a soil mixture best for plant growth. Using soil analyses and materials specified in other articles of this Section.

Manufacturer: Stancills Inc, www.stancills.com, 877-536-9572

If there is no existing soil on site, contractor to import certified planting soil to meet requirements of plantings.

Contractor to provide lab test reports and lab recommendations (if any) of the planting soil to the Landscape Architect for approval prior to installation.

1. Particle Size Distribution by USDA Textures: Classified as sandy loam soil according to USDA textures.
2. Percentage of Organic Matter: Minimum 6 percent by volume tested by LOI test
3. Soil Reaction: pH of 5.5 to 7.
4. Soluble-Salt Content: .5 to .10 dS/m measured by electrical conductivity.

Amend imported soil with materials specified in other articles of this Section to become planting soil complying with the following requirements:

5. Sources: Take imported, unamended soil from sources that are naturally well drained. Sites where topsoil occurs at least 4 inches deep, not from agricultural land, bogs, or marshes; and that do not contain undesirable organisms; disease-

causing plant pathogens; or obnoxious weeds and invasive plants including, however, not limited to, those identified by the Virginia Cooperative Extension or the Virginia Department of Agriculture and Consumer Services.

6. Additional Properties of Imported Soil before Amending: Minimum of 4 percent organic-matter content, friable, and with sufficient structure to give good tilth and aeration. Clean soil to be free of the following:

    a. Unacceptable Materials: Concrete slurry, concrete layers or chunks, cement, plaster, building debris, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, acid, and other extraneous materials that are harmful to plant growth.
    b. Unsuitable Materials: Stones, roots, plants, sod, clay lumps, and pockets of coarse sand that exceed a combined maximum of 4 percent by dry weight of the imported soil.
    c. Large Materials: Stones, clods, roots, clay lumps, and pockets of coarse sand exceeding 2 inches in any dimension.

7. Percentage of Organic Matter: Minimum 6 percent by volume.
8. Soil Reaction: pH of 5.5 to 7

B. Screened Topsoil for all planting areas

Imported topsoil or manufactured topsoil that has been modified as specified with soil amendments to produce a soil mixture best for plant growth. Using soil analyses and materials specified in other articles of this Section. Topsoil to be screened topsoil.

Manufacturer: Stancills Inc, www.stancills.com, 877-536-9572

Product - Screened topsoil

1. Particle Size Distribution by USDA Textures: Classified as sandy loam soil according to USDA textures.
2. Percentage of Organic Matter: Minimum 6 percent by volume tested by LOI test
3. Soil Reaction: pH of 5.5 to 7.
4. Clean soil to be free of the following:

    a. Unacceptable Materials: Concrete slurry, concrete layers or chunks, cement, plaster, building debris, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, acid, and other extraneous materials that are harmful to plant growth.
    b. Unsuitable Materials: Stones, roots, plants, sod, clay lumps, and pockets of coarse sand that exceed a combined maximum of 4 percent by dry weight of the imported soil.
    c. Large Materials: Stones, clods, roots, clay lumps, and pockets of coarse sand exceeding 2 inches in any dimension.

2.2 INORGANIC SOIL AMENDMENTS

A. Lime: ASTM C 602, agricultural liming material containing a minimum of 80 percent calcium carbonate equivalent and as follows:
   1. Class: T, with a minimum of 99 percent passing through a No. 8 sieve and a minimum of 75 percent passing through a No. 60 sieve.
   2. Class: O, with a minimum of 95 percent passing through No. 8 sieve and a minimum of 55 percent passing through a No. 60 sieve.
   3. Form: Provide lime in form of ground dolomitic limestone.
   4. Sulfur: Granular, biodegradable, and containing a minimum of 90 percent elemental sulfur, with a minimum of 99 percent passing through a No. 6 sieve and a maximum of 10 percent passing through a No. 40 (0.425-mm) sieve.
   5. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.
   6. Agricultural Gypsum: Minimum 90 percent calcium sulfate, finely ground with 90 percent passing through a No. 50 sieve.
   7. Sand: Clean, washed, natural or manufactured, free of toxic materials, and according to ASTM C 33/C 33M.

2.3 ORGANIC SOIL AMENDMENTS

A. Compost: Well-composted, stable, and weed-free organic matter produced by composting feedstock, and bearing USCC's "Seal of Testing Assurance," and as follows:

   1. Feedstock: Limited to leaves, may include animal waste.
   2. Reaction: pH of 5.5 to 8
   3. Soluble-Salt Concentration: Less than 4 dS/m
   4. Moisture Content: 35 to 55 percent by weight.
   5. Organic-Matter Content: 30 to 40 percent of dry weight.
   6. Particle Size: Minimum of 98 percent passing through a 1/2-inch sieve.

B. Sphagnum Peat: Partially decomposed sphagnum peat moss, finely divided or of granular texture with 100 percent passing through a 1/2-inch sieve, a pH of 3.4 to 4.8, and a soluble-salt content measured by electrical conductivity of maximum 5 dS/m.

C. Manure: Well-rotted, unleached, free of antibiotics, stable or cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials; free of toxic substances, stones, sticks, soil, weed seed, debris, and material harmful to plant growth.

2.4 FERTILIZERS

A. Superphosphate: Commercial, phosphate mixture, soluble; a minimum of 20 percent available phosphoric acid.

B. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:

1. Composition: 1 lb/1000 sq. ft. of actual nitrogen, 4 percent phosphorous, and 2 percent potassium, by weight.
2. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified testing agency.

C. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:

1. Composition: 20 percent nitrogen, 5 percent phosphorous, and 10 percent potassium, by weight.
2. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified testing agency.

D. Chelated Iron: Commercial-grade FeEDDHA for dicots and woody plants, and commercial-grade FeDTPA for ornamental grasses and monocots.

PART 3 - EXECUTION

3.1 GENERAL

A. Place planting soil and fertilizers according to requirements in other Specification Sections.

B. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in planting soil.

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

D. All areas that are on-structure to receive lightweight soil (planting or structural) as noted in the contract drawings for the entire depth i.e. from the finished grade condition to the top of slab as shown in the contract drawings.

3.2 PREPARATION OF UNAMENDED, ON-SITE SOIL BEFORE AMENDING

A. Excavation: Excavate soil from designated area(s) to a depth of 6 inches and stockpile until amended.

B. Unacceptable Materials: Concrete slurry, concrete layers or chunks, cement, plaster, building debris, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, acid, and other extraneous materials that are harmful to plant growth.

C. Unsuitable Materials: Cleaned soil should not contain roots, plants, sod, clay lumps, and pockets of coarse sand.

D. Screening: Pass unamended soil through a 1/2-inch sieve to remove large materials.

3.3 PLACING AND MIXING PLANTING SOIL OVER EXPOSED SUBGRADE

A. General: Apply and mix unamended soil with amendments on-site to produce required planting soil. Do not apply materials or till if existing soil or subgrade is frozen, muddy, or excessively wet.

B. Subgrade Preparation: Till subgrade to a minimum depth of 12 inches. Remove stones larger than 2 inches in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.

1. Apply, add soil amendments, and mix approximately half the thickness of unamended soil over prepared, loosened subgrade according to "Mixing" Paragraph below. Mix thoroughly into top 4 inches of subgrade. Spread remainder of planting soil.

C. Mixing: Spread unamended soil to total depth of 8 inches, but not less than required to meet finish grades after mixing with amendments and natural settlement. Do not spread if soil or subgrade is frozen, muddy, or excessively wet.

1. Amendments: Apply soil amendments, except compost, and fertilizer, if required, evenly on surface, and thoroughly blend them with unamended soil to produce planting soil.

    a. Mix lime and sulfur with dry soil before mixing fertilizer.
    b. Mix fertilizer with planting soil no more than seven days before planting.

2. Lifts: Apply and mix unamended soil and amendments in lifts not exceeding 12 inches in loose depth for material compacted by compaction equipment, and not more than 6 inches in loose depth for material compacted by hand-operated tampers.

D. Compaction: Compact each blended lift of planting soil to 75-82 percent of maximum Standard Proctor density according to ASTM D 698.

E. Finish Grading: Grade planting soil to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades. Till soil so that it is loose for roots to penetrate, till to a minimum depth of 8”.

3.4 PLACING MANUFACTURED PLANTING SOIL OVER EXPOSED SUBGRADE

A. General: Apply manufactured soil on-site in its final, blended condition. Do not apply materials or till if existing soil or subgrade is frozen, muddy, or excessively wet.

B. Subgrade Preparation: Till subgrade to a minimum depth of 12 inches. Remove stones larger than 2 inches in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.

1. Apply approximately half the thickness of planting soil over prepared, loosened subgrade. Mix thoroughly into top 4 inches of subgrade. Spread remainder of planting soil.

C. Application: Spread planting soil to total depth of 8 inches, but not less than required to meet finish grades after natural settlement. Do not spread if soil or subgrade is frozen, muddy, or excessively wet.

1. Lifts: Apply planting soil in lifts not exceeding 12 inches in loose depth for material compacted by compaction equipment, and not more than 6 inches in loose depth for material compacted by hand-operated tampers.

D. Compaction: Compact each lift of planting soil to 75 to 82 percent of maximum Standard Proctor density according to ASTM D 698.

E. Finish Grading: Grade planting soil to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.

3.5 BLENDING PLANTING SOIL IN PLACE

A. General: Mix amendments with in-place, unamended soil to produce required planting soil. Do not apply materials or till if existing soil or subgrade is frozen, muddy, or excessively wet.

B. Preparation: Till unamended, existing soil in planting areas to a minimum depth of 6 inches. Remove stones larger than 2 inches in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.

C. Mixing: Apply soil amendments, except compost, and fertilizer, if required, evenly on surface, and thoroughly blend them into full depth of unamended, in-place soil to produce planting soil.

1. Mix lime and sulfur with dry soil before mixing fertilizer.
2. Mix fertilizer with planting soil no more than seven days before planting.

D. Compaction: Compact blended planting soil to 75 to 82 percent of maximum Standard Proctor density according to ASTM D 698.

E. Finish Grading: Grade planting soil to a smooth, uniform surface plane with loose, uniformly fine texture. Rake, remove ridges, and fill depressions to meet finish grades.

3.6 APPLYING COMPOST TO SURFACE OF PLANTING SOIL

A. Application: Apply compost component of planting-soil mix 4 inches of compost to surface of in-place planting soil. Do not apply materials or till if existing soil or subgrade is frozen, muddy, or excessively wet.

B. Finish Grading: Grade surface to a smooth, uniform surface plane with loose, uniformly fine texture. Rake, remove ridges, and fill depressions to meet finish grades.

3.7 PROTECTION

A. Protection Zone: Identify protection zones according to Section 015639 "Temporary Tree and Plant Protection."

B. Protect areas of in-place soil from additional compaction, disturbance, and contamination. Prohibit the following practices within these areas except as required to perform planting operations:

1. Storage of construction materials, debris, or excavated material.
2. Parking vehicles or equipment.
3. Vehicle traffic.
4. Foot traffic.
5. Erection of sheds or structures.
6. Impoundment of water.
7. Excavation or other digging unless otherwise indicated.

C. If planting soil or subgrade is over compacted (more than 85%), disturbed, or contaminated by foreign or deleterious materials or liquids, remove the planting soil and contamination; restore the subgrade as directed by Landscape Architect and replace contaminated planting soil with new planting soil.

3.8 CLEANING

A. Protect areas adjacent to planting-soil preparation and placement areas from contamination. Keep adjacent paving and construction clean and work area in an orderly condition.

B. Remove surplus soil and waste material including excess subsoil, unsuitable materials, trash, and debris and legally dispose of them off Owner's property unless otherwise indicated.

1. Dispose of excess subsoil and unsuitable materials on-site where directed by Owner.

END OF SECTION 329115

SECTION 329200

TURF AND GRASSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Seeding
2. Sodding

B. Related Requirements:

1. Section 329300 "Plants" for trees, shrubs, ground covers, and other plants as well as border edgings and mow strips.
2. Category 300 “Drainage and Utility Construction” (Baltimore County Standard Specifications and Details for Construction).

1.3 DEFINITIONS

A. Finish Grade: Elevation of finished surface of planting soil.

B. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. Pesticides include insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. They also include substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.

C. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. Pests include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.

D. Planting Soil: Existing, on-site soil; imported soil; or manufactured soil that has been modified with soil amendments and perhaps fertilizers to produce a soil mixture best for

plant growth. See Section 329115 "Soil Preparation (Performance Specification)" and drawing designations for planting soils.

E. Subgrade: The surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.

1.4 PREINSTALLATION MEETINGS

A. Pre-installation Conference: Conduct conference at Project site.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For landscape Installer.

B. Certification of Grass Seed: From seed vendor for each grass-seed monostand or mixture, stating the botanical and common name, percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packaging.

1. Certification of each seed mixture for turfgrass sod. Include identification of source and name and telephone number of supplier.

C. Product Certificates: For fertilizers, from manufacturer.

D. Pesticides and Herbicides: Product label and manufacturer's application instructions specific to Project.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: Recommended procedures to be established by Owner for maintenance of turf during a calendar year. Submit before expiration of required maintenance periods.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape installer whose work has resulted in successful turf establishment.

1. Professional Membership: Installer shall be a member in good standing of either the Professional Landcare Network or the American Nursery and Landscape Association.
2. Experience: Five years' experience in turf installation in addition to requirements in Section 014000 "Quality Requirements."

3. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
4. Personnel Certifications: Installer's field supervisor shall have certification in one of the following categories from the Professional Landcare Network:

    a. Landscape Industry Certified Technician - Exterior.
    b. Landscape Industry Certified Lawncare Manager.
    c. Landscape Industry Certified Lawncare Technician.

5. Pesticide Applicator: State licensed, commercial.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Seed and Other Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of compliance with state and Federal laws, as applicable.

B. Sod: Harvest, deliver, store, and handle sod according to requirements in "Specifications for Turfgrass Sod Materials" and "Specifications for Turfgrass Sod Transplanting and Installation" sections in TPI's "Guideline Specifications to Turfgrass Sodding." Deliver sod within 24 hours of harvesting and in time for planting promptly. Protect sod from breakage and drying.

C. Bulk Materials:

1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
2. Provide erosion-control measures to prevent erosion or displacement of bulk materials; discharge of soil-bearing water runoff; and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
3. Accompany each delivery of bulk materials with appropriate certificates.

1.9 FIELD CONDITIONS

A. Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with initial maintenance periods to provide required maintenance from date of Substantial Completion.

1. Spring Planting: April 1 to May 15
2. Fall Planting: September 1 to October 15

B. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 SEED

A. Grass Seed: Fresh, clean, dry, new-crop seed complying with AOSA's "Rules for Testing Seeds" for purity and germination tolerances.

B. Seed Species:

1. Quality: State-certified seed of grass species as listed below for solar exposure.
2. Quality: Seed of grass species as listed below for solar exposure, with not less than 85 percent germination, not less than 95 percent pure seed, and not more than 0.5 percent weed seed:
3. Full Sun: Bermudagrass (Cynodon dactylon).
4. Full Sun: Kentucky bluegrass (Poa pratensis), a minimum of three cultivars.
5. Sun and Partial Shade: Proportioned by weight as follows:

    a. 50 percent Kentucky bluegrass (Poa pratensis).
    b. 30 percent chewings red fescue (Festuca rubra variety).
    c. 10 percent perennial ryegrass (Lolium perenne).
    d. 10 percent redtop (Agrostis alba).

6. Shade: Proportioned by weight as follows:

    a. 50 percent chewings red fescue (Festuca rubra variety).
    b. 35 percent rough bluegrass (Poa trivialis).
    c. 15 percent redtop (Agrostis alba).

2.2 TURFGRASS SOD

A. Turfgrass Sod: Certified and approved and Number 1 Quality/Premium, including limitations on thatch, weeds, diseases, nematodes, and insects, complying with "Specifications for Turfgrass Sod Materials" in TPI's "Guideline Specifications to Turfgrass Sodding." Furnish viable sod of uniform density, color, and texture that is strongly rooted and capable of vigorous growth and development when planted.

B. Manufacturer: Royal Sod Farms, LLC

C. Product: Royal Sod Fescue Blend

- Bravado Tall Fescue
- Xtreme Green Tall Fescue
- Titanium Tall Fescue

- Raven KY Blue (less than 10%)

D. Turfgrass Species: Sod of grass species, with not less than 85 percent germination, not less than 95 percent pure seed, and not more than 0.5 percent weed seed

E. MD preferred sod mix - 3 species of tall fescue and max. 5% of Bluegrass

2.3 FERTILIZERS

A. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:

1. Composition: 1 lb/1000 sq. ft. of actual nitrogen, 4 percent phosphorous, and 2 percent potassium, by weight.
2. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.

B. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:

1. Composition: 20 percent nitrogen, 10 percent phosphorous, and 10 percent potassium, by weight.
2. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.

2.4 MULCHES

A. Straw Mulch: Provide air-dry, clean, mildew- and seed-free, salt hay or threshed straw of wheat, rye, oats, or barley.

B. Sphagnum Peat Mulch: Partially decomposed sphagnum peat moss, finely divided or of granular texture, and with a pH range of 3.4 to 4.8.

C. Muck Peat Mulch: Partially decomposed moss peat, native peat, or reed-sedge peat, finely divided or of granular texture, with a pH range of 6 to 7.5, and having a water-absorbing capacity of 1100 to 2000 percent, and containing no sand.

D. Compost Mulch: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1-inch sieve; soluble salt content of 2 to 5 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:

1. Organic Matter Content: 50 to 60 percent of dry weight.

2. Feedstock: Agricultural, food, or industrial residuals; bio-solids; yard trimmings; or source-separated or compostable mixed solid waste.

E. Fiber Mulch: Biodegradable, dyed-wood, cellulose-fiber mulch; nontoxic and free of plant-growth or germination inhibitors; with a maximum moisture content of 15 percent and a pH range of 4.5 to 6.5.

F. Non asphaltic Tackifier: Colloidal Tackifier recommended by fiber-mulch manufacturer for slurry application; nontoxic and free of plant-growth or germination inhibitors.

G. Asphalt Emulsion: ASTM D 977, Grade SS-1; nontoxic and free of plant-growth or germination inhibitors.

2.5 PESTICIDES

A. General: Pesticide, registered and approved by the EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.

B. Pre-Emergent Herbicide (Selective and Nonselective): Effective for controlling the germination or growth of weeds within planted areas at the soil level directly below the mulch layer.

C. Post-Emergent Herbicide (Selective and Nonselective): Effective for controlling weed growth that has already germinated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to be planted for compliance with requirements and other conditions affecting installation and performance of the Work.

1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
2. Suspend planting operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
3. Uniformly moisten excessively dry soil that is not workable or which is dusty.

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

C. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Architect and replace with new planting soil.

3.2 PREPARATION

A. Protect structures; utilities; sidewalks; pavements; and other facilities, trees, shrubs, and plantings from damage caused by planting operations.

1. Protect adjacent and adjoining areas from hydro seeding and hydro mulching overspray.
2. Protect grade stakes set by others until directed to remove them.

B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.3 TURF AREA PREPARATION

A. General: Prepare planting area for soil placement and mix planting soil according to Section 329115 "Soil Preparation" – for planting soil.

B. Placing Planting Soil: Place manufactured planting soil over exposed subgrade.

1. Reduce elevation of planting soil to allow for soil thickness of sod.

C. Moisten prepared area before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

D. Before planting, obtain Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

3.4 SEEDING

A. Sow seed with spreader or seeding machine. Do not broadcast or drop seed when wind velocity exceeds 5 mph.

1. Evenly distribute seed by sowing equal quantities in two directions at right angles to each other.
2. Do not use wet seed or seed that is moldy or otherwise damaged.
3. Do not seed against existing trees. Limit extent of seed to outside edge of planting saucer.

B. Sow seed at a total rate of 5 to 8 lb/1000 sq. ft..

C. Rake seed lightly into top 1/8 inch of soil, roll lightly, and water with fine spray.

D. Protect seeded areas with slopes exceeding 1:4 with erosion-control blankets and 1:6 with erosion-control fiber mesh installed and stapled according to manufacturer's written instructions.

E. Protect seeded areas with erosion-control mats where indicated on Drawings; install and anchor according to manufacturer's written instructions.

F. Protect seeded areas with slopes not exceeding 1:6 by spreading straw mulch. Spread uniformly at a minimum rate of 2 tons/acre to form a continuous blanket 1-1/2 inches in loose thickness over seeded areas. Spread by hand, blower, or other suitable equipment.

1. Anchor straw mulch by crimping into soil with suitable mechanical equipment.
2. Bond straw mulch by spraying with asphalt emulsion at a rate of 10 to 13 gal./1000 sq. ft.. Take precautions to prevent damage or staining of structures or other plantings adjacent to mulched areas. Immediately clean damaged or stained areas.

G. Protect seeded areas from hot, dry weather or drying winds by applying compost mulch or peat mulch within 24 hours after completing seeding operations. Soak areas, scatter mulch uniformly to a thickness of 3/16 inch, and roll surface smooth.

3.5 HYDROSEEDING

A. Hydroseeding: Mix specified seed, slow-release fertilizer, and fiber mulch in water, using equipment specifically designed for hydroseed application. Continue mixing until uniformly blended into homogeneous slurry suitable for hydraulic application.

1. Mix slurry with fiber-mulch manufacturer's recommended tackifier.
2. Spray-apply slurry uniformly to all areas to be seeded in a one-step process. Apply slurry at a rate so that mulch component is deposited at not less than 1500-lb/acre dry weight, and seed component is deposited at not less than the specified seed-sowing rate.
3. Spray-apply slurry uniformly to all areas to be seeded in a two-step process. Apply first slurry coat at a rate so that mulch component is deposited at not less than 500-lb/acre dry weight, and seed component is deposited at not less than the specified seed-sowing rate. Apply slurry cover coat of fiber mulch (hydromulching) at a rate of 1000 lb/acre.

3.6 SODDING

A. Lay sod within 24 hours of harvesting. Do not lay sod if dormant or if ground is frozen or muddy.

B. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod; do not stretch or overlap. Stagger sod strips or pads to offset joints in adjacent courses. Avoid damage to soil or sod during installation. Tamp and roll lightly to ensure contact with soil, eliminate air pockets, and form a smooth surface. Work sifted soil or fine sand into minor cracks between pieces of sod; remove excess to avoid smothering sod and adjacent grass.

1. Lay sod across slopes exceeding 1:3.
2. Anchor sod on slopes exceeding 1:6 with wood pegs or steel staples spaced as recommended by sod manufacturer but not less than two anchors per sod strip to prevent slippage.

C. Saturate sod with fine water spray within two hours of planting. During first week after planting, water daily or more frequently as necessary to maintain moist soil to a minimum depth of 1-1/2 inches below sod.

3.7 TURF MAINTENANCE

A. General: Maintain and establish turf by watering, fertilizing, weeding, mowing, trimming, replanting, and performing other operations as required to establish healthy, viable turf. Roll, regrade, and replant bare or eroded areas and re-mulch to produce a uniformly smooth turf. Provide materials and installation the same as those used in the original installation.

1. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace materials and turf damaged or lost in areas of subsidence.
2. In areas where mulch has been disturbed by wind or maintenance operations, add new mulch and anchor as required to prevent displacement.
3. Apply treatments as required to keep turf and soil free of pests and pathogens or disease. Use integrated pest management practices whenever possible to minimize the use of pesticides and reduce hazards.

B. Watering: Install and maintain temporary piping, hoses, and turf-watering equipment to convey water from sources and to keep turf uniformly moist to a depth of 4 inches.

1. Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch. Lay out temporary watering system to avoid walking over muddy or newly planted areas.
2. Water turf with fine spray at a minimum rate of 1 inch per week unless rainfall precipitation is adequate.

C. Mow turf as soon as top growth is tall enough to cut. Repeat mowing to maintain specified height without cutting more than one-third of grass height. Remove no more than one-third of grass-leaf growth in initial or subsequent mowings. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet. Schedule initial and subsequent mowings to maintain the following grass height:

1. Mow bentgrass to a height of 1/2 inch or less.
2. Mow bermudagrass to a height of 1/2 to 1 inch.
3. Mow Kentucky bluegrass to a height of 1-1/2 to 2 inches.
4. Mow turf-type tall fescue to a height of 2 to 3 inches.

D. Turf Postfertilization: Apply slow-release fertilizer after initial mowing and when grass is dry.

1. Use fertilizer that provides actual nitrogen of at least 1 lb/1000 sq. ft. to turf area.

3.8 SATISFACTORY TURF

A. Turf installations shall meet the following criteria as determined by Architect:

1. Satisfactory Seeded Turf: At end of maintenance period, a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, with coverage exceeding 90 percent over any 10 sq. ft. and bare spots not exceeding 5 by 5 inches.
2. Satisfactory Sodded Turf: At end of maintenance period, a healthy, well-rooted, even-colored, viable turf has been established, free of weeds, open joints, bare areas, and surface irregularities.

B. Use specified materials to reestablish turf that does not comply with requirements, and continue maintenance until turf is satisfactory.

3.9 PESTICIDE APPLICATION

A. Apply pesticides and other chemical products and biological control agents according to requirements of authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.

B. Post-Emergent Herbicides (Selective and Nonselective): Apply only as necessary to treat already-germinated weeds and according to manufacturer's written recommendations.

3.10 PLUGGING

Plant plugs in holes or furrows, spaced 12 inches apart in a triangular pattern.

3.11 CLEANUP AND PROTECTION

A. Promptly remove soil and debris created by turf work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.

B. Remove surplus soil and waste material, including excess subsoil, unsuitable soil, trash, and debris, and legally dispose of them off Owner's property.

C. Erect temporary fencing or barricades and warning signs as required to protect newly planted areas from traffic. Maintain fencing and barricades throughout initial maintenance period and remove after plantings are established.

D. Remove non-degradable erosion-control measures after grass establishment period.

3.12 MAINTENANCE SERVICE

A. Turf Maintenance Service: Provide full maintenance by skilled employees of landscape Installer. Maintain as required in "Turf Maintenance" Article. Begin maintenance immediately after each area is planted and continue until acceptable turf is established, but for not less than the following periods:

1. Seeded Turf: 60 days from date of planting completion.

    a. When initial maintenance period has not elapsed before end of planting season, or if turf is not fully established, continue maintenance during next planting season.

2. Sodded Turf: 60 days from date of planting completion.

END OF SECTION 329200

SECTION 329300

PLANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Plants
2. Tree stabilization
3. Tree-watering devices
4. Landscape edgings

B. Related Requirements:

1. Section 015639 "Temporary Tree and Plant Protection" for protecting, trimming, pruning, repairing, and replacing existing trees to remain that interfere with, or are affected by, execution of the Work.
2. Section 329200 "Turf and Grasses" for turf (lawn), hydroseeding, and erosion-control materials.
3. Category 700 "Landscaping" (Baltimore County Standard Specifications and Details for Construction).

1.3 DEFINITIONS

A. Backfill: The earth used to replace or the act of replacing earth in an excavation.

B. Balled and Burlapped Stock: Plants dug with firm, natural balls of earth in which they were grown, with a ball size not less than diameter and depth recommended by ANSI Z60.1 for type and size of plant required; wrapped with burlap, tied, rigidly supported, and drum laced with twine with the root flare visible at the surface of the ball as recommended by ANSI Z60.1.

C. Balled and Potted Stock: Plants dug with firm, natural balls of earth in which they are grown and placed, unbroken, in a container. Ball size is not less than diameter and depth recommended by ANSI Z60.1 for type and size of plant required.

D. Bare-Root Stock: Plants with a well-branched, fibrous-root system developed by transplanting or root pruning, with soil or growing medium removed, and with not less than the minimum root spread according to ANSI Z60.1 for type and size of plant required.

E. Container-Grown Stock: Healthy, vigorous, well-rooted plants grown in a container, with a well-established root system reaching sides of container and maintaining a firm ball when removed from container. Container shall be rigid enough to hold ball shape and protect root mass during shipping and be sized according to ANSI Z60.1 for type and size of plant required.

F. Fabric Bag-Grown Stock: Healthy, vigorous, well-rooted plants established and grown in-ground in a porous fabric bag with well-established root system reaching sides of fabric bag. Fabric bag size is not less than diameter, depth, and volume required by ANSI Z60.1 for type and size of plant.

G. Finish Grade: Elevation of finished surface of planting soil.

H. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. Pesticides include insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. They also include substances or mixtures intended for use as a plant regulator, defoliant, or desiccant. Some sources classify herbicides separately from pesticides.

I. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. Pests include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.

J. Planting Area: Areas to be planted.

K. Planting Soil: Existing, on-site soil; imported soil; or manufactured soil that has been modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth. See Section 329115 "Soil Preparation (Performance Specification)" for drawing designations for planting soils.

L. Plant; Plants; Plant Material: These terms refer to vegetation in general, including trees, shrubs, vines, ground covers, ornamental grasses, bulbs, corms, tubers, or herbaceous vegetation.

M. Root Flare: Also called "trunk flare." The area at the base of the plant's stem or trunk where the stem or trunk broadens to form roots; the area of transition between the root system and the stem or trunk.

N. Stem Girdling Roots: Roots that encircle the stems (trunks) of trees below the soil surface.

O. Subgrade: The surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.

1.4 COORDINATION

A. Coordination with Turf Areas (Lawns): Plant trees, shrubs, and other plants after finish grades are established and before planting turf areas unless otherwise indicated.

1. When planting trees, shrubs, and other plants after planting turf areas, protect turf areas, and promptly repair damage caused by planting operations.

1.5 PREINSTALLATION MEETINGS

A. Pre-installation Conference: Conduct conference at Project site.

1.6 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Plant Materials: Include quantities, sizes, quality, and sources for plant materials.
2. Plant Photographs: Include color photographs in digital format of each required species and size of plant material as it will be furnished to Project. Take photographs from an angle depicting true size and condition of the typical plant to be furnished. Include a scale rod or other measuring device in each photograph. For species where more than 20 plants are required, include a minimum of three photographs showing the average plant, the best quality plant, and the worst quality plant to be furnished. Identify each photograph with the full scientific name of the plant, plant size, and name of the growing nursery.

B. LEED Submittals: Comply with Section 018113.

1. SS Credit 2: Protect or Restore Habitat

2. Provide documentation that confirms all criteria listed in Part 2 of this Section is met for all imported soils.

C. Samples for Verification: For each of the following:

1. Trees and Shrubs: Three Samples of each variety and size delivered to site for review. Maintain approved Samples on-site as a standard for comparison.
2. Organic Compost Mulch: 1-quart volume of each organic mulch required; in sealed plastic bags labeled with composition of materials by percentage of

weight and source of mulch. Each Sample shall be typical of the lot of material to be furnished; provide an accurate representation of color, texture, and organic makeup.

3. Weed Control Barrier: 12 by 12 inches.
4. Proprietary Root-Ball-Stabilization Device: One unit.
5. Slow-Release, Tree-Watering Device: One unit of each size required.
6. Edging Materials and Accessories: Manufacturer's standard size, to verify color selected.
7. Tree Grates, Frames, and Accessories: Manufacturer's standard size delivered to site for review, to verify design and color selected.
8. Root Barrier: Width of panel by 12 inches.

1.7 INFORMATIONAL SUBMITTALS

A. Qualification Data: For landscape Installer. Include list of similar projects completed by Installer demonstrating Installer's capabilities and experience. Include project names, addresses, and year completed, and include names and addresses of owners' contact persons.

B. Product Certificates: For each type of manufactured product, from manufacturer, and complying with the following:

1. Manufacturer's certified analysis of standard products.
2. Analysis of other materials by a recognized laboratory made according to methods established by the Association of Official Analytical Chemists, where applicable.

C. Pesticides and Herbicides: Product label and manufacturer's application instructions specific to Project.

D. Sample Warranty: For special warranty.

1.8 CLOSEOUT SUBMITTALS

A. Maintenance Data: Recommended procedures to be established by Owner for maintenance of plants during a calendar year. Submit before expiration of required maintenance periods.

1.9 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape installer whose work has resulted in successful establishment of plants.

1. Professional Membership: Installer shall be a member in good standing of either the Professional Landcare Network or the American Nursery and Landscape Association.
2. Experience: Five years' experience in landscape installation in addition to requirements in Section 014000 "Quality Requirements."
3. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
4. Personnel Certifications: Installer's field supervisor shall have certification in one of the following categories from the Professional Landcare Network:

    a. Landscape Industry Certified Technician - Exterior.
    b. Landscape Industry Certified Horticultural Technician.

5. Pesticide Applicator: State licensed, commercial.

B. Provide quality, size, genus, species, and variety of plants indicated, complying with applicable requirements in ANSI Z60.1.

1. Selection of plants purchased under allowances is made by Architect, who tags plants at their place of growth before they are prepared for transplanting.

C. Measurements: Measure according to ANSI Z60.1. Do not prune to obtain required sizes.

1. Trees and Shrubs: Measure with branches and trunks or canes in their normal position. Take height measurements from or near the top of the root flare for field-grown stock and container-grown stock. Measure main body of tree or shrub for height and spread; do not measure branches or roots tip to tip. Take caliper measurements 6 inches above the root flare for trees up to 4-inch caliper size, and 12 inches above the root flare for larger sizes.
2. Other Plants: Measure with stems, petioles, and foliage in their normal position.

D. Plant Material Observation: Landscape Architect may observe plant material either at place of growth or at site before planting for compliance with requirements for genus, species, variety, cultivar, size, and quality. Landscape Architect may also observe trees and shrubs further for size and condition of balls and root systems, pests, disease symptoms, injuries, and latent defects and may reject unsatisfactory or defective material at any time during progress of work. Remove rejected trees or shrubs immediately from Project site.

1. Notify Landscape Architect of sources of planting materials seven days in advance of delivery to site.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of compliance with state and Federal laws if applicable.

B. Bulk Materials:

1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
2. Provide erosion-control measures to prevent erosion or displacement of bulk materials; discharge of soil-bearing water runoff; and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
3. Accompany each delivery of bulk materials with appropriate certificates.

C. Deliver bare-root stock plants within 24 hours of digging. Immediately after digging up bare-root stock, pack root system in wet straw, hay, or other suitable material to keep root system moist until planting. Transport in covered, temperature-controlled vehicles, and keep plants cool and protected from sun and wind at all times.

D. Do not prune trees and shrubs before delivery. Protect bark, branches, and root systems from sun scald, drying, wind burn, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy their natural shape. Provide protective covering of plants during shipping and delivery. Do not drop plants during delivery and handling.

E. Handle planting stock by root ball.

F. Store bulbs, corms, and tubers in a dry place at 60 to 65 deg F until planting.

G. Apply antidesiccant to trees and shrubs using power spray to provide an adequate film over trunks (before wrapping), branches, stems, twigs, and foliage to protect during digging, handling, and transportation.

1. If deciduous trees or shrubs are moved in full leaf, spray with antidesiccant at nursery before moving and again two weeks after planting.

H. Wrap trees and shrubs with burlap fabric over trunks, branches, stems, twigs, and foliage to protect from wind and other damage during digging, handling, and transportation.

I. Deliver plants after preparations for planting have been completed, and install immediately. If planting is delayed more than six hours after delivery, set plants and trees in their appropriate aspect (sun, filtered sun, or shade), protect from weather and mechanical damage, and keep roots moist.

1. Heel-in bare-root stock. Soak roots that are in less than moist condition in water for two hours. Reject plants with dry roots.

2. Set balled stock on ground and cover ball with soil, peat moss, sawdust, or other acceptable material.
3. Do not remove container-grown stock from containers before time of planting.
4. Water root systems of plants stored on-site deeply and thoroughly with a fine-mist spray. Water as often as necessary to maintain root systems in a moist, but not overly wet condition.

1.11 FIELD CONDITIONS

A. Field Measurements: Verify actual grade elevations, service and utility locations, irrigation system components, and dimensions of plantings and construction contiguous with new plantings by field measurements before proceeding with planting work.

B. Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with maintenance periods to provide required maintenance from date of Substantial Completion.

1. Spring Planting: April 1 to May 15
2. Fall Planting: September 1 to October 15

C. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions and warranty requirements.

1.12 WARRANTY

A. Special Warranty: Installer agrees to repair or replace plantings and accessories that fail in materials, workmanship, or growth within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Death and unsatisfactory growth, except for defects resulting from abuse, lack of adequate maintenance, or neglect by Owner.
b. Structural failures including plantings falling or blowing over.
c. Faulty performance of tree stabilization, edgings and tree grates.
d. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

2. Warranty Periods: From date of Substantial Completion.

a. Trees, Shrubs, Vines, and Ornamental Grasses: 24 months.
b. Ground Covers, Biennials, Perennials, and Other Plants: 12 months.
c. Annuals: Three months.

3. Include the following remedial actions as a minimum:

    a. Immediately remove dead plants and replace unless required to plant in the succeeding planting season.
    b. Replace plants that are more than 25 percent dead or in an unhealthy condition at end of warranty period.
    c. A limit of one replacement of each plant is required except for losses or replacements due to failure to comply with requirements.
    d. Provide extended warranty for period equal to original warranty period, for replaced plant material.

PART 2 - PRODUCTS

2.1 PLANT MATERIAL

A. General: Furnish nursery-grown plants true to genus, species, variety, cultivar, stem form, shearing, and other features indicated in Plant List, Plant Schedule, or Plant Legend indicated on Drawings and complying with ANSI Z60.1; and with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock, densely foliated when in leaf and free of disease, pests, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.

1. Trees with damaged, crooked, or multiple leaders; tight vertical branches where bark is squeezed between two branches or between branch and trunk ("included bark"); crossing trunks; cut-off limbs more than 3/4 inch in diameter; or with stem girdling roots are unacceptable.
2. Collected Stock: Do not use plants harvested from the wild, from native stands, from an established landscape planting, or not grown in a nursery unless otherwise indicated.

B. Do not use nurseries that have a different soil structure than Maryland’s (e.g. do not use nurseries from the South, Tennessee and Georgia to name a few)

C. Provide plants of sizes, grades, and ball or container sizes complying with ANSI Z60.1 for types and form of plants required. Plants of a larger size may be used if acceptable to Architect, with a proportionate increase in size of roots or balls.

D. Root-Ball Depth: Furnish trees and shrubs with root balls measured from top of root ball, which begins at root flare according to ANSI Z60.1. Root flare shall be visible before planting.

E. Labeling: Label each plant of each variety, size, and caliper with a securely attached, waterproof tag bearing legible designation of common name and full scientific name, including genus and species. Include nomenclature for hybrid, variety, or cultivar, if applicable for the plant.

F. If formal arrangements or consecutive order of plants is indicated on Drawings, select stock for uniform height and spread, and number the labels to assure symmetry in planting.

G. Annuals and Biennials: Provide healthy, disease-free plants of species and variety shown or listed, with well-established root systems reaching to sides of the container to maintain a firm ball, but not with excessive root growth encircling the container. Provide only plants that are acclimated to outdoor conditions before delivery and that are in bud but not yet in bloom.

H. Do not install plants if they appear to be damaged during transit or on site.

I. Trees to be protected during transit so that they do not get wind burn etc.

J. Imported soils: Comply with the following criteria:

Original function is comparable to reuse function

Not classified as prime farmland, unique farmland or farmland of statewide or local importance

Not extracted from a greenfield site

Does not include sphagnum peat moss

2.2 FERTILIZERS

A. Planting Tablets: Tightly compressed chip-type, long-lasting, slow-release, commercial-grade planting fertilizer in tablet form. Tablets shall break down with soil bacteria, converting nutrients into a form that can be absorbed by plant roots.

1. Size: 5-gram tablets.
2. Nutrient Composition: 20 percent nitrogen, 10 percent phosphorous, and 5 percent potassium, by weight plus micronutrients.

2.3 PLANT WATERING DEVICES

A. Shade trees

Manufacturer: TreeGator Original, www.treegator.com (size of bag dependent on tree size)

B. Evergreen and multi-stem trees:

Manufacturer: TreeGator Jr. Pro, www.treegator.com (size of bag dependent on tree size)

2.4 MULCHES

A. Organic Mulch: Free from deleterious materials and suitable as a top dressing of trees and shrubs, consisting of one of the following:

1. Type: Shredded hardwood.
2. Size Range: 3 inches maximum, 1/2 inch minimum.
3. Color: Natural.

B. Compost Mulch: Well-composted, stable, and weed-free organic matter, pH of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through a 1-inch sieve; soluble-salt content of 2 to 5 dS/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:

1. Organic Matter Content: 50 to 60 percent of dry weight.
2. Feedstock: Agricultural, food, or industrial residuals; bio-solids; yard trimmings; or source-separated or compostable mixed solid waste.

2.5 WEED-CONTROL BARRIERS

A. Nonwoven Geotextile Filter Fabric: Polypropylene or polyester fabric, 3 oz./sq. yd. minimum, composed of fibers formed into a stable network so that fibers retain their relative position. Fabric shall be inert to biological degradation and resist naturally encountered chemicals, alkalis, and acids.

B. Composite Fabric: Woven, needle-punched polypropylene substrate bonded to a nonwoven polypropylene fabric, 4.8 oz./sq. yd..

2.6 PESTICIDES

A. General: Pesticide registered and approved by the EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.

B. Pre-Emergent Herbicide (Selective and Nonselective): Effective for controlling the germination or growth of weeds within planted areas at the soil level directly below the mulch layer.

C. Post-Emergent Herbicide (Selective and Nonselective): Effective for controlling weed growth that has already germinated.

2.7 TREE-STABILIZATION MATERIALS

A. Trunk-Stabilization Materials:

1. Upright and Guy Stakes: Rough-sawn, sound, new hardwood, free of knots, holes, cross grain, and other defects, 2-by-2-inch nominal by length indicated, pointed at one end.
2. Wood Deadmen: Timbers measuring 8 inches in diameter and 48 inches long, treated with specified wood pressure-preservative treatment.
3. Flexible Ties: Wide rubber or elastic bands or straps of length required to reach stakes or turnbuckles or compression springs.
4. Guys and Tie Wires: ASTM A 641/A 641M, Class 1, galvanized-steel wire, two-strand, twisted, 0.106 inch in diameter.
5. Tree-Tie Webbing: UV-resistant polypropylene or nylon webbing with brass grommets.
6. Guy Cables: Five-strand, 3/16-inch-diameter, galvanized-steel cable, with zinc-coated turnbuckles or compression springs, a minimum of 3 inches long, with two 3/8-inch galvanized eyebolts.
7. Flags: Standard surveyor's plastic flagging tape, white, 6 inches long.
8. Proprietary Staking-and-Guying Devices: Proprietary stake or anchor and adjustable tie systems to secure each new planting by plant stem; sized as indicated and according to manufacturer's written recommendations.
    a. Platipus anchoring system (http://www.platipus-anchors.us/)

B. Root-Ball Stabilization Materials:

1. Upright Stakes and Horizontal Hold-Down: Rough-sawn, sound, new hardwood or softwood, free of knots, holes, cross grain, and other defects, 2-by-2-inch nominal by length indicated (min. 8’-0 out of ground and 2’-0 underground); stakes pointed at one end.
2. Wood Screws: ASME B18.6.1.
3. Proprietary Root-Ball Stabilization Devices: Proprietary at- or below-grade stabilization systems to secure each new planting by root ball and that do not encircle the trunk; sized according to manufacturer's written recommendations unless otherwise indicated.
    a. Platipus anchoring system – Plati Mat – model # depends on size of the tree specified in planting schedule (http://www.platipus-anchors.us/)

2.8 LANDSCAPE EDGINGS

A. Steel Edging: Standard commercial-steel edging, fabricated in sections of standard lengths, with loops stamped from or welded to face of sections to receive stakes.

1. Border Concepts Steel Edging (Border King)
2. Edging Size: 1/4 inch thick by 5 inches deep.
3. Stakes: Tapered steel, a minimum of 12 inches long.
4. Accessories: Standard tapered ends, corners, and splicers.
5. Finish: Manufacturer's standard paint.

    a. Paint Color: Contractor to submit all manufacturer colors for approval.

2.9 MISCELLANEOUS PRODUCTS

A. Wood Pressure-Preservative Treatment: AWPA U1, Use Category UC4a; acceptable to authorities having jurisdiction, and containing no arsenic or chromium.

B. Root Barrier: Black, molded, modular panels 24 inches high (deep), 85 mils thick, and with vertical root deflecting ribs protruding 3/4 inch out from panel surface; manufactured with minimum 50 percent recycled polyethylene plastic with UV inhibitors.

C. Antidesiccant: Water-insoluble emulsion, permeable moisture retarder, film forming, for trees and shrubs. Deliver in original, sealed, and fully labeled containers and mix according to manufacturer's written instructions.

D. Burlap: Non-synthetic, biodegradable.

E. Planter Drainage Gravel: Washed on site after delivery with no fines, #57 stone.

F. Planter Filter Fabric: Nonwoven geotextile manufactured for separation applications and made of polypropylene, polyolefin, or polyester fibers or combination of them.

G. Concrete Parking Stops: For anchoring trees on structure. Use minimum 3 parking stops per tree. 200 lbs+ per parking stop minimum weight. Parking stops to be installed prior to infilling soil trench. Document via photos that the parking stops were installed correctly for each tree pit.

H. Mycorrhizal Fungi: Dry, granular inoculant containing at least 5300 spores per lb of vesicular-arbuscular mycorrhizal fungi and 95 million spores per lb of ectomycorrhizal fungi, 33 percent hydrogel, and a maximum of 5.5 percent inert material.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive plants, with Installer present, for compliance with requirements and conditions affecting installation and performance of the Work.

1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
2. Verify that plants and vehicles loaded with plants can travel to planting locations with adequate overhead clearance.
3. Suspend planting operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
4. Uniformly moisten excessively dry soil that is not workable or which is dusty.

B. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Architect and replace with new planting soil.

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

3.2 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities and turf areas and existing plants from damage caused by planting operations.

B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

C. Lay out individual tree and shrub locations and areas for multiple plantings. Stake locations, outline areas, adjust locations when requested, and obtain Architect's acceptance of layout before excavating or planting. Make minor adjustments as required.

D. Lay out plants at locations directed by Landscape Architect. Stake locations of individual trees and shrubs and outline areas for multiple plantings.

3.3 PLANTING AREA ESTABLISHMENT

A. General: Prepare planting area for soil placement and mix planting soil according to Section 329115 "Soil Preparation."

B. Placing Planting Soil: Place manufactured planting soil over exposed subgrade.

C. Before planting, obtain Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

D. Application of Mycorrhizal Fungi: At time directed by Architect, broadcast dry product uniformly over prepared soil at application rate according to manufacturer's written recommendations.

3.4 EXCAVATION FOR TREES AND SHRUBS

A. Planting Pits and Trenches: Excavate circular planting pits.
   1. Excavate planting pits with sides sloping inward at a 45-degree angle. Excavations with vertical sides are unacceptable and will be rejected.
   2. Trim perimeter of bottom leaving center area of bottom raised slightly to support root ball and assist in drainage away from center. Do not further disturb base.

Ensure that root ball will sit on undisturbed base soil to prevent settling. Scarify sides of planting pit smeared or smoothed during excavation.

3. Excavate three times as wide as ball diameter for balled and Burlapped, balled and potted, container-grown and fabric bag-grown stock.
4. Excavate at least 12 inches wider than root spread and deep enough to accommodate vertical roots for bare-root stock.
5. Do not excavate deeper than depth of the root ball, measured from the root flare to the bottom of the root ball.
6. If area under the plant was initially dug too deep, add soil to raise it to the correct level and thoroughly tamp the added soil to prevent settling.
7. Maintain angles of repose of adjacent materials to ensure stability. Do not excavate subgrades of adjacent paving, structures, hardscapes, or other new or existing improvements.
8. Maintain supervision of excavations during working hours.
9. Keep excavations covered or otherwise protected after working hours.
10. If drain tile is indicated on Drawings or required under planting areas, excavate to top of porous backfill over tile.

B. Backfill Soil: Subsoil and topsoil removed from excavations may not be used as backfill soil unless otherwise indicated.

C. Obstructions: Notify Architect if unexpected rock or obstructions detrimental to trees or shrubs are encountered in excavations.

1. Hardpan Layer: Drill 6-inch-diameter holes, 24 inches apart, into free-draining strata or to a depth of 10 feet, whichever is less, and backfill with free-draining material.

D. Drainage: Notify Architect if subsoil conditions evidence unexpected water seepage or retention in tree or shrub planting pits.

E. Fill excavations with water and allow it to percolate away before positioning trees and shrubs.

3.5 TREE, SHRUB, AND VINE PLANTING

A. Inspection: Contractor to layout all plants prior to installation and get landscape architect’s approval on the layout. Installation to occur only after landscape architect has approved the layout. Contractor to notify landscape architect minimum 7 days in advance for conducting a site visit to approve the planting layout. Layout of plants to be in accordance with contract documents.

B. At time of planting, verify that root flare is visible at top of root ball according to ANSI Z60.1. If root flare is not visible, remove soil in a level manner from the root ball to where the top-most root emerges from the trunk. After soil removal to expose the root flare, verify that root ball still meets size requirements.

C. Roots: Remove stem girdling roots and kinked roots. Remove injured roots by cutting cleanly; do not break.

D. Balled and Burlapped Stock: Set each plant plumb and in center of planting pit or trench with root flare 1 inch above adjacent finish grades.

1. Backfill: Planting soil. For trees, use excavated soil for backfill.
2. After placing some backfill around root ball to stabilize plant, carefully cut and remove burlap, rope, and wire baskets from tops of root balls and from sides, but do not remove from under root balls. Remove pallets, if any, before setting. Do not use planting stock if root ball is cracked or broken before or during planting operation.
3. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
4. Place planting tablets equally distributed around each planting pit when pit is approximately one-half filled. Place tablets beside the root ball about 1 inch from root tips; do not place tablets in bottom of the hole.

    a. Quantity: Two per plant.

5. Continue backfilling process. Water again after placing and tamping final layer of soil.

E. Balled and Potted and Container-Grown Stock: Set each plant plumb and in center of planting pit or trench with root flare 2 inches above Insert requirement adjacent finish grades.

1. Backfill: Planting soil. For trees, use excavated soil for backfill.
2. Carefully remove root ball from container without damaging root ball or plant.
3. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
4. Place planting tablets equally distributed around each planting pit when pit is approximately one-half filled. Place tablets beside the root ball about 1 inch from root tips; do not place tablets in bottom of the hole.

    a. Quantity: Two per plant.

5. Continue backfilling process. Water again after placing and tamping final layer of soil.

F. Fabric Bag-Grown Stock: Set each plant plumb and in center of planting pit or trench with root flare 2 inches above adjacent finish grades.

1. Backfill: Planting soil. For trees, use excavated soil for backfill.
2. Carefully remove root ball from fabric bag without damaging root ball or plant. Do not use planting stock if root ball is cracked or broken before or during planting operation.
3. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
4. Place planting tablets equally distributed around each planting pit when pit is approximately one-half filled. Place tablets beside the root ball about 1 inch from root tips; do not place tablets in bottom of the hole.

    a. Quantity: Two per plant.

5. Continue backfilling process. Water again after placing and tamping final layer of soil.

G. Bare-Root Stock: Set and support each plant in center of planting pit or trench with root flare 2 inches above adjacent finish grade.

1. Backfill: Planting soil. For trees, use excavated soil for backfill.
2. Spread roots without tangling or turning toward surface. Plumb before backfilling, and maintain plumb while working.
3. Carefully work backfill in layers around roots by hand. Bring roots into close contact with the soil.
4. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
5. Place planting tablets equally distributed around each planting pit when pit is approximately one-half filled. Place tablets beside soil-covered roots about 1 inch from root tips; do not place tablets in bottom of the hole or touching the roots.

    a. Quantity: Two per plant.

6. Continue backfilling process. Water again after placing and tamping final layer of soil.

H. Watering Pipe: During backfilling, install watering pipe 4 feet deep into the planting pit outside the root ball with top of pipe 1 inch above the mulched surface.

I. Slopes: When planting on slopes, set the plant so the root flare on the uphill side is flush with the surrounding soil on the slope; the edge of the root ball on the downhill side will be above the surrounding soil. Apply enough soil to cover the downhill side of the root ball.

3.6 MECHANIZED TREE-SPADE PLANTING

A. Trees may be planted with an approved mechanized tree spade at the designated locations. Do not use tree spade to move trees larger than the maximum size allowed for a similar field-grown, balled-and-burlapped root-ball diameter according to ANSI Z60.1, or larger than manufacturer's maximum size recommendation for the tree spade being used, whichever is smaller.

B. Use the same tree spade to excavate the planting hole as will be used to extract and transport the tree.

C. When extracting the tree, center the trunk within the tree spade and move tree with a solid ball of earth.

D. Cut exposed roots cleanly during transplanting operations.

E. Plant trees following procedures in "Tree, Shrub, and Vine Planting" Article.

F. Where possible, orient the tree in the same direction as in its original location.

3.7 TREE, SHRUB, AND VINE PRUNING

A. Remove only dead, dying, or broken branches. Do not prune for shape.

B. Prune, thin, and shape trees, shrubs, and vines as directed by Architect.

C. Prune, thin, and shape trees, shrubs, and vines according to standard professional horticultural and arboricultural practices. Unless otherwise indicated by Architect, do not cut tree leaders; remove only injured, dying, or dead branches from trees and shrubs; and prune to retain natural character.

D. Do not apply pruning paint to wounds.

3.8 TREE STABILIZATION

A. Trunk Stabilization by Upright Staking and Tying: Install trunk stabilization as follows unless otherwise indicated:

1. Upright Staking and Tying: Stake trees of 2- through 5-inch caliper. Stake trees of less than 2-inch caliper only as required to prevent wind tip out. Use a minimum of two stakes of length required to penetrate at least 18 inches below bottom of backfilled excavation and to extend one-third of trunk height above grade. Set vertical stakes and space to avoid penetrating root balls or root masses.

2. Upright Staking and Tying: Stake trees with two stakes for trees up to 12 feet high and 2-1/2 inches or less in caliper; three stakes for trees less than 14 feet high and up to 4 inches in caliper. Space stakes equally around trees.
3. Support trees with bands of flexible ties at contact points with tree trunk. Allow enough slack to avoid rigid restraint of tree.
4. Support trees with two strands of tie wire, connected to the brass grommets of tree-tie webbing at contact points with tree trunk. Allow enough slack to avoid rigid restraint of tree.

B. Trunk Stabilization by Staking and Guying: Install trunk stabilization as follows unless otherwise indicated on Drawings. Stake and guy trees more than 14 feet in height and more than 3 inches in caliper unless otherwise indicated.

1. Site-Fabricated, Staking-and-Guying Method: Install no fewer than three guys spaced equally around tree.

    a. Securely attach guys to stakes 30 inches long, driven to grade. Adjust spacing to avoid penetrating root balls or root masses. Provide turnbuckle or compression spring for each guy wire and tighten securely.
    b. For trees more than 6 inches in caliper, anchor guys to wood deadmen buried at least 36 inches below grade. Provide turnbuckle or compression spring for each guy wire and tighten securely.
    c. Support trees with bands of flexible ties at contact points with tree trunk and reaching to turnbuckle or compression spring. Allow enough slack to avoid rigid restraint of tree.
    d. Support trees with guy cable, connected to the brass grommets of tree-tie webbing at contact points with tree trunk and reaching to turnbuckle or compression spring. Allow enough slack to avoid rigid restraint of tree.
    e. Attach flags to each guy wire, 30 inches above finish grade.
    f. Paint turnbuckles or compression springs with luminescent white paint.

2. Proprietary Staking and Guying Device: Install staking and guying system sized and positioned as recommended by manufacturer unless otherwise indicated and according to manufacturer's written instructions.

C. Root-Ball Stabilization: Install at- or below-grade stabilization system to secure each new planting by the root ball unless otherwise indicated.

1. Wood Hold-Down Method: Place vertical stakes against side of root ball and drive them into subsoil; place horizontal wood hold-down stake across top of root ball and screw at each end to one of the vertical stakes.

    a. Install stakes of length required to penetrate at least 18 inches below bottom of backfilled excavation. Saw stakes off at horizontal stake.
    b. Install screws through horizontal hold-down and penetrating at least 1 inch into stakes. Predrill holes if necessary to prevent splitting wood.
    c. Install second set of stakes on other side of root trunk for larger trees.

2. Proprietary Root-Ball Stabilization Device: Install root-ball stabilization system sized and positioned as recommended by manufacturer unless otherwise indicated and according to manufacturer's written instructions.

3.9 ROOT-BARRIER INSTALLATION

A. Install root barrier where trees are planted within 60 inches of paving or other hardscape elements, such as walls, curbs, and walkways, unless otherwise indicated on Drawings.

B. Align root barrier with bottom edge angled at 20 degrees away from the paving or other hardscape element and run it linearly along and adjacent to the paving or other hardscape elements to be protected from invasive roots.

C. Install root barrier continuously for a distance of 60 inches in each direction from the tree trunk, for a total distance of 10 feet per tree. If trees are spaced closer, use a single continuous piece of root barrier.

1. Position top of root barrier according to manufacturer's written recommendations.
2. Overlap root barrier a minimum of 12 inches at joints.
3. Do not distort or bend root barrier during construction activities.
4. Do not install root barrier surrounding the root ball of tree.

3.10 PLACING SOIL IN PLANTERS

A. Place a layer of drainage gravel at least 4 inches thick in bottom of planter. Cover bottom with filter fabric and wrap filter fabric 6 inches up on all sides. Duct tape along the entire top edge of the filter fabric, to secure the filter fabric against the sides during the soil-filling process.

B. Fill planter with planting soil. Place soil in lightly compacted layers to an elevation of 1-1/2 inches below top of planter, allowing natural settlement.

3.11 GROUND COVER AND PLANT PLANTING

A. Set out and space ground cover and plants other than trees, shrubs, and vines as indicated on Drawings in even rows with triangular spacing.

B. Use planting soil for backfill.

C. Dig holes large enough to allow spreading of roots.

D. For rooted cutting plants supplied in flats, plant each in a manner that minimally disturbs the root system but to a depth not less than two nodes.

E. Work soil around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water.

F. Water thoroughly after planting, taking care not to cover plant crowns with wet soil.

G. Protect plants from hot sun and wind; remove protection if plants show evidence of recovery from transplanting shock.

3.12 PLANTING AREA MULCHING

A. Install weed-control barriers before mulching according to manufacturer's written instructions. Completely cover area to be mulched, overlapping edges a minimum of 6 inches and secure seams with galvanized pins.

B. Mulch backfilled surfaces of planting areas and other areas indicated.

1. Trees and Treelike Shrubs in Turf Areas: Apply organic or mineral mulch ring of 2-inch average thickness, with 36-inch radius around trunks or stems. Do not place mulch within 6 inches of trunks or stems.
2. Organic Mulch in Planting Areas: Apply 2-inch average thickness of organic mulch extending 12 inches beyond edge of individual planting pit or trench and over whole surface of planting area, and finish level with adjacent finish grades. Do not place mulch within 6 inches of trunks or stems.
3. Mineral Mulch in Planting Areas: Apply 2-inch average thickness of mineral mulch extending 12 inches beyond edge of individual planting pit or trench and over whole surface of planting area, and finish level with adjacent finish grades. Do not place mulch within 6 inches of trunks or stems.

3.13 EDGING INSTALLATION

A. Steel Edging: Install steel edging where indicated according to manufacturer's written instructions. Anchor with steel stakes spaced approximately 30 inches apart, driven below top elevation of edging.

B. Shovel-Cut Edging: Separate mulched areas from turf areas, curbs, and paving with a 45-degree, 4- to 6-inch-deep, shovel-cut edge.

C. Mow-Strip Installation:

1. Excavate for mow strip.
2. Compact subgrade uniformly beneath mow strip.
3. Apply nonselective, pre-emergent herbicide that inhibits growth of grass and weeds.
4. Install steel edging, delineating the edge of mow strip.

5. Install weed-control barrier before mulching, covering area of mow strip, and overlapping and pinning edges of barrier at least 6 inches and according to manufacturer's written instructions.
6. Place indicated thickness of organic or mineral mulch, fully covering weed barrier.
7. Rake mulch to a uniform surface level with adjacent finish grades.

3.14 INSTALLING SLOW-RELEASE WATERING DEVICE

A. Provide one device for each tree.

B. Place device on top of the mulch at base of tree stem and fill with water according to manufacturer's written instructions.

3.15 PLANT MAINTENANCE

A. Maintain plantings by pruning, cultivating, and watering, weeding, fertilizing, mulching, restoring planting saucers, adjusting and repairing tree-stabilization devices, resetting to proper grades or vertical position, and performing other operations as required to establish healthy, viable plantings.

B. Fill in, as necessary, soil subsidence that may occur because of settling or other processes. Replace mulch materials damaged or lost in areas of subsidence.

C. Apply treatments as required to keep plant materials, planted areas, and soils free of pests and pathogens or disease. Use integrated pest management practices when possible to minimize use of pesticides and reduce hazards. Treatments include physical controls such as hosing off foliage, mechanical controls such as traps, and biological control agents.

3.16 PESTICIDE APPLICATION

A. Apply pesticides and other chemical products and biological control agents according to authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.

B. Pre-Emergent Herbicides (Selective and Nonselective): Apply to tree, shrub, and ground-cover areas according to manufacturer's written recommendations. Do not apply to seeded areas.

C. Post-Emergent Herbicides (Selective and Nonselective): Apply only as necessary to treat already-germinated weeds and according to manufacturer's written recommendations.

3.17 REPAIR AND REPLACEMENT

A. General: Repair or replace existing or new trees and other plants that are damaged by construction operations, in a manner approved by Architect.

1. Submit details of proposed pruning and repairs.
2. Perform repairs of damaged trunks, branches, and roots within 24 hours, if approved.
3. Replace trees and other plants that cannot be repaired and restored to full-growth status, as determined by Architect.

B. Remove and replace trees that are more than 25 percent dead or in an unhealthy condition before the end of the corrections period or are damaged during construction operations that Architect determines are incapable of restoring to normal growth pattern.

1. Provide new trees of same size as those being replaced for each tree of 6 inches or smaller in caliper size.
2. Provide two new tree(s) of 6-inch caliper size for each tree being replaced that measures more than 6 inches in caliper size.
3. Species of Replacement Trees: Species selected by Architect.

3.18 CLEANING AND PROTECTION

A. During planting, keep adjacent paving and construction clean and work area in an orderly condition. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.

B. Remove surplus soil and waste material including excess subsoil, unsuitable soil, trash, and debris and legally dispose of them off Owner's property.

C. Protect plants from damage due to landscape operations and operations of other contractors and trades. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged plantings.

D. After installation and before Substantial Completion, remove nursery tags, nursery stakes, tie tape, labels, wire, burlap, and other debris from plant material, planting areas, and Project site.

E. At time of Substantial Completion, verify that tree-watering devices are in good working order and leave them in place. Replace improperly functioning devices.

3.19 MAINTENANCE SERVICE

A. Maintenance Service for Trees and Shrubs: Provide maintenance by skilled employees of landscape Installer. Maintain as required in "Plant Maintenance" Article. Begin

maintenance immediately after plants are installed and continue until plantings are acceptably healthy and well established, but for not less than maintenance period below:

1. Maintenance Period: 24 months from date of Substantial Completion.

B. Maintenance Service for Ground Cover and Other Plants: Provide maintenance by skilled employees of landscape Installer. Maintain as required in "Plant Maintenance" Article. Begin maintenance immediately after plants are installed and continue until plantings are acceptably healthy and well established, but for not less than maintenance period below:

1. Maintenance Period: 12 months from date of Substantial Completion.

END OF SECTION 329300

SECTION 330500

COMMON WORK RESULTS FOR UTILITIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Baltimore County Department of Public Works and Transportation Standard Specifications for Construction and Materials, Latest Edition.

1.2 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. Piping system common requirements.
8. Equipment installation common requirements.
9. Painting.

1.3 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.

1.4 ACTION SUBMITTALS

A. Product Data: For the following:

1. Dielectric fittings.
2. Identification devices.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.6 COORDINATION

A. Coordinate installation of identifying devices after completing covering and painting if devices are applied to surfaces.

PART 2 - PRODUCTS

2.1 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. 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.

2.2 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.

C. AWWA Transition Couplings NPS 2 and Larger:
1. Description: AWWA C219, metal sleeve-type coupling for underground pressure piping.

D. 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.

2.3 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: 150 psig minimum.
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: 150 psig minimum.

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.

2.4 SLEEVES

A. Galvanized-Steel Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

B. Steel Pipe Sleeves: ASTM A53/A53M, Type E, Grade B, Schedule 40, galvanized, plain ends.

C. Cast-Iron Sleeves: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

D. Molded PVC Sleeves: Permanent, with nailing flange for attaching to wooden forms.

E. PVC Pipe Sleeves: ASTM D1785, Schedule 40.

F. Molded PE Sleeves: Reusable, PE, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

2.5 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. Snap-on Plastic Pipe Markers: Manufacturer's standard preprinted, semirigid, snap-on type. Include color-coding according to ASME A13.1, unless otherwise indicated.

D. Pressure-Sensitive Pipe Markers: Manufacturer's standard preprinted, color-coded, pressure-sensitive-vinyl type with permanent adhesive.

E. Pipes with OD, Including Insulation, Less Than 6 Inches: Full-band pipe markers, extending 360 degrees around pipe at each location.

F. 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.

G. 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.

H. 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.

I. 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.
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 diameter, unless otherwise indicated.
6. Shape: As indicated for each piping system.

J. Valve Tag Fasteners: Brass, wire-link or beaded chain; or brass S-hooks.

K. 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, unless otherwise indicated.
3. Thickness: 1/16 inch, for units up to 20 sq. in. or 8 inches in length, and 1/8 inch for larger units.
4. Fasteners: Self-tapping, stainless-steel screws or contact-type permanent adhesive.

L. 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.

2.6 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.

2.7 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

3.1 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.

3.2 DIELECTRIC FITTING APPLICATIONS

A. Wet Piping Systems: Connect piping of dissimilar metals with the following:

1. NPS 2 and Smaller: Dielectric couplings or dielectric nipples.
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.

3.3 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. Verify final equipment locations for roughing-in.

L. Refer to equipment specifications in other Sections for roughing-in requirements.

3.4 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.

3.5 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping NPS 2and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 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.

3.6 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.

3.7 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. Adjusting: Relocate identifying devices that become visually blocked by work of this or other Divisions.

3.8 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 330500

SECTION 334200

STORMWATER CONVEYANCE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Baltimore County Department of Public Works and Transportation Standard Specifications for Construction and Materials, Latest Edition.

1.2 SUMMARY

A. Section Includes:

1. HDPE pipe and fittings.
2. PVC pipe and fittings.
3. Concrete pipe and fittings.
4. Cleanouts.
5. Drains.
6. Manholes.
7. Polymer-concrete, channel drainage systems.
8. Stormwater inlets.
9. Pipe outlets.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

1. Manholes: Include plans, elevations, sections, details, frames, and covers.
2. Stormwater Inlets: Include plans, elevations, sections, details, frames, covers, and grates.
3. Stormwater Detention Structures: Include plans, elevations, sections, details, frames, covers, design calculations, and concrete design-mix reports.

1.4 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. Profile Drawings: Show system piping in elevation. Draw profiles at horizontal scale of not less than 1 inch equals 50 feet and vertical scale of not less than 1 inch equals 5 feet. Indicate manholes and piping. Show types, sizes, materials, and elevations of other utilities crossing system piping.

C. Product Certificates: For each type of cast-iron soil pipe and fitting, from manufacturer.

D. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

1.6 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 and stormwater inlets in accordance with manufacturer's written rigging instructions.

1.7 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 two days in advance of proposed interruption of service.
2. Do not proceed with interruption of service without Owner's written permission.

PART 2 - PRODUCTS

Refer to Baltimore County Standard Specifications for Construction and Materials, Section 905 – Pipe

PART 3 - EXECUTION

Refer to Baltimore County Standard Specifications for Construction and Materials, Section 303 – Pipe Culverts

END OF SECTION 334200

APPENDIX A

GEOTECHNICAL SUBSURFACE INVESTIGATION REPORT

GEOTECHNICAL SUBSURFACE INVESTIGATION REPORT

Northwest Regional Park – Splash Pad and Supporting Facilities
Baltimore County, Maryland

PREPARED FOR:

Mahan Rykiel
3300 Clipper Mill Road, Suite 200
Baltimore, MD 21211

PREPARED BY:

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April 9, 2025

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Revised on April 9, 2025
August 14, 2024

Attn: Mr. Mark. E Pelusi, Jr
Mahan Rykiel
3300 Clipper Mill Road, Suite 200
Baltimore, MD 21211

REF: Report of Subsurface Investigation and Studies
Northwest Regional Park – Splash Pad and Supporting Facilities
Baltimore County, Maryland
AB Job No. 2021528-01

Dear Mr. Pelusi:

AB Consultants, Inc. (ABC) is pleased to submit this soil report containing the results of the geotechnical investigation for the above-referenced project. To obtain information of the subsurface conditions, eight (8) 6.5- to 15-foot deep soil borings were drilled, and two (2) infiltration tests were performed. The purpose of this study was to explore the subsurface conditions for the proposed splash pad and supporting facilities located within the Northwest Regional Pak in Baltimore County, Maryland. The following report sections discuss the results of field and laboratory studies, design recommendations and construction methods for the proposed improvements.

All samples obtained from the soil test borings will be retained in our laboratory for a period of thirty (30) days from the date of this report. They will be available for inspection during this period. After that time, the samples will be discarded.

It has been a pleasure serving you on this project. If you have any questions regarding this report, or if we can be of further service in any way, please contact us.

Very truly yours,
AB Consultants, Inc.

Fu Guo, P.E.
Project Engineer

Andinet Tolla, P.E.
Project Manager

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1.0 INTRODUCTION

1.1 General

This report presents the findings from subsurface exploration, laboratory test results, and geotechnical recommendations for the proposed splash pad and supporting facilities within Northwest Regional Park in Baltimore County, Maryland. The site improvements include Stormwater Management (SWM) features, a concrete splash pad, a pumping station, a sanitary sewer, a water line, a storm drain, comfort station and light poles. This geotechnical report primarily focuses on the proposed SWM facilities, concrete splash pad, comfort station and pumping station. The study was conducted by performing field and laboratory tests at the site. The results of these tests form the basis for determining the relevant design parameters for the proposed improvements. This subsurface study was conducted for Mahan Rykiel and has been performed in general accordance with our proposal dated May 16, 2023, and subsequent conversations.

1.2 Scope of Work

The investigation of existing subsurface soil conditions at the site consisted of the following:

- Planning and executing subsurface exploration programs to evaluate soil and ground conditions for the proposed site improvements.
- Performing on-site infiltration tests.
- Performing laboratory tests on soil samples obtained from the borings.
- Providing a geotechnical report that includes a summary of field findings, laboratory test results and geotechnical recommendations.

1.3 Site Location

The project site is located at 9912 Lyons Mill Road, Owings Mills, Maryland. The field study was focused on a grass area located between the existing parking lot and football field.

2.0 FIELD ACTIVITIES AND SUBSURFACE EXPLORATION

2.1 Soil Borings

To obtain information of the subsurface conditions, a total of six (6) soil borings were drilled at the project site; four soil borings were performed for the splash pad and

supporting pumping station (SB-1 through SB-4) and two soil borings for the SWM facilities (SWM-1 and SWM-2). Soil borings were drilled to depths of 10- to 15-feet below existing grade between July 19 and 22, 2024. In addition, two (2) hand auger borings and Dynamic Cone Penetrometer (DCP) tests were performed at the proposed Comfort Station on April 4, 2025. Soil borings were staked out in the field by ABC; in addition, all field drilling operations were managed and supervised by ABC. A site location map and boring plan are included in Appendix B and C, respectively.

2.2 Subsurface Investigation

Borings for this project were drilled utilizing a CME-45 series truck-mounted drilling rig. Test borings were advanced using hollow-stem augers and soil samples were obtained using the Standard Penetration Test (SPT) procedure in accordance with ASTM D1586. SPT samples were obtained from the borings at depth intervals of 2.5 feet in the top ten feet, and at 5-foot intervals, thereafter. A representative portion of each split spoon sample was placed in a glass jar and was transported to our laboratory. In addition, bulk samples were collected in most of the borings.

In the split-barrel sampling procedure, a 2.0-inch O.D. split-barrel sampling spoon is driven into the ground with a 140-pound hammer, free falling a distance of 30 inches. The blows required to advance the sampling spoon to a specified distance are reported as the penetration resistance values. The values are shown on the boring logs at the depths of their occurrence. The N-value is the sum of standard penetration resistance values that advanced through the last 12 inches of sampling. The N-value is an indication of the relative density of in-place granular soils and, to a lesser degree of accuracy, the consistency of cohesive soils.

Hand augers and soil samples were collected from the augers. Representative portions of sample were placed in a glass jar and were transported to our laboratory. Dynamic Cone Penetration (DCP) test were performed in accordance with ASTM Special Technical Publication #399 for each boring at depth intervals of every 1 foot.

In the procedure of DCP test, the dynamic portable penetrometer is driven into the ground with a 15-pound hammer, free falling a distance of 20 inches. The blows required to advance the dynamic cone to a specified distance are recorded. The penetration resistance values are corrected to the Standard Penetration Tests (SPT) values. The

values are shown on test pit logs at the depths of their occurrence. The N-value is the sum of last two penetration resistance values.

Groundwater levels were monitored in all borings. Samples obtained from the borings were inspected by a geotechnical engineer and the field logs were edited accordingly. The final logs indicating the encountered subsurface conditions are included in Appendix D.

2.3 On-site Infiltration Tests and Results

Two (2) infiltration tests were performed at the proposed bio-retention facility location; the borings for the infiltration tests were drilled within a 5-foot radius of the soil sample borings. Infiltration test holes were drilled with a 6-inch diameter auger to an approximate depth of 5 feet below existing grade. Five-inch diameter solid PVC casings were inserted into the test holes and water was then introduced for an overnight pre-soaking period. The infiltration tests were performed the following day by refilling the PVC casings with water to the pre-soak level and then monitoring water levels at one-hour time periods. This procedure was then repeated (refilling the casings each time) three additional times, for a total of four observations. Field in-situ infiltration test data is included in Appendix F and the results are summarized in the following table.

SUMMARY OF IN-SITU INFILTRATION TEST RESULTS			
Boring No.	Test Hole Depth (ft)	Sample Description at Bottom of Test Hole	Average 4-hr Field Infiltration Rate (in./hr)
SWM-1	5	Sandy Silt	0.3
SWM-2	5	Sandy Clay	0.1

3.0 LABORATORY TESTING PROGRAM

3.1 Laboratory Testing Program

Laboratory tests were performed on selected representative samples. Natural moisture contents were performed on all soil samples, and the results are included in the boring logs. Sieve analysis and modified proctor tests were conducted on selected samples; gradation curves and proctor results are presented in Appendix E.

3.2 Laboratory Results

Results of the standard proctor laboratory tests are summarized in the following table. Other pertinent soil data are presented in the boring logs and Appendix E.

RESULTS SUMMARY OF MODIFIED PROCTOR TESTS								
Boring No.	Sample Depth (ft)	Atterberg Limits			Passing #200 Sieve (%)	Modified Proctor Test		Soil Classification
		LL	PL	PI		Max. Dry Density (pcf)	Opt. Moist. Content (%)	
SB-1	1 to 6	Non-plasticity			63.9	117.9	14.4	ML/A-4
SB-4	1 to 5	34	25	9	60.9	120.6	11.1	ML/A-4

4.0 GENERAL SITE AND SUBSURFACE CONDITIONS

4.1 Site Condition

The study area is located within Northwest Regional Park, a large public park situated at 9912 Lyons Mill Road, Owings Mills, Maryland. The park is bordered by Lyons Mill Road to the south, Deer Park Road to the west, Dolfield Road to the north, and residential neighborhoods to the east. The study site is a grassy field between the park's main parking lot and football field. A playground is situated to the south of the study area, while football and baseball fields occupy the northern section. Emmaus Missionary Baptist Church is also found east of the study site, near the park entrance. The site is characterized by mature trees in the surrounding area.

4.2 Site Geology

According to the *Maryland Geological Map published by The Maryland Geologic Survey (1968)*, the site appears to be located within the Wissahickon Formation; Lower Pelitic Schist Rock Formation believed to be of the Late Precambrian age. This formation consists of medium- to coarse-grained biotite-oligoclase-muscovite-quartz schist with garnet, staurolite, and kyanite; it is fine- to medium-grained semipelitic schist; and fine-grained granular to weakly schistose psammitic granulite, with psammitic beds that increase upward. The approximate thickness is 5,500 feet or more

4.3 Subsurface Soil Condition

Various soil types were grouped into the major zones noted on the boring logs. A brief explanation of the terms and notes used in the logs is included with this report. The stratification lines designating the interfaces between earth materials on the boring logs are approximate; in situ, the transitions may be gradual. Detailed soil descriptions and depth of various soil strata are given in the boring logs, together with SPT blow counts with depth. In general, the encountered soils are grouped and summarized as follows:

Topsoil: Topsoil was encountered in all borings with an approximate thickness ranging between 3- and 4.5-inches. Topsoil is defined as the more highly-organic, weathered surficial soils horizon capable of supporting vegetation.

Type I: *Lean Clay:* Orange brown, light brown and brown lean clay with sand and mica was encountered in borings SB-1 and SB-2, and extended to 3-ft below existing grand and to completion depths, respectively. N-values for this soil type ranged from 5 to 16 blows per foot (bpf).

Type II: *Sandy Silt:* Orange brown, brown and light brown sandy silt with mica was encountered in all borings; this soil type extended to a various depth ranging from 3.5- to 8-feet below existing grade and completion depths. The N-values for this type of soil were ranged between 3 and 14 (bpf).

Type III: *Clayey Sand to Sandy Clay:* Orange brown, reddish brown and brown clayey sand to sandy clay with mica were encountered in boing SB-1, SB-3, SB-4 and SWM-2. These types of soils extended to various depths ranging from 3- to 8-ft below existing grade and completion depths. N-values for this soil type were ranged between 4 and 19 bpf.

Type IV: *Silty Sand:* Orange-brown and brown silty sand was encountered in boring SB-3 and extended to 5.5-ft below existing grade. N-value for this soil type was 14 bpf.

4.4 Groundwater Observations

The boreholes were observed for the presence and level of groundwater while drilling and after completion of drilling operations. As noted on the boring logs, groundwater was encountered in SWM borings only. Water level observations are presented at the lower left-hand corner of the boring logs. Fluctuations in the level and quantity of groundwater will occur due to variations in rainfall, temperature, soil permeability and other factors not evident at the time of the water level measurements recorded on the boring logs. Groundwater observations are summarized in the following table.

SUMMARY OF GROUNDWATER OBSERVATIONS				
Boring No.	Boring Depth (ft)	Groundwater Depth Encountered at Drilling (ft)	Groundwater Depth Encountered at Completion (ft)	Groundwater Depth Encountered After 24 Hrs (ft)
SB-1	10	Dry	Dry, Caved in at 6.5	n/a
SB-2	15	Dry	Dry, Caved in at 11	n/a
SB-3	15	Dry	Dry, Caved in at 10.5	n/a
SB-4	10	Dry	Dry, Caved in at 6.5	n/a
SB-5	6.5	Dry	Dry	n/a
SB-6	6.5	Dry	Dry	n/a
SWM-1	15	13	10.5	9
SWM-2	15	Dry	Dry, Caved in at 11	8.5

5.0 ANALYSIS AND RECOMMENDATIONS

5.1 SWM Facility Considerations

The infiltration design criteria established by the Maryland Department of the Environment (MDE) Water Management Administration advises that infiltration practices not be recommended to be utilized: (a) in regions where the bottom of the infiltration facility is in existing or newly placed fill, or (b) in materials that exhibit infiltration rates less than 0.52 inches per hour, or (c) where the groundwater table or bedrock is within 4 feet of the bottom of the infiltration facility. Moreover, bio-swales/bio-retention practices are not recommended to be utilized where the groundwater table is within 2 feet of the proposed facility bottom. For surface sand filters (F-1) and bio-retention (F-6) practices, a minimum infiltration rate is not required if these facilities are designed with a “day-lighting” underdrain system; otherwise these facilities require a 0.52 inch per hour (in/hr) rate. A summary of the field findings and recommendations for the proposed SWM features is presented in the following sections.

5.1.1 Bio-retention Facilities

Based on the boring data, laboratory tests, field infiltration test results and our visual classification of the recovered soil samples, the encountered subsoils at the site are classified in accordance with the U.S. Department of Agriculture (USDA) classification system; the classification, along with some engineering properties, are summarized in the following table.

SUMMARY OF SOIL PROPERTIES PER USDA CLASSIFICATION				
Boring No.	Sample Depth (ft)	USDA Textural Classification	Infiltration Rate per USDA (in/hr)	Hydrologic Soil Grouping
SWM-1	0.5 to 15	Silty Loam	0.27	C
SWM-2	0.5 to 3.5	Silty Loam	0.27	C
	3.5 to 5.5	Sandy Clay Loam	0.17	C
	5.5 to 15	Silty Loam	0.27	C

Bottom of the proposed bio-retention section appears to be located at a depth of approximately 5-feet below existing grade (Elev. 608). Considering the USDA classification, boring information, on-site infiltration test results and groundwater observations, the feasibility of infiltration practices at the proposed locations and depth are summarized in the following table.

SUMMARY OF SWM CONSIDERATIONS					
Boring No.	Existing Ground Elevation (ft)	Elevation at Bottom of Proposed Facility (ft)	On-site Infiltration Rate (in/hr)	Infiltration Rate per USDA (in/hr)	Infiltration Practice
SWM-1	613	608	0.3	0.27	Not Acceptable
SWM-2	613	608	0.17	0.1	Not Acceptable

Silty loam and sandy clay loam materials were encountered at boring borings, which exhibit a poor infiltration rate based on USDA classification. The on-site infiltration rate does align well with the USDA soil type at these locations. Therefore, using an infiltration practice at this proposed location is not recommended. Therefore, an alternative system, such as a "day-lighting" underdrain system, should be considered.

It is recommended that during the construction of any SWM facility, the soil encountered at and below the planned elevation be verified along with their infiltration characteristics.

5.2 Mechanical Room and Collection Vault

Approximately 23’long 17’wide mechanical room and collation vault are proposed. The foundation elevation of the vault is at Elev. 605. Excavation on the order of 11 ft is anticipated to establish foundation elevations. With the anticipated structural loads, a foundation system comprised of a shallow footing founded on natural soil, or engineered fill, could be utilized.

Based on the boring data, the engineering properties of the encountered soils at, or about, the expected vault foundations are summarized in the following table. Soil parameters are based on laboratory results, empirical correlation between the SPT and laboratory data, and published information.

SUMMARY OF ENCOUNTERED SOIL PROPERTIES					
Location	Soil Type	USCS	Range of N-Values	Range of Effective Unit Weight, γ (pcf)	Bearing Capacity (psf)
SB-2 & SB-3 8 to 12 ft	Lean Clay/ Sandy Clay	CL	4 to 5	100 to 105	1500

Considering boring information revealed at the proposed structure, soft lean clay to sandy clay was encountered. Undercut on the order of 24" of in-situ material and backfilling with suitable selected fill is recommended to support vault foundations. Furthermore, this encountered materials are susceptible for moisture fluctuation and may become unstable if it is exposed to moisture and it is necessary to take proactive measures.

The bearing capacity at the final footing elevations should be verified in the field by the geotechnical engineer to ensure that the bearing capacity at the bottom of the footing is adequate for the design load.

The recommended bearing value is based on a minimum factor of safety of 2.5 with respect to anticipated shear strength of properly compacted select fill.

5.2.1 Below-Grade Wall

Below-grade walls retaining soils and fills will be subjected to lateral earth pressures. The magnitude of lateral earth pressure will depend upon the type and density of the backfill and/or natural soil adjacent to the wall, the rigidity of the wall and the drainage conditions behind the wall. It is expected that the walls be fixed at each corner, as well as a top slab, restricting rotation about the wall base.

The wall design should also account for any surcharge loads. Wall surcharge loads must also be considered in the design. Based on soil test borings, the following parameters are recommended for the wall design:

1. Soil Unit Weight, γ_s = 110 pcf (saturated)
2. Angle of Internal Friction, $\phi = 20^{\circ}$
3. Ko = 0.66

4. Ka = 0.49
5. Kp = 2.04

The wall design should also account for any surcharge loads within a 45-degree slope from the base of the wall. The design lateral earth pressures provided above do not include a factor of safety. Surcharge due to a sloping ground surface above the wall and other loads located adjacent to and above the base of the wall can have significant influence on lateral earth pressure and should be considered during design. Also, there is no provision in the above pressures for hydrostatic loading on the wall.

The design lateral earth parameters provided above do not include a factor of safety. Surcharge due to a sloping ground surface above the wall and other loads located adjacent to, and above, the base of the wall can have significant influence in lateral earth pressure and should be considered during design. Also, there is no provision in the above pressures for hydrostatic loading on the wall.

5.3 Comfort Station Foundation Design

As revealed from the borings in the proposed comfort station area, N-values in the upper portion of borings are relatively consistent. Shallow footings are anticipated to be placed in a properly prepared subgrade. Footings found in existing soil or engineering fills may be sized based on a maximum net allowable bearing pressure of 2500 psf, and with minimum footing width requirements of 2-ft for strip/wall and 3-ft for individual/column, or other dimensions approved by structural engineer. Shallow foundations should be placed at a minimum of 2.5 ft below finished grade or lowest final grade, whichever is greater

The recommended bearing values are based on a minimum factor of safety of 2.5 with respect to measured strength of natural soils and anticipated shear strength of properly compacted select fill. Settlement of foundations proportioned based on these allowable pressures should be within tolerable limits for the structure, which is expected to be less than one (1) inch.

During the construction period the bearing capacity at the final footing elevations should be verified in the field by the geotechnical engineer to ensure the bearing capacity at the bottom of each footing excavation is adequate for the design loads.

5.3.1 Floor Slab

Slab-on-grade construction is considered appropriate for building floor slabs in conjunction with the shallow footing foundation systems. It is recommended the slabs be supported on a 4- to 6-inch-thick clean sand or gravel layer placed on a properly prepared subgrade. Impervious sheeting should be placed between the slab and granular course to act as a vapor barrier. For the design of concrete slab, the Modulus of Subgrade Reaction (k) of 100 psi can be used.

5.4 Seismic Considerations

A seismic site classification was selected in accordance with Section 1613.3.2 of the 2015 International Building Code (IBC) and Chapter 20 of the American Society of Civil Engineers Minimum Design Loads for Buildings and Other Structures (ASCE7). The site classification is based on the Average Standard Penetration Resistance, N_{bar}. ASCE7 Table 20.3.1 provides correlations for Site Classes C, D, and E with various ranges of N values to be calculated for the top 100 feet of the subsurface materials. Based on the subsurface conditions, the following information was utilized to determine the seismic site classification.

N-value Range	3 to <50
Soil Profile	Stiff to Dense
Shear Wave Velocity	600 to 12000 ft/sec
Undrained Shear Strength for Cohesive Soils	1000 to 2000 psf

Based on the criteria, a site soil classification of Class D was determined.

5.5 Splash Pad Slab

Minor excavation is expected to establish splash pad subgrades. The subgrade areas are anticipated to consist of firm to stiff lean clay to sandy clay. These materials are susceptible to moisture fluctuations and may become unstable if exposed to moisture. Therefore, we recommend that construction be carried out during a dry season. Following the stripping and removal of any organic surface soils, the subgrade should be proof-rolled using a pneumatic roller, loaded tandem-wheel dump truck, or similar equipment. Areas identified during the proof-rolling process as soft or exhibiting 'pumping' tendencies should be undercut, processed, and recompacted or removed and replaced with suitable fill, as appropriate.

It is recommended the slabs be supported on a 4- to 6-inch-thick clean sand or gravel layer placed on a properly prepared subgrade. Impervious sheeting should be placed between the slab and granular course to act as a vapor barrier. For the design of concrete slab, the Modulus of Subgrade Reaction (k) of 100 psi can be used.

5.6 Excavation Support

The excavation for side walls may be open cut or will require temporary support. All excavations should be performed in accordance with the latest Occupational Safety and Health Administration (OSHA) requirements. The OSHA soil classification system categorizes soil and rock deposits in hierarchy of Stable Rock, Type A, Type B, and Type C, in decreasing order of stability as follows:

- **Type A Soils** are cohesive soils with an unconfined compressive strength of 1.5 tons per square foot (tsf) or greater.
- **Type B Soils** are cohesive soils with an unconfined compressive strength greater than 0.5 tsf, but less than 1.5 tsf; or granular cohesionless soils; or previously disturbed soils unless otherwise classified as Type C.
- **Type C Soils** are cohesive soils with an unconfined compressive strength of 0.5 tsf or less.

Based on field and laboratory test results, silty material was encountered at the site. Due to the general nature of these soils, they are categorized as Type C soils in accordance with the OSHA soil classification system. The maximum allowable side slopes for unsupported/free-standing short-term excavation less than 20 feet deep in Type C soils is 1.5 horizontal to 1 vertical (1.5H:1V or 34 degrees).

A temporary excavation support system may be required for the deep below-grade excavation for the structure. Temporary excavation support system should be determined with a structural analysis. The final design of the system should be performed by a specialist in this area and is not part of the scope of this report. Soil parameters provided under Section 5.3.1 can be used for design purposes.

6.0 SITE GRADING AND CONSTRUCTION CONSIDERATIONS

6.1 Site Grading

Once approved erosion and sediment control measures are installed, site preparation operations may be initiated. Grading preparation should include clearing within the limits of construction and removal of organic surficial soils. Design and construction should include provisions for temporary storage, hauling, and disposal of stripped materials at an approved off-site location.

Following stripping and cutting, the subgrade should be verified prior to the installation of SWM facilities and permeable pavement features. Areas identified during the proof-rolling process as soft, or exhibiting "pumping" tendencies, shall be undercut, processed and recompacted, or removed and replaced with suitable fill, whichever is appropriate.

6.2 Suitable Fill Material

Fill and backfill material should be free of organics, debris and/or rock fragments in excess of 3 inches, in any dimension. In the top 18 inches of fill, the maximum particle size should be limited to approximately 1.5 inches. In accordance with the ASTM D2487 Unified Soil Classification, imported select fill should consist of silty gravel (GM), clayey gravel (GC), gravelly sand (SP), silty sand (SM), clayey sand (SC), or low-plasticity sandy clay (CL) with a liquid limit and plasticity index of less than 40 and 15, respectively, or an approved alternate.

6.3 Compaction Requirement

Fill soils should be compacted to a minimum of 92% maximum Modified Proctor dry density (ASTM D1557/AASHTO T180), with a moisture content range of ±2% of its optimum. Fill should be placed in nominal 10-inch-thick loose lifts. Each lift of fill should be properly compacted, tested and approved prior to placing subsequent lifts.

7.0 CONSTRUCTION CONSIDERATIONS

Positive surface drainage should be established at the start of work, be maintained during construction and following the completion of the project to prevent surface water ponding and subsequent saturation of subgrade soils. Prolonged exposure or saturation of subgrade soils by ponding or runoff water may result in significant changes in strength

and compressibility characteristics. Saturated subgrade soils should be excavated and replaced with suitable materials.

Depending upon weather conditions during and prior to construction, groundwater may be encountered in the excavation areas. Any seepage into the construction excavation could be controlled by pumping from sump pits. During site preparation, surface runoff should be directed away from the construction areas.

8.0 GENERAL COMMENTS

The soil classifications presented in this report are based upon the data obtained from the soil borings performed at the indicated locations and from any other information discussed in this report. This report does not reflect any variations that may occur across the site. The nature and extent of such variations may not become evident until construction. If variations do occur, the conclusion and recommendations of this report should then be reviewed by an ABC geotechnical engineer in light of the new information.

This report has been prepared for the exclusive use of our client for the specific application to the project discussed and has been prepared in accordance with generally accepted geotechnical engineering practices. No other warranties, either expressed or implied, are intended or made. In the event that any changes in the nature, design or location of the project as outlined in this report are planned, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed and the conclusions of this report modified or verified in writing by the ABC geotechnical engineer of record.

APPENDIX

A. General Notes

B. Vicinity Map

C. Boring Plan

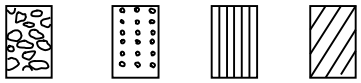
D. Boring Logs

E. Lab Test Results

F. Field Infiltration Test Results

A. GENERAL NOTES

Drilling and Sampling Symbols



Gravel Sand Silt Clay

Split Spoon (SS) Auger Cutting (AU) Shelby Tube (ST) Rock Core (RC)

N = Standard penetration, blows per foot of a 140 lbs hammer for 30" drop
RQD = Rock Quality Designation
LL = Liquid Limit PL = Plastic Limit PI = Plasticity Index

Cohesionless Soils

If the sand or silt content of a soil is great enough, the soil becomes non-cohesive or semi-cohesive. The soil classification becomes SAND or SILT with the other soil constituents being modifying.

Based on N-Value

0 to 4 Blows…….Very Loose	30 to 59 Blows…….Dense
5 to 9 Blows…….Loose	Over 60 Blows…….Very Dense
10 to 29 Blows…….Medium Dense	

Cohesive Soils

If clay content is sufficient so that clay dominates soil properties, then CLAY becomes the major soil constituent as modifier. Other minor soil constituents may be added according to classification breakdown for cohesion less soils: i.e. silty clay, trace of some sand, trace of gravel.

Based on N-Value

0 to 3 Blows…….Very Soft	16 to 30 Blows……..Stiff
4 to 5 Blows…….Soft	30 to 60 Blows……..Very Stiff
6 to 16 Blows……...Firm	Over 61 Blows……..Hard

Based on Penetrometer Value

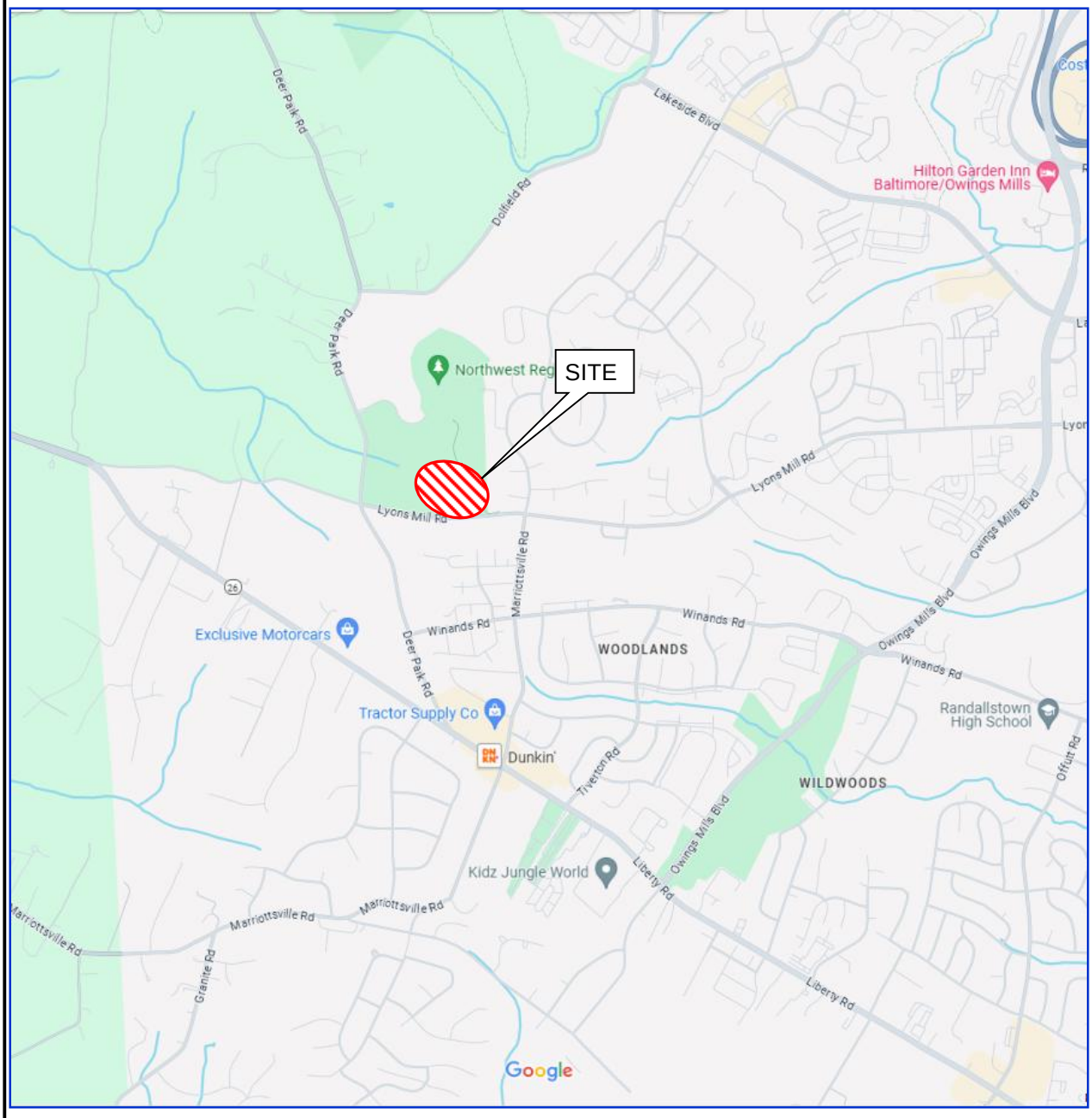
Below 0.25……...Very Soft	1.00 to 1.99……...Stiff
0.25 to 0.49……..Soft	2.00 to 3.99……...Very Stiff
0.50 to 0.99……..Firm	Over 4.00…….Hard

Quantity Modifiers

Term	% of Dry Weight
trace	0 to 10
little	11 to 20
some	21 to 35
and/with	36 to 50

Particle Size Identifications

Boulder ……..Over 8 inch diameter
Cobbles……...3 inch to 8 inch
Gravel……...Coarse……1 inch to 3 inch
Medium…….1/2 inch to 1 inch
Fine……....4.75 mm to 1/2 inch
Sand……....Coarse……....2 mm to 4.75 mm
Medium……..0.425 mm to 2 mm
Fine……....0.075 mm to 0.425 mm
Silt/Clay…….....Below 0.075 mm



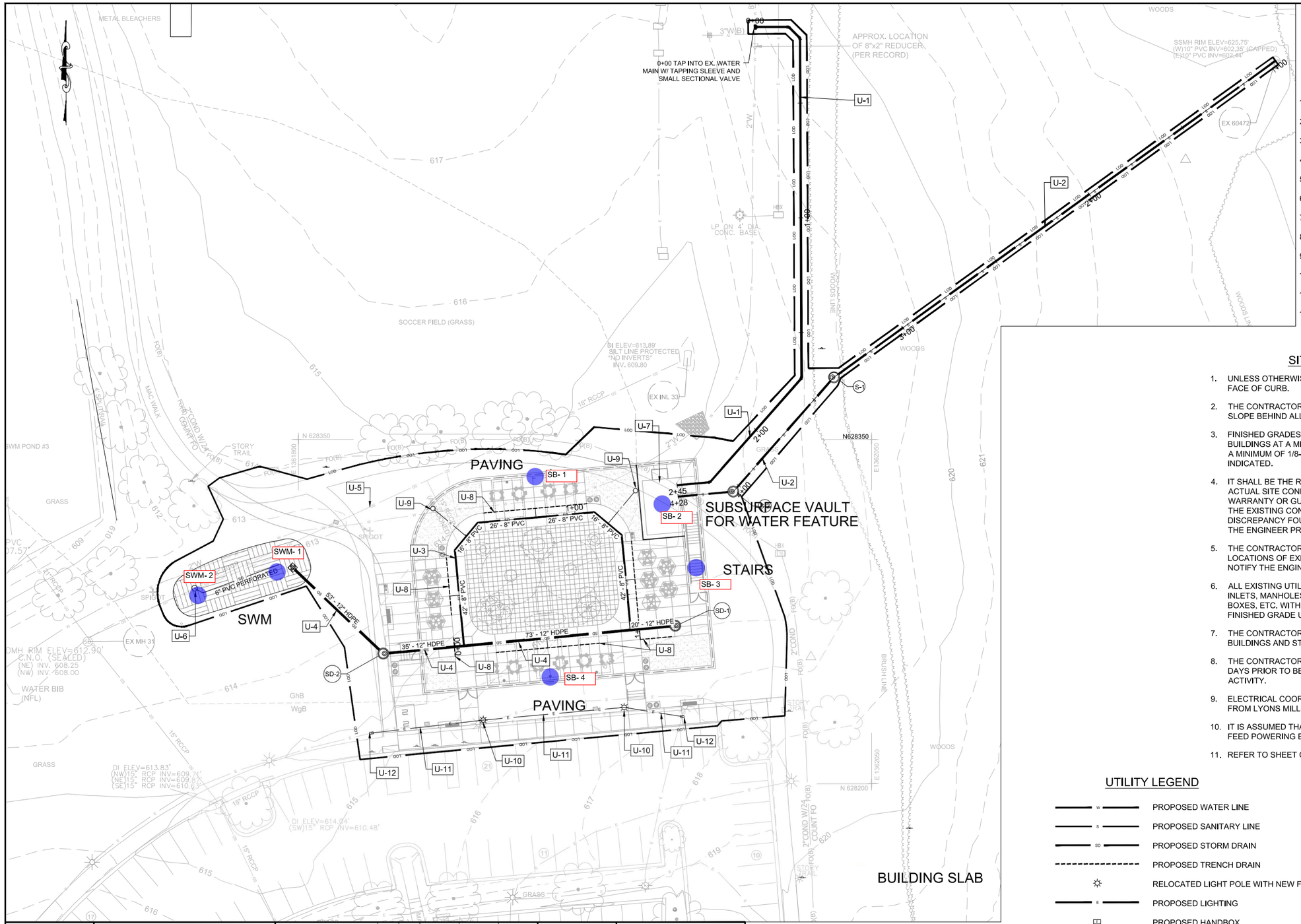
B. VICINITY MAP

Northwest Regional Park
Baltimore County, Maryland

JOB NO.: 2021528-01
SCALE: N.T.S.
DATE: 8/14/24

AB CONSULTANTS, INC.

C. BORING PLAN



UTILITY PLAN NOTES

KEY U-1 •

1. PROPOSED 6" WATER LINE - 245 LF
2. PROPOSED 4" SANITARY LINE - 330 LF
3. PROPOSED 8" PVC STORM DRAIN
4. PROPOSED 12" HDPE STORM DRAIN
5. EXISTING 18" STORM DRAIN
6. PROPOSED RISER TO TIE INTO EXISTING STORM DRAIN LINE
7. PROPOSED UTILITY VAULT
8. PROPOSED TRENCH DRAIN
9. CLEANOUT WITH NDS ATRIUM GRATE
10. PROPOSED LIGHT POLES
11. PROPOSED 1" PVC CONDUIT FOR LIGHTING
12. PROPOSED HANDBOX

SITE AND UTILITY PLAN NOTES

1. UNLESS OTHERWISE NOTED, DIMENSIONS FROM CURB ARE MEASURED AT FACE OF CURB.
2. THE CONTRACTOR SHALL PROVIDE A TWO-FOOT AREA AT 1/2-INCH PER FOOT SLOPE BEHIND ALL PROPOSED CURB, UNLESS OTHERWISE INDICATED.
3. FINISHED GRADES SHALL FALL AWAY FROM EXISTING AND PROPOSED BUILDINGS AT A MINIMUM OF 1/4-INCH PER FOOT FOR VEGETATED AREAS AND A MINIMUM OF 1/8-INCH PER FOOT FOR PAVED AREAS UNLESS OTHERWISE INDICATED.
4. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO FIELD VERIFY ACTUAL SITE CONDITIONS PRIOR TO THE START OF WORK. THERE IS NO WARRANTY OR GUARANTEE ON THE COMPLETENESS OR CORRECTNESS OF THE EXISTING CONDITION INFORMATION SHOWN ON THESE DRAWINGS. ANY DISCREPANCY FOUND SHALL BE BROUGHT TO THE IMMEDIATE ATTENTION OF THE ENGINEER PRIOR TO STARTING WORK.
5. THE CONTRACTOR SHALL FIELD VERIFY HORIZONTAL AND VERTICAL LOCATIONS OF EXISTING UTILITIES PRIOR TO STARTING WORK AND SHALL NOTIFY THE ENGINEER OF ANY DISCREPANCIES THAT EXIST.
6. ALL EXISTING UTILITY SURFACE FEATURES INCLUDING BUT NOT LIMITED TO INLETS, MANHOLES, HAND HOLES, MECHANICAL LIDS, FIRE HYDRANTS, VALVE BOXES, ETC. WITHIN THE LIMITS OF DISTURBANCE TO BE ADJUSTED TO FINISHED GRADE UNLESS OTHERWISE NOTED.
7. THE CONTRACTOR SHALL MAINTAIN POSITIVE DRAINAGE AWAY FROM BUILDINGS AND STRUCTURES AT ALL TIMES.
8. THE CONTRACTOR SHALL CONTACT "MISS UTILITY" (1-800-257-7777) AT LEAST 5 DAYS PRIOR TO BEGINNING ANY DEMOLITION, UTILITY, OR EXCAVATION ACTIVITY.
9. ELECTRICAL COORDINATION WITH BGE IS ANTICIPATED TO PROVIDE POWER FROM LYONS MILLS ROAD TO THE PROJECT SITE.
10. IT IS ASSUMED THAT PROPOSED LIGHT POLES WILL BE POWERED FROM THE FEED POWERING EXISTING LIGHT POLES
11. REFER TO SHEET C-401 FOR PROFILES AND STRUCTURE TABLES

UTILITY LEGEND

- PROPOSED WATER LINE
- PROPOSED SANITARY LINE
- PROPOSED STORM DRAIN
- PROPOSED TRENCH DRAIN
- RELOCATED LIGHT POLE WITH NEW FOUNDATION
- PROPOSED LIGHTING
- PROPOSED HANDBOX

20 10 0 20 40
SCALE: 1" = 20'

DWG. FILENAME:

SEAL

DATE : _____

PROFESSIONAL CERTIFICATION

I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND.
LICENSE NO. 41799, EXPIRATION DATE 04/12/2026

ENGINEER: RUMMEL, KLEPPER & KAHL (F-410-2763)
RKK 700 E. Pratt Street, Suite 500 Baltimore, MD 21202

AS-BUILT PER RECORD PRINT
BY:
DATE:

DGN BY: SHK
DWN BY: DTP
CHKD BY: MBT

AS-BUILT / REVISION	BY	DATE
CONTRACT COMPLETION BOX		

P.W.A. NO.	KEY SHEET	POSITION SHT
R.O.W NO.	PNW	35NW40

DRAWING SCALE	
PLAN SCALE:	AS SHOWN
PROFILE SCALE:	AS SHOWN / AS SHOWN

PROPERTY MANAGEMENT
APPROVED BY: _____ PROPERTY MANAGER
DATE: _____

BUREAU OF ENGINEERING AND CONSTRUCTION	TRAFFIC	HIGHWAYS	STRUCTURES	STORM DRAINS	SEWER	WATER	FIELD ENGINEER
REVIEWED BY:							
DATE REVIEWED:							

BALTIMORE COUNTY OFFICE OF BUDGET AND FINANCE – PROPERTY MANAGEMENT
NORTHWEST REGIONAL PARK – SPLASH PAD AND SUPPORTING FACILITIES
UTILITY PLAN
SPLASH PAD AND SUPPORTING FACILITIES
SUBDIVISION: OWINGS MILLS: 4515 DEER PARK ROAD, OWINGS MILLS, MD 21117
COUNCILMAN DISTRICT:
ELECTION DISTRICT: 4C4

SHEET DESIGNATION	CONTRACT NUMBER
C-400	
JOB ORDER NUMBER	
PROJ-1000634	
SHEET 7 OF 39	
DRAWING NUMBER	
FILE NO.:	

SB-6

SB-5

N 628185

N628187

N628165

N 628144

N 628146

E 1362000

E 1362035

E1362061

E1362049

E 1362038

E1362064

N 628200

FO(B)

HBX

1191

D. BORING LOGS

Project No. 2021528-01

LOG OF BOREHOLE SB-1

CLIENT: Mahan Rykiel Associates Inc

PROJECT: **Northwest Regional Park**

ARCHITECT/ENGINEER:

SITE: **Baltimore County, Maryland**

SURFACE ELEV.: **614.5** ft.

			SAMPLES				TESTS				
		GRAPHIC LOG	DEPTH (FT)	BLOWS/6" N - VALUE RQD	NUMBER	TYPE	IN. RECOVERED IN. DRIVEN	MOISTURE (%)	DRY DENSITY (PCF)	Qu (TSF)	% PASSING #200 SIEVE	REMARKS/ ADDITIONAL DATA
0.3	3" Topsoil	614.3										
	Dry, Stiff, Orange Brown and Light Brown, LEAN CLAY (CL), with sand			7-8-8 N=16	1	SS	14/18 78%	24			81	
3.0		611.5										
	Moist, Medium Dense, Orange Brown and Brown, CLAYEY SAND (SC)		5	3-5-5 N=10	2	SS	18/18 100%	16			37	
				6-5-5 N=10	3	SS	14/18 78%	15				
8.0		606.5										
	Moist, Loose, Orange Brown and Brown, SANDY SILT (ML)			2-3-3 N=6	4	SS	14/18 78%	31				
10.0		604.5	10									
	End of Boring @ 10 ft											
	Borehole was backfilled after water level reading											

WATER LEVEL OBSERVATIONS		
WL	Dry	@ Drilling
WL	Dry, Caved-In @ 6.5 ft0 hrs	

AB Consultants, Inc.
9450 Annapolis Road
Lanham, MD 20706
Phone: 301-306-3091
Fax: 301-306-3092

STARTED:	7/19/24	FINISHED:	7/19/24
DRILL CO.:	ABC	DRILL RIG:	CME-45
DRILLER:	AE	ASS'T DRILLER:	
LOGGED BY:		APPROVED:	

BORING LOG AB09 2021528-01 NORTHWEST REGIONAL PARK.GPJ AB_CONS.GDT 8/8/24

Project No. 2021528-01

LOG OF BOREHOLE SB-2

CLIENT: Mahan Rykiel Associates Inc

PROJECT: **Northwest Regional Park**

ARCHITECT/ENGINEER:

SITE: **Baltimore County, Maryland**

SURFACE ELEV.: **615.0** ft.

DEPTH (FT)	GRAPHIC LOG	SAMPLES: BLOWS/6" N - VALUE RQD	NUMBER	TYPE	IN. RECOVERED IN. DRIVEN	TESTS: MOISTURE (%)	DRY DENSITY (PCF)	Qu (TSF)	% PASSING #200 SIEVE	REMARKS/ ADDITIONAL DATA
0.3 (614.7) 4" Topsoil Dry to Moist, Medium Dense to Loose, Light Brown, Orange Brown and Brown, SANDY SILT (ML), with mica		6-7-6 N=13	1	SS	10/18 56%	17				
		3-4-5 N=9	2	SS	10/18 56%	21			57	
5		3-2-4 N=6	3	SS	14/18 78%	22			51	
8.0 (607.0) Moist, Soft to Firm, Orange Brown and Brown, LEAN CLAY (CL), with sand and mica		WOH/6"-2-3 N=5	4	SS	10/18 56%	32			76	
10										
		2-3-3 N=6	5	SS	18/18 100%	38				
15.0 (600.0) End of Boring @ 15 ft Borehole was backfilled after water level reading										
15										

WATER LEVEL OBSERVATIONS

WL	Dry	@ Drilling
WL	Dry, Caved-In @ 11 ft	0 hrs

AB Consultants, Inc.
9450 Annapolis Road
Lanham, MD 20706
Phone: 301-306-3091
Fax: 301-306-3092

STARTED:	7/22/24	FINISHED:	7/22/24
DRILL CO.:	ABC	DRILL RIG:	CME-45
DRILLER:	AE	ASS'T DRILLER:	
LOGGED BY:		APPROVED:	

BORING LOG AB09 2021528-01 NORTHWEST REGIONAL PARK.GPJ AB_CONS.GDT 8/8/24

Project No. 2021528-01

LOG OF BOREHOLE SB-3

Sheet 1 of 1

CLIENT: Mahan Rykiel Associates Inc

PROJECT: **Northwest Regional Park**

ARCHITECT/ENGINEER:

SITE: **Baltimore County, Maryland**

SURFACE ELEV.: **616.0** ft.

				SAMPLES				TESTS				
		GRAPHIC LOG	DEPTH (FT)	BLOWS/6" N - VALUE RQD	NUMBER	TYPE	IN. RECOVERED IN. DRIVEN	MOISTURE (%)	DRY DENSITY (PCF)	Qu (TSF)	% PASSING #200 SIEVE	REMARKS/ ADDITIONAL DATA
0.3	3" Topsoil											
	Dry, Stiff, Brown, SANDY CLAY (CL)			10-9-10 N=19	1	SS	18/18 100%	13				
3.0	613.0											
	Moist, Medium Dense, Orange Brown and Brown, SILTY SAND (SM)			3-6-8 N=14	2	SS	14/18 78%	19			48	
5.5	610.5		5									
	Moist, Loose, Orange Brown and Brown, SANDY SILT (ML), with gravel			4-3-4 N=7	3	SS	18/18 100%	56			56	
8.0	608.0											
	Moist, Soft, Reddish Brown, SANDY CLAY (CL)			1-2-2 N=4	4	SS	18/18 100%	35			67	
			10									
				2-2-3 N=5	5	SS	18/18 100%	33				
15.0	601.0		15									
	End of Boring @ 15 ft											
	Borehole was backfilled after water level reading											

WATER LEVEL OBSERVATIONS		
WL	Dry	@ Drilling
WL	Dry, Caved-In @ 10.5 f0 hrs	

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Lanham, MD 20706
Phone: 301-306-3091
Fax: 301-306-3092

STARTED:	7/22/24	FINISHED:	7/22/24
DRILL CO.:	ABC	DRILL RIG:	CME-45
DRILLER:	AE	ASS'T DRILLER:	
LOGGED BY:		APPROVED:	

BORING LOG AB09 2021528-01 NORTHWEST REGIONAL PARK.GPJ AB_CONS.GDT 8/8/24

Project No. 2021528-01

LOG OF BOREHOLE SB-4

CLIENT: Mahan Rykiel Associates Inc

PROJECT: **Northwest Regional Park**

ARCHITECT/ENGINEER:

SITE: **Baltimore County, Maryland**

SURFACE ELEV.: **616.5** ft.

DEPTH (FT)	GRAPHIC LOG	SAMPLES: BLOWS/6" N - VALUE RQD	NUMBER	TYPE	IN. RECOVERED IN. DRIVEN	TESTS: MOISTURE (%)	DRY DENSITY (PCF)	Qu (TSF)	% PASSING #200 SIEVE	REMARKS/ ADDITIONAL DATA
0.3										
0.3 – 5.5	3" Topsoil (616.3) Dry, Firm, Brown, SANDY CLAY (CL), with mica	5-5-5 N=10	1	SS	10/18 56%	15			65	
		4-6-9 N=15	2	SS	10/18 56%	13				LL = 45 PL = 25 PI = 20
5.5 – 10.0	Moist, Loose, Orange Brown and Light Brown, SANDY SILT (ML), with mica (611.0)	3-4-4 N=8	3	SS	18/18 100%	26			54	
10.0	(606.5)	2-3-3 N=6	4	SS	18/18 100%	35				

End of Boring @ 10 ft

Borehole was backfilled after water level reading

WATER LEVEL OBSERVATIONS		
WL	Dry	@ Drilling
WL	Dry, Caved-In @ 6.5 ft0 hrs	

AB Consultants, Inc.
9450 Annapolis Road
Lanham, MD 20706
Phone: 301-306-3091
Fax: 301-306-3092

STARTED:	7/22/24	FINISHED:	7/22/24
DRILL CO.:	ABC	DRILL RIG:	CME-45
DRILLER:	AE	ASS'T DRILLER:	
LOGGED BY:		APPROVED:	

BORING LOG AB09 2021528-01 NORTHWEST REGIONAL PARK.GPJ AB_CONS.GDT 8/8/24

Project No. 2021528-01

LOG OF BOREHOLE SB-5

Sheet 1 of 1

CLIENT: Mahan Rykiel Associates Inc

PROJECT: **Northwest Regional Park**

ARCHITECT/ENGINEER:

SITE: **Baltimore County, Maryland**

Northing.: Easting.:

SURFACE ELEV.: **621.0** ft.

DEPTH (FT)	GRAPHIC LOG	SAMPLES: BLOWS/6" N - VALUE RQD	NUMBER	TYPE	IN. RECOVERED IN. DRIVEN	TESTS: MOISTURE (%)	DRY DENSITY (PCF)	Qu (TSF)	% PASSING #200 SIEVE	REMARKS/ ADDITIONAL DATA
		6" Topsoil								
0.5		620.5								
		Moist, Stiff, Brown, Light Brown and Orange Brown, SANDY CLAY (CL), with mica								
		8-10-13 10 N=23	1	AU	7/7 100%					
		7-7-8 9 N=15	2	AU	7/7 100%					
3.0		618.0								
		Moist, Medium Dense, Orange Brown and Yellowish Brown, SANDY SILT (ML), with mica								
		6-7-9 8 N=16	3	AU	7/7 100%					
		6-6-6 7 N=12	4	AU	7/7 100%					
5		6-8-9 9 N=17	5	AU	7/7 100%					
		8-10-12 12 N=22	6	AU	7/7 100%					
6.5		614.5								
		End of Boring @ 6.5 ft								
		Borehole was backfilled after water level reading								

WATER LEVEL OBSERVATIONS

WL	Dry	@ Drilling

AB Consultants, Inc.
9450 Annapolis Road
Lanham, MD 20706
Phone: 301-306-3091
Fax: 301-306-3092

STARTED:	3/4/25	FINISHED:	3/4/25
DRILL CO.:	ABC	DRILL RIG:	Hand Auger
DRILLER:	TR	ASS'T DRILLER:	
LOGGED BY:		APPROVED:	

BORING LOG AB09 2021528-01 NORTHWEST REGIONAL PARK.GPJ AB_CONS.GDT 4/9/25

Project No. 2021528-01

LOG OF BOREHOLE SB-6

Sheet 1 of 1

CLIENT: Mahan Rykiel Associates Inc

PROJECT: **Northwest Regional Park**

ARCHITECT/ENGINEER:

SITE: **Baltimore County, Maryland**

Northing.: Easting.:

SURFACE ELEV.: **620.0** ft.

DEPTH (FT)	GRAPHIC LOG	SAMPLES: BLOWS/6" N - VALUE RQD	NUMBER	TYPE	IN. RECOVERED IN. DRIVEN	TESTS: MOISTURE (%)	DRY DENSITY (PCF)	Qu (TSF)	% PASSING #200 SIEVE	REMARKS/ ADDITIONAL DATA
0.3 / 619.7	4" Topsoil									
	Moist, Stiff to Firm, Brown, Light Brown and Orange Brown, SANDY CLAY (CL), with mica	5-6-9 11 N=15	1	AU	7/7 100%					
		11-11-13 10 N=24	2	AU	7/7 100%					
		5-7-7 7 N=14	3	AU	7/7 100%					
4.5 / 615.5		7-9-11 12 N=20	4	AU	7/7 100%					
	Moist, Medium Dense, Orange Brown, SANDY SILT (ML), with mica	5-6-7 9 N=13	5	AU	7/7 100%					
6.5 / 613.5		4-5-4 5 N=9	6	AU	7/7 100%					
	End of Boring @ 6.5 ft Borehole was backfilled after water level reading									

WATER LEVEL OBSERVATIONS

WL	Dry	@ Drilling

AB Consultants, Inc.
9450 Annapolis Road
Lanham, MD 20706
Phone: 301-306-3091
Fax: 301-306-3092

STARTED:	3/4/25	FINISHED:	3/4/25
DRILL CO.:	ABC	DRILL RIG:	Hand Auger
DRILLER:	TR	ASS'T DRILLER:	
LOGGED BY:		APPROVED:	

BORING LOG AB09 2021528-01 NORTHWEST REGIONAL PARK.GPJ AB_CONS.GDT 4/9/25

Project No. 2021528-01

LOG OF BOREHOLE SWM-1

CLIENT: Mahan Rykiel Associates Inc

PROJECT: **Northwest Regional Park**

ARCHITECT/ENGINEER:

SITE: **Baltimore County, Maryland**

SURFACE ELEV.: **613.0** ft.

DEPTH (FT)	GRAPHIC LOG	SAMPLES: BLOWS/6" N - VALUE RQD	NUMBER	TYPE	IN. RECOVERED IN. DRIVEN	TESTS: MOISTURE (%)	DRY DENSITY (PCF)	Qu (TSF)	% PASSING #200 SIEVE	REMARKS/ ADDITIONAL DATA
0.3		3" Topsoil								
		612.8								
		Moist to Wet, Medium Dense to Loose to Very Loose, Light Brown, Orange Brown and Brown, SANDY SILT (ML), with mica								
		8-7-7 N=14	1	SS	18/18 100%	14				
		2-4-3 N=7	2	SS	10/18 56%	20			63	
5										
		2-3-5 N=8	3	SS	10/18 56%	29			53	
		2-1-3 N=4	4	SS	18/18 100%	44				
10										
		1-2-3 N=5	5	SS	18/18 100%	55				
15										
15.0		598.0								
		End of Boring @ 15 ft								
		Borehole was backfilled after water level reading								

WATER LEVEL OBSERVATIONS			
WL	▽	13	@ Drilling
WL	▼	10.5	0 hrs
WL	▼	9	@ 24 hrs

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STARTED:	7/19/24	FINISHED:	7/19/24
DRILL CO.:	ABC	DRILL RIG:	CME-45
DRILLER:	AE	ASS'T DRILLER:	
LOGGED BY:		APPROVED:	

BORING LOG AB09 2021528-01 NORTHWEST REGIONAL PARK.GPJ AB_CONS.GDT 8/8/24

Project No. 2021528-01

LOG OF BOREHOLE SWM-2

CLIENT: Mahan Rykiel Associates Inc

PROJECT: **Northwest Regional Park**

ARCHITECT/ENGINEER:

SITE: **Baltimore County, Maryland**

SURFACE ELEV.: **613.0** ft.

DEPTH (FT)	GRAPHIC LOG	SAMPLES: BLOWS/6" N - VALUE RQD	NUMBER	TYPE	IN. RECOVERED IN. DRIVEN	TESTS: MOISTURE (%)	DRY DENSITY (PCF)	Qu (TSF)	% PASSING #200 SIEVE	REMARKS/ ADDITIONAL DATA
0.4 612.6										
4.5" Topsoil										
Moist, Loose, Orange Brown and Brown, SANDY SILT (ML), with mica		4-4-5 N=9	1	SS	18/18 100%	19				
3.5 609.5										
Moist, Soft, Orange Brown and Brown, SANDY CLAY (CL)		1-2-2 N=4	2	SS	18/18 100%	24				LL = 50 PL = 28 PI = 22
5.5 607.5										
Moist, Very Loose and Loose, Orange Brown and Brown, SANDY SILT (ML), with mica		3-3-3 N=6	3	SS	10/18 56%	29			70	
		1-1-2 N=3	4	SS	10/18 56%	43				
		2-3-3 N=6	5	SS	18/18 100%	36				
15.0 598.0										
End of Boring @ 15 ft										
Borehole was backfilled after water level reading										

WATER LEVEL OBSERVATIONS

WL	Dry	@ Drilling
WL	Dry, Caved-In @ 11 ft	0 hrs
WL	▼ 8.5	@ 24 hrs

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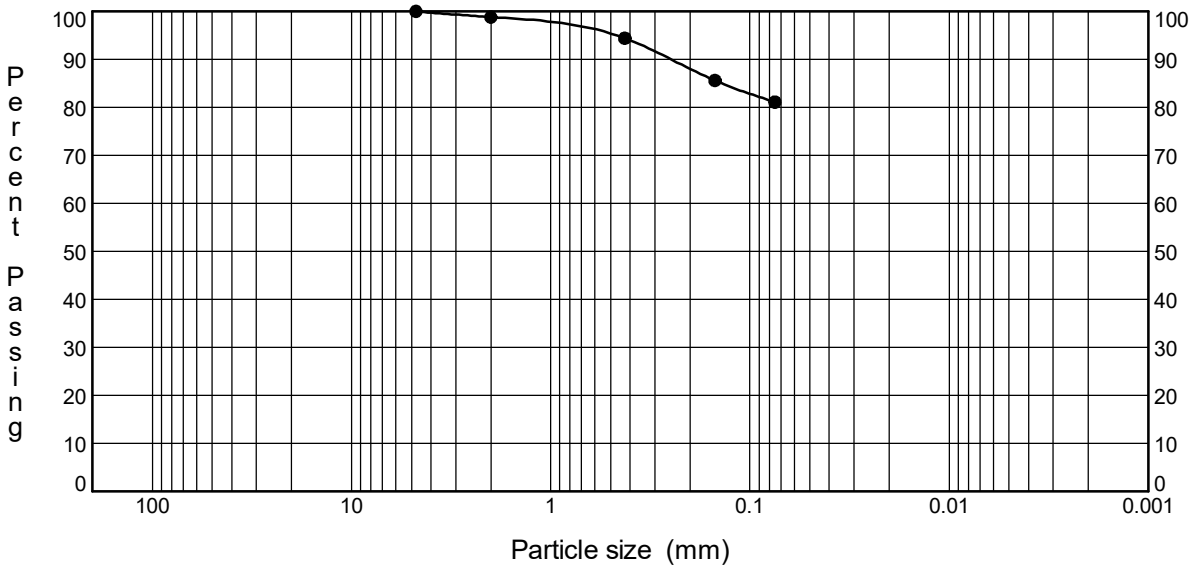
STARTED:	7/19/24	FINISHED:	7/19/24
DRILL CO.:	ABC	DRILL RIG:	CME-45
DRILLER:	AE	ASS'T DRILLER:	
LOGGED BY:		APPROVED:	

BORING LOG AB09 2021528-01 NORTHWEST REGIONAL PARK.GPJ AB_CONS.GDT 8/8/24

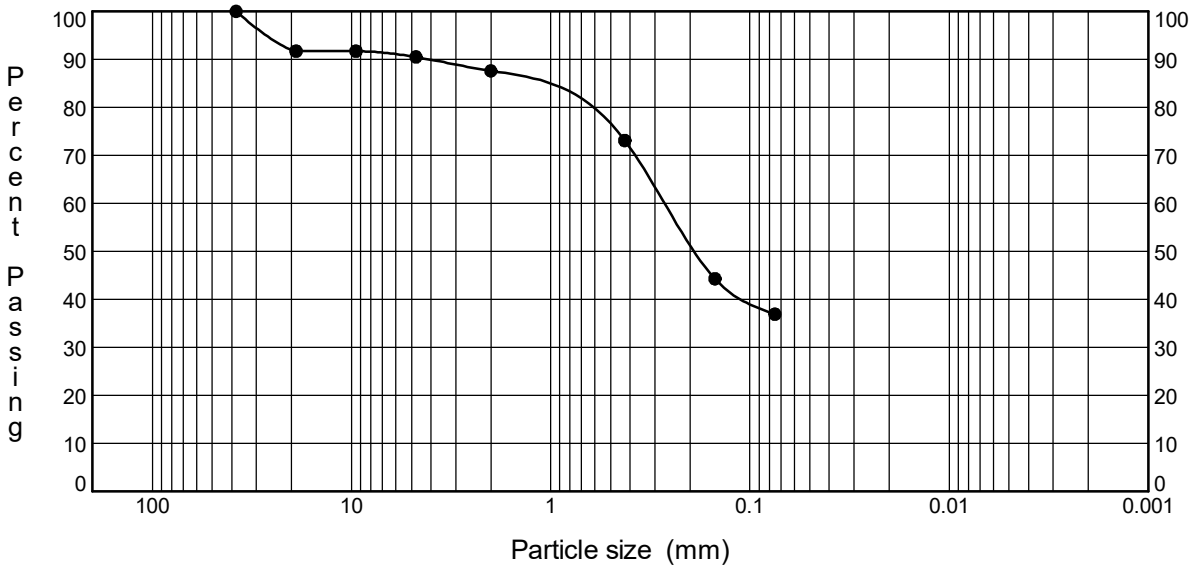
E. LAB TEST RESULTS

BOREHOLE NO. **SB-1** DEPTH **1.0**



Cobbles	Gravel		Sand			Silt	Clay
	coarse	fine	coarse	medium	fine		

BOREHOLE NO. **SB-1** DEPTH **3.5**



Cobbles	Gravel		Sand			Silt	Clay
	coarse	fine	coarse	medium	fine		

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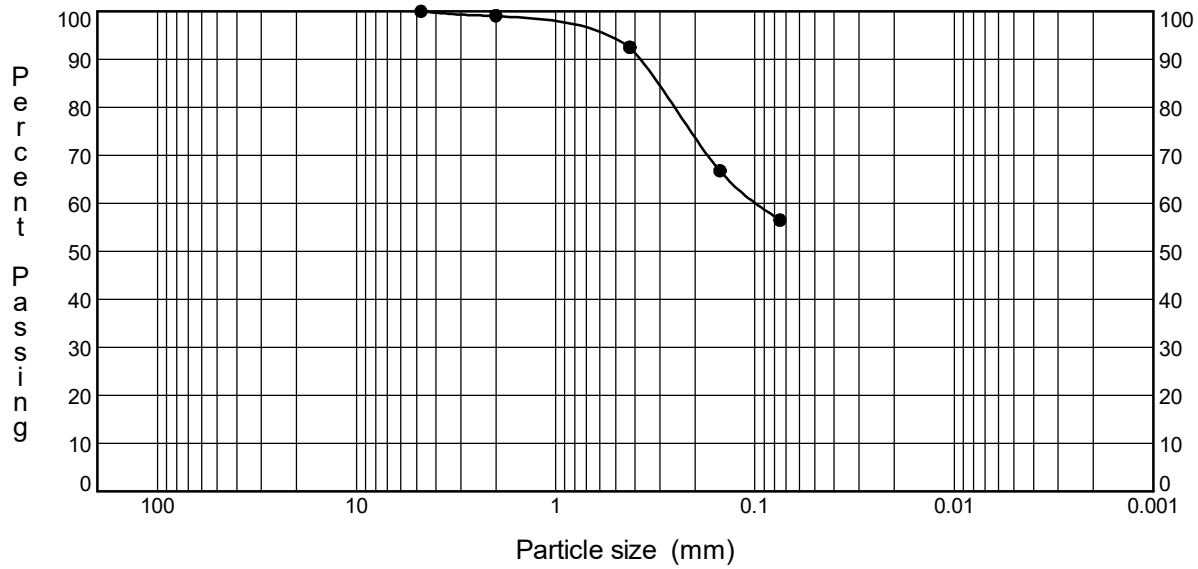
GRAIN SIZE DISTRIBUTION

CLIENT: Mahan Rykiel Associates Inc
PROJECT NO.: 2021528-01
PROJECT: Northwest Regional Park
SITE:
Baltimore County, Maryland

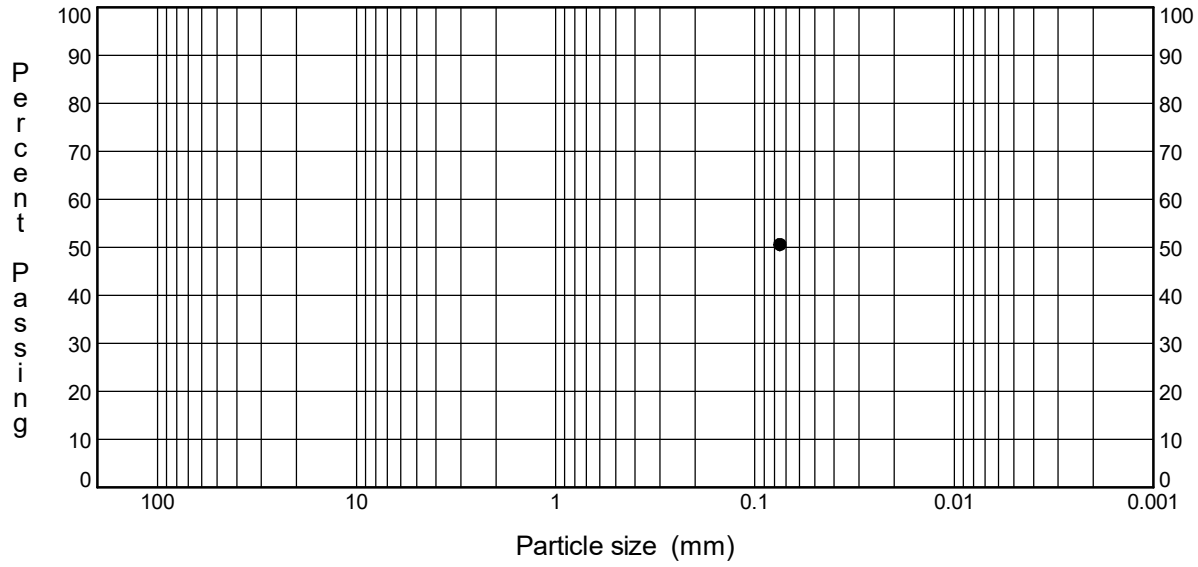
US GSD DOUBLE 2021528-01 NORTHWEST REGIONAL PARK.GPJ AB_CONS.GDT 8/8/24

BOREHOLE NO. **SB-2** DEPTH **3.5**



Cobbles	Gravel		Sand			Silt	Clay
	coarse	fine	coarse	medium	fine		

BOREHOLE NO. **SB-2** DEPTH **6.0**



Cobbles	Gravel		Sand			Silt	Clay
	coarse	fine	coarse	medium	fine		

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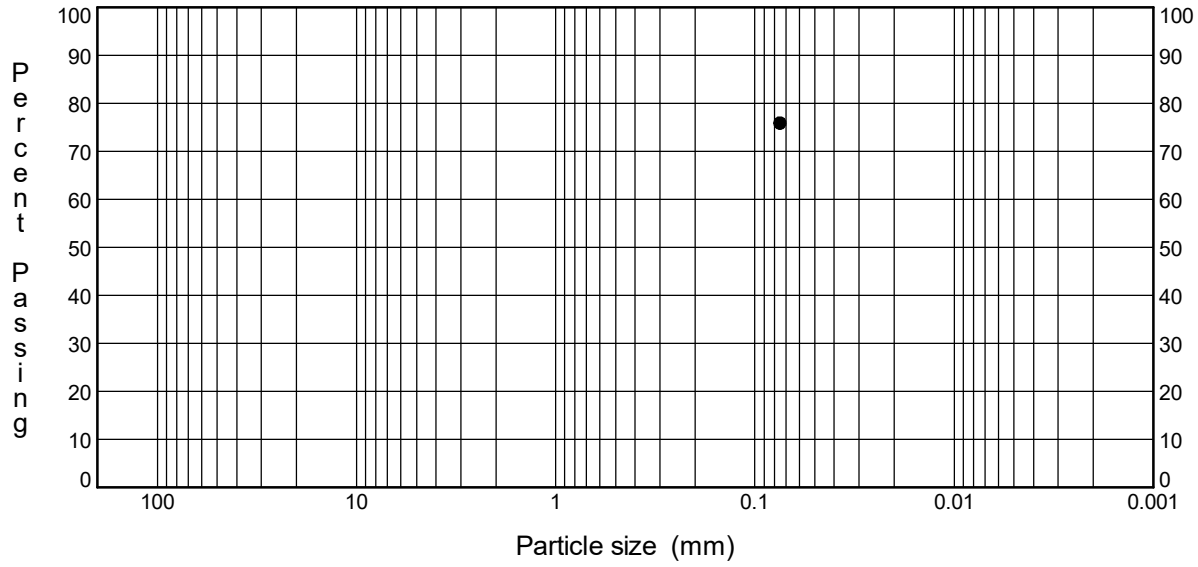
PROJECT: Northwest Regional Park
SITE:
Baltimore County, Maryland

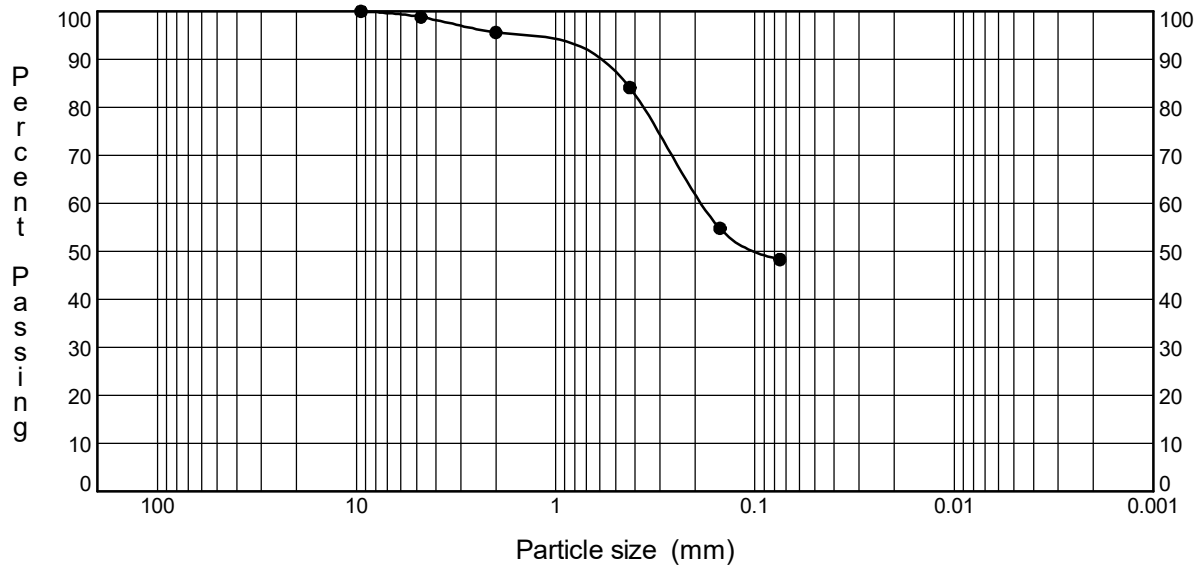
US GSD DOUBLE 2021528-01 NORTHWEST REGIONAL PARK.GPJ AB_CONS.GDT 8/8/24

BOREHOLE NO. **SB-2** DEPTH **8.5**



Cobbles	Gravel		Sand			Silt	Clay
	coarse	fine	coarse	medium	fine		

BOREHOLE NO. **SB-3** DEPTH **3.5**



Cobbles	Gravel		Sand			Silt	Clay
	coarse	fine	coarse	medium	fine		

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GRAIN SIZE DISTRIBUTION

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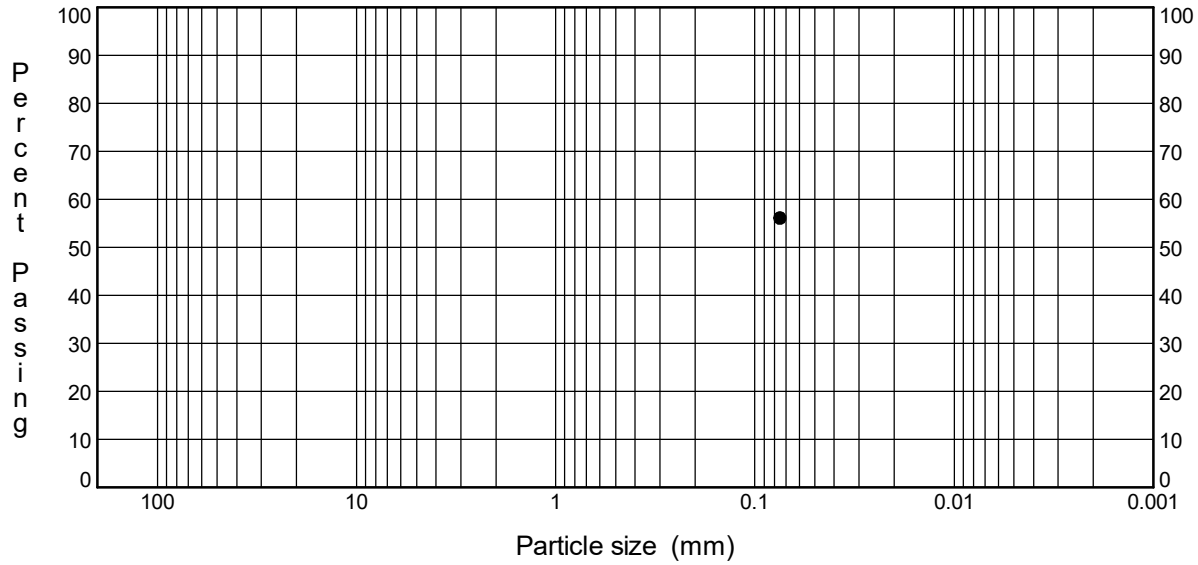
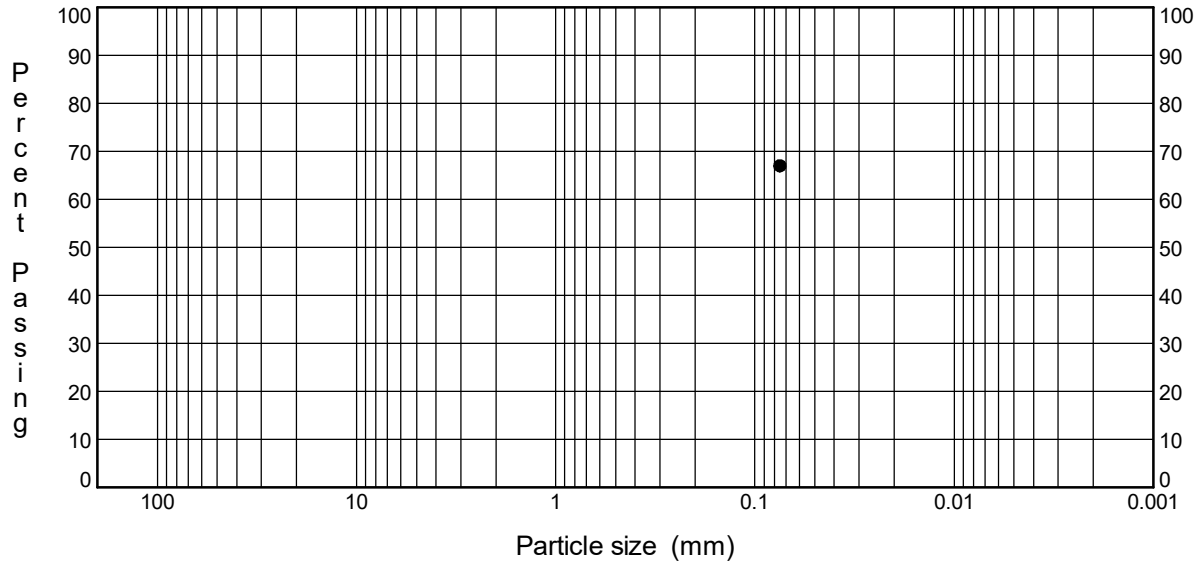
BOREHOLE NO. **SB-3** DEPTH **6.0**



Cobbles	Gravel: coarse	Gravel: fine	Sand: coarse	Sand: medium	Sand: fine	Silt	Clay

BOREHOLE NO. **SB-3** DEPTH **8.5**



Cobbles	Gravel: coarse	Gravel: fine	Sand: coarse	Sand: medium	Sand: fine	Silt	Clay

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GRAIN SIZE DISTRIBUTION

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PROJECT: Northwest Regional Park
SITE:
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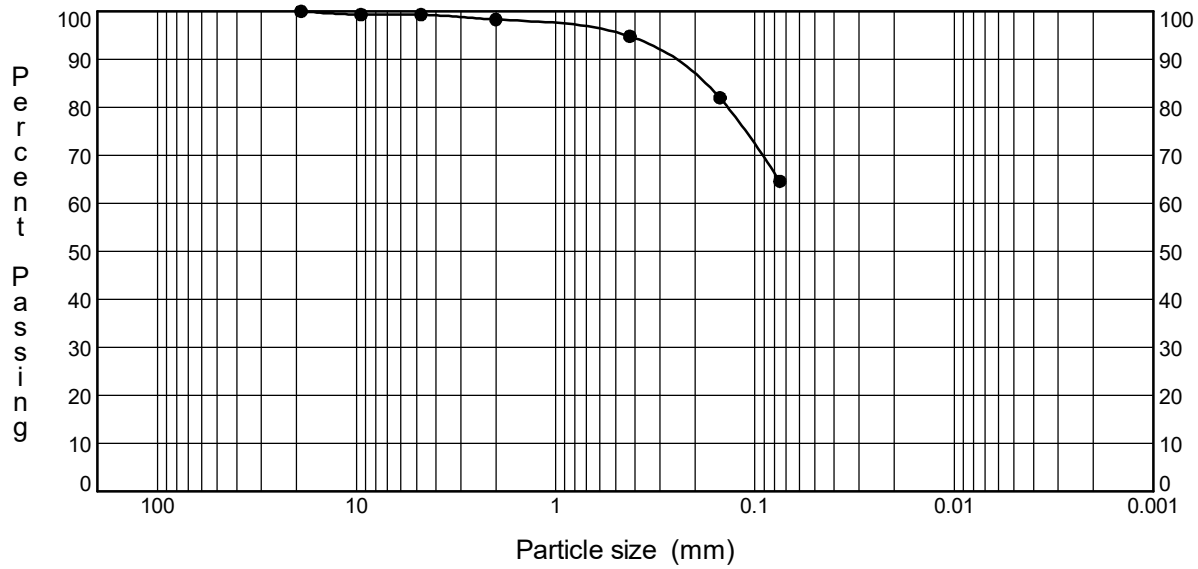
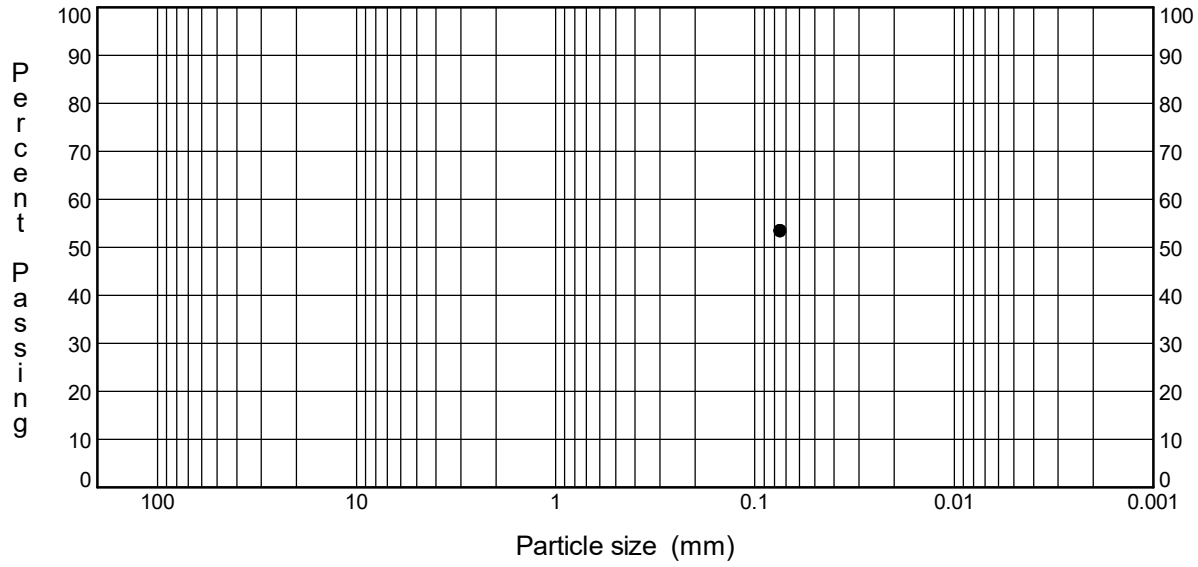
US GSD DOUBLE 2021528-01 NORTHWEST REGIONAL PARK.GPJ AB_CONS.GDT 8/8/24

BOREHOLE NO. **SB-4** DEPTH **1.0**



Cobbles	Gravel		Sand			Silt	Clay
	coarse	fine	coarse	medium	fine		

BOREHOLE NO. **SB-4** DEPTH **6.0**



Cobbles	Gravel		Sand			Silt	Clay
	coarse	fine	coarse	medium	fine		

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PROJECT: Northwest Regional Park
SITE:
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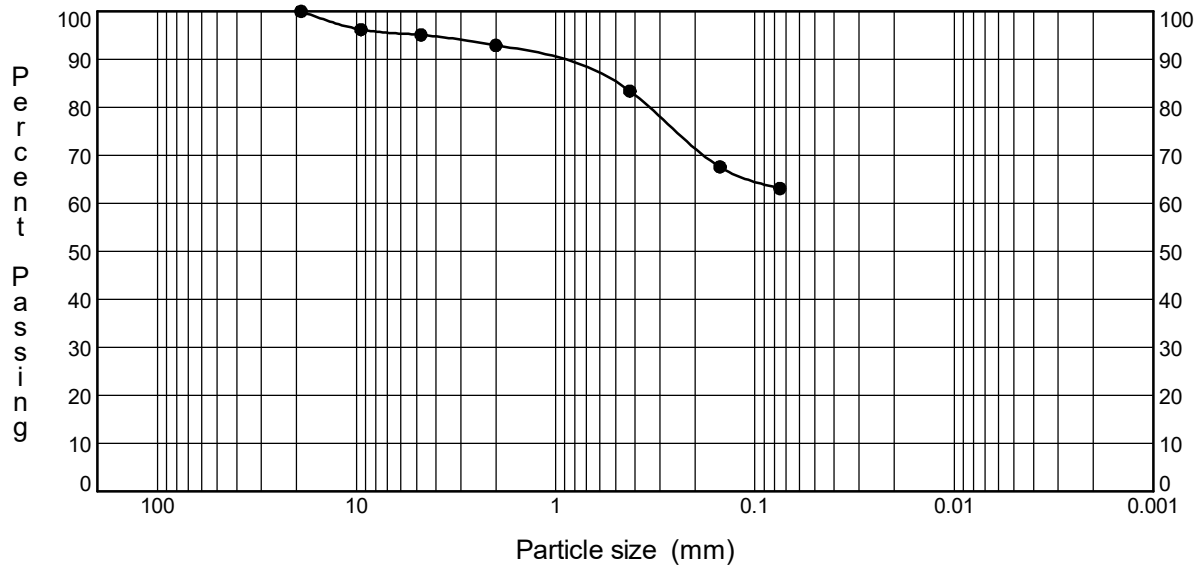
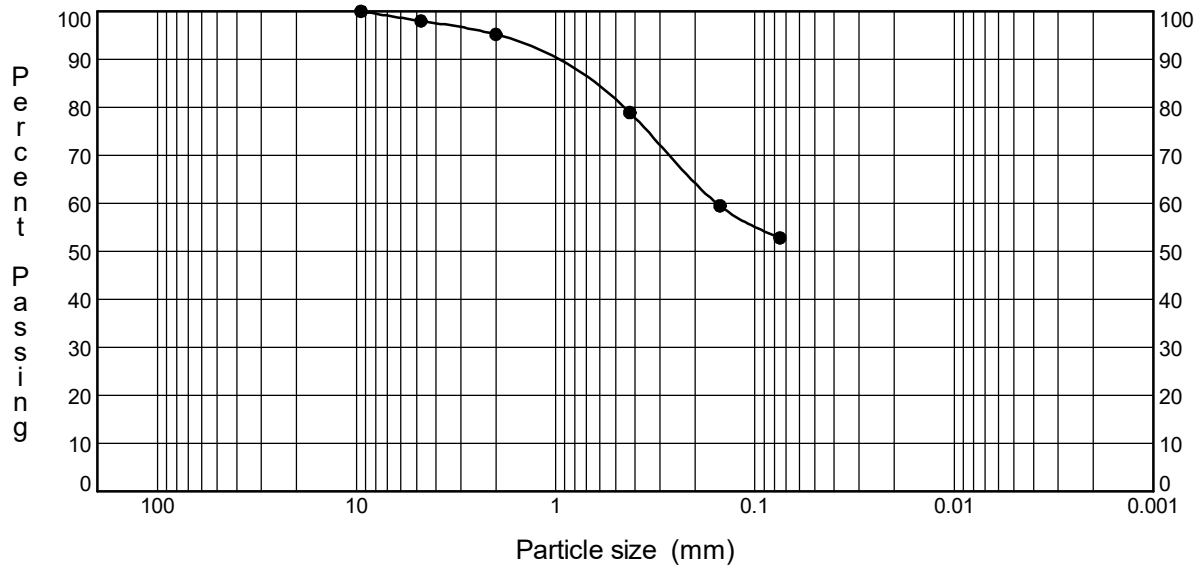
US GSD DOUBLE 2021528-01 NORTHWEST REGIONAL PARK.GPJ AB_CONS.GDT 8/8/24

BOREHOLE NO. **SWM-1** DEPTH **3.5**



Cobbles	coarse	fine	coarse	medium	fine	Silt	Clay
	Gravel		Sand				

BOREHOLE NO. **SWM-1** DEPTH **6.0**



Cobbles	coarse	fine	coarse	medium	fine	Silt	Clay
	Gravel		Sand				

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GRAIN SIZE DISTRIBUTION

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SITE:
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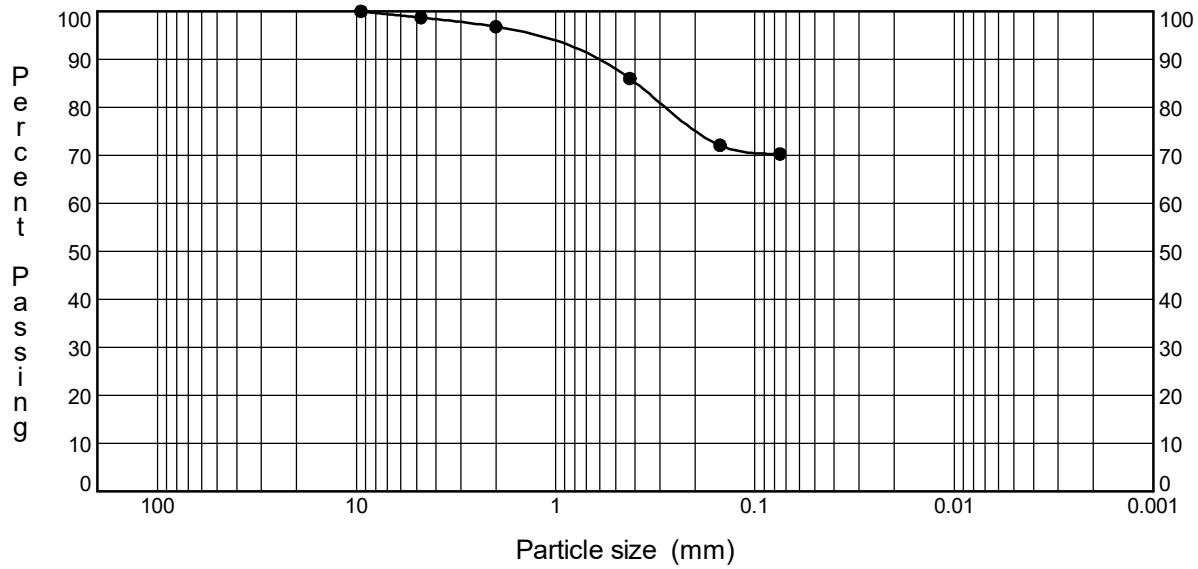
US GSD DOUBLE 2021528-01 NORTHWEST REGIONAL PARK.GPJ AB_CONS.GDT 8/8/24

BOREHOLE NO. **SWM-2** DEPTH **6.0**



Cobbles	Gravel		Sand			Silt	Clay
	coarse	fine	coarse	medium	fine		

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GRAIN SIZE DISTRIBUTION

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SITE:
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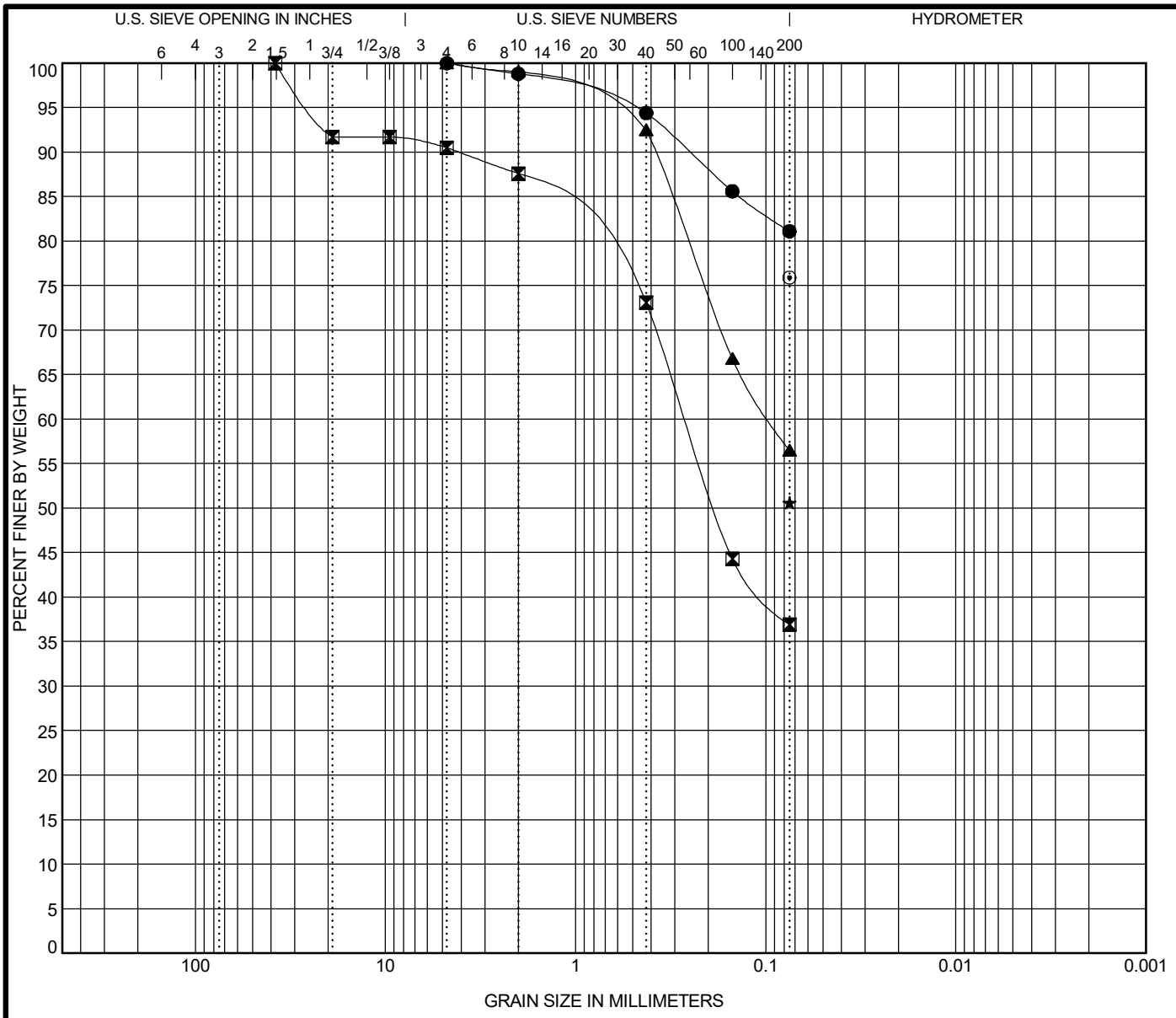

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	SB-1	1.0						
⊠	SB-1	3.5						
▲	SB-2	3.5						
★	SB-2	6.0						
⊙	SB-2	8.5						

	Specimen Identification		D100	D60	D50	D30	%Gravel	%Sand	%Silt	%Clay
●	SB-1	1.0	4.75				0.0	18.9	81.1	
⊠	SB-1	3.5	38	0.265	0.184		9.5	53.6	36.9	
▲	SB-2	3.5	4.75	0.095			0.0	43.5	56.5	
★	SB-2	6.0	0.075				0.0	0.0	50.6	
⊙	SB-2	8.5	0.075				0.0	0.0	75.9	

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GRAIN SIZE DISTRIBUTION

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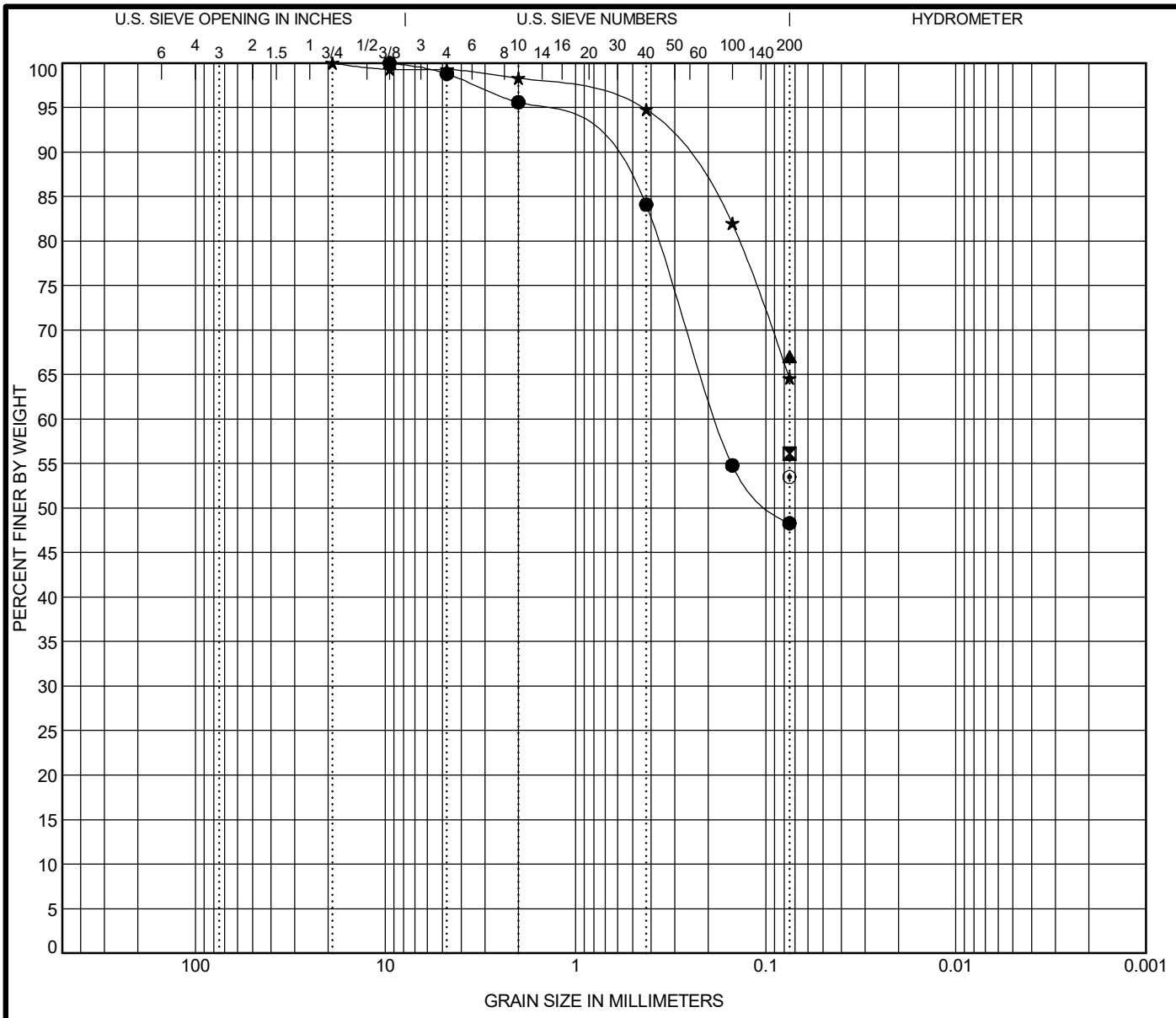
PROJECT: Northwest Regional Park
SITE:
Baltimore County, Maryland

US GRAIN SIZE 2021528-01 NORTHWEST REGIONAL PARK.GPJ AB CONS.GDT 8/8/24



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	SB-3 3.5						
⊠	SB-3 6.0						
▲	SB-3 8.5						
★	SB-4 1.0						
⊙	SB-4 6.0						

Specimen Identification		D100	D60	D50	D30	%Gravel	%Sand	%Silt	%Clay
●	SB-3 3.5	9.5	0.18	0.09		1.2	50.5	48.3	
⊠	SB-3 6.0	0.075				0.0	0.0	56.1	
▲	SB-3 8.5	0.075				0.0	0.0	67.0	
★	SB-4 1.0	19				0.7	34.7	64.6	
⊙	SB-4 6.0	0.075				0.0	0.0	53.5	

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GRAIN SIZE DISTRIBUTION

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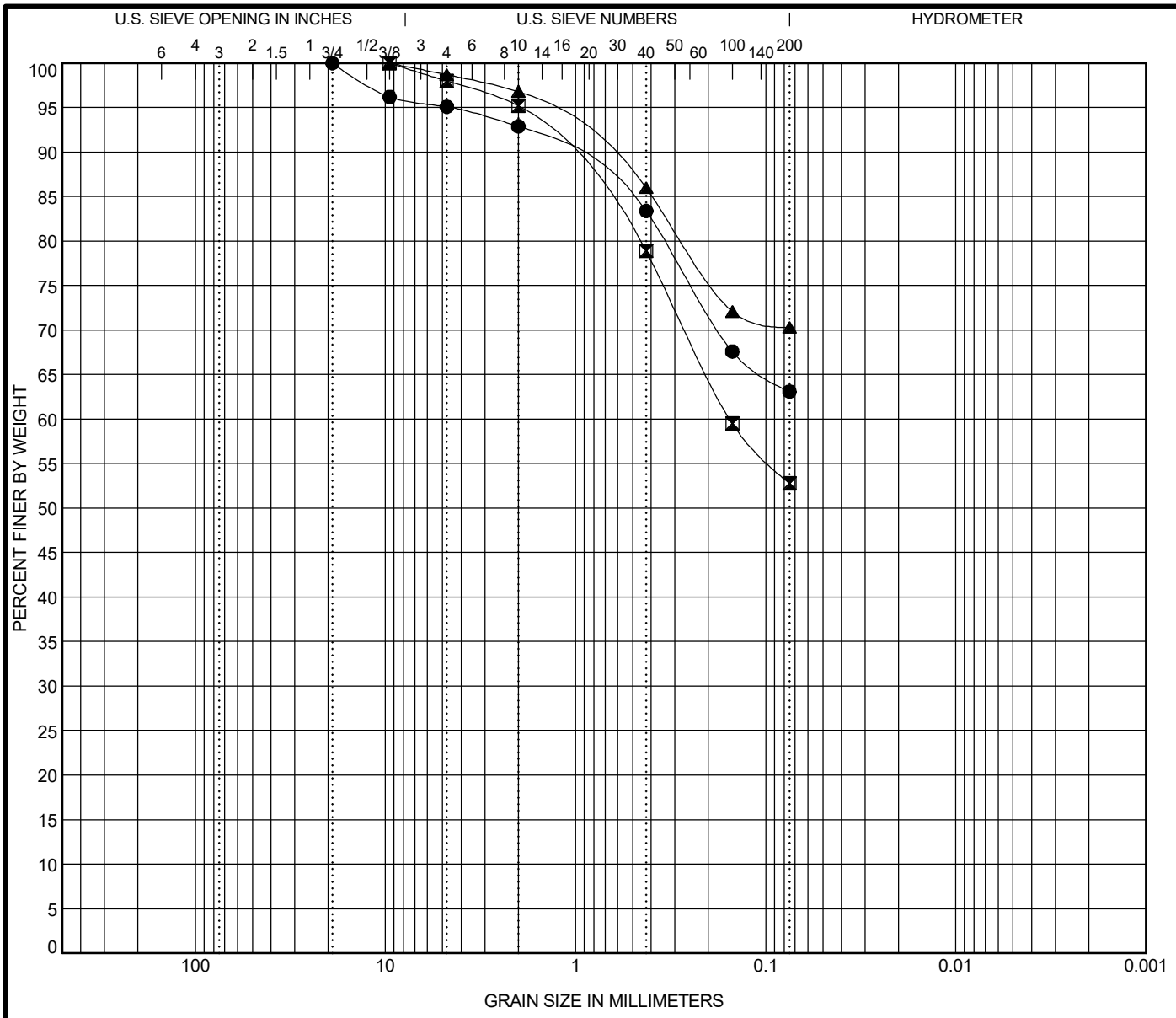
PROJECT: Northwest Regional Park
SITE:
Baltimore County, Maryland

US GRAIN SIZE 2021528-01 NORTHWEST REGIONAL PARK.GPJ AB CONS.GDT 8/8/24



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	**SWM-1**	**3.5**						
⊠	**SWM-1**	**6.0**						
▲	**SWM-2**	**6.0**						

	Specimen Identification		D100	D60	D50	D30	%Gravel	%Sand	%Silt	%Clay
●	**SWM-1**	**3.5**	**19**				**4.9**	**32.0**	**63.1**	
⊠	**SWM-1**	**6.0**	**9.5**	**0.154**			**2.0**	**45.2**	**52.8**	
▲	**SWM-2**	**6.0**	**9.5**				**1.3**	**28.4**	**70.3**	

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GRAIN SIZE DISTRIBUTION

CLIENT: Mahan Rykiel Associates Inc
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PROJECT: Northwest Regional Park
SITE:
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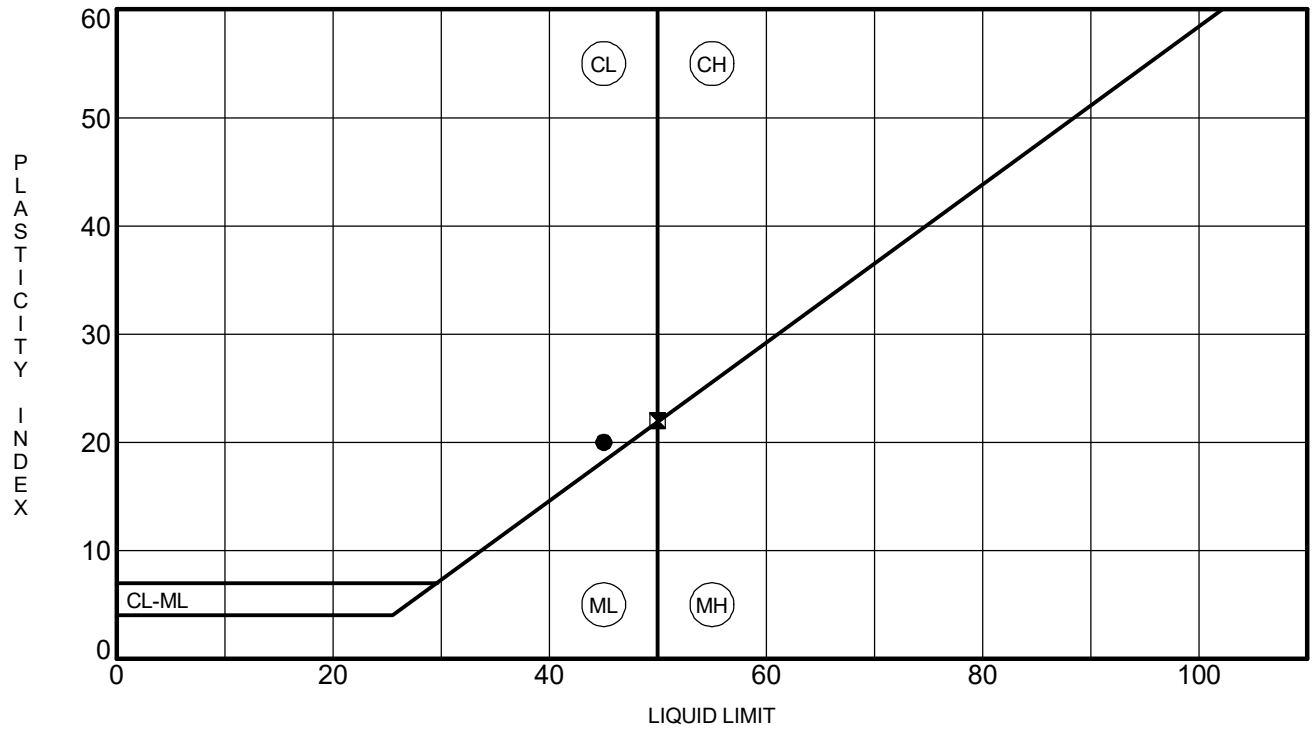
US GRAIN SIZE 2021528-01 NORTHWEST REGIONAL PARK.GPJ AB_CONS.GDT 8/8/24



	Specimen Identification		LL	PL	PI	Fines	Classification
●	**SB-4**	**3.5**	**45**	**25**	**20**		
⊠	**SWM-2**	**3.5**	**50**	**28**	**22**		

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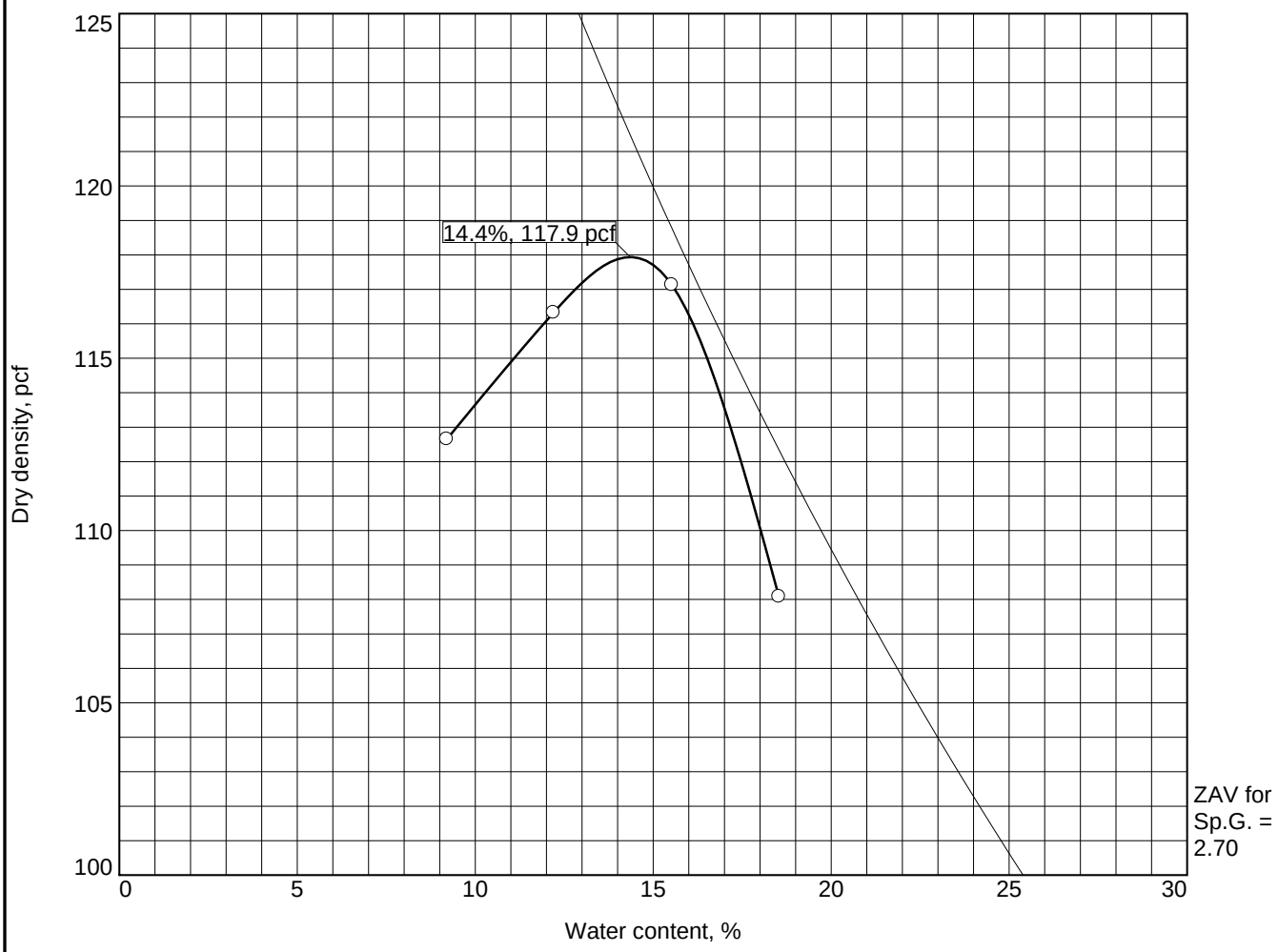
ATTERBERG LIMITS' RESULTS

CLIENT: Mahan Rykiel Associates Inc
PROJECT NO.: 2021528-01
PROJECT: Northwest Regional Park
SITE:
Baltimore County, Maryland

US ATTERBERG_LIMITS 2021528-01 NORTHWEST REGIONAL PARK.GPJ AB_CONS.GDT 8/8/24

COMPACTION TEST REPORT



Test specification: ASTM D 1557-12 Method A Modified

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > #4	% < No.200
	USCS	AASHTO						
1 to 6 ft	ML	A-4(0)	13.8	2.7	27	NP	1.8	63.9

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 117.9 pcf Optimum moisture = 14.4 %	Brown sandy silt

Project No. 2021528-01 **Client:** Mahan Rykiel Associates Inc.
Project: Northwest Regional Park

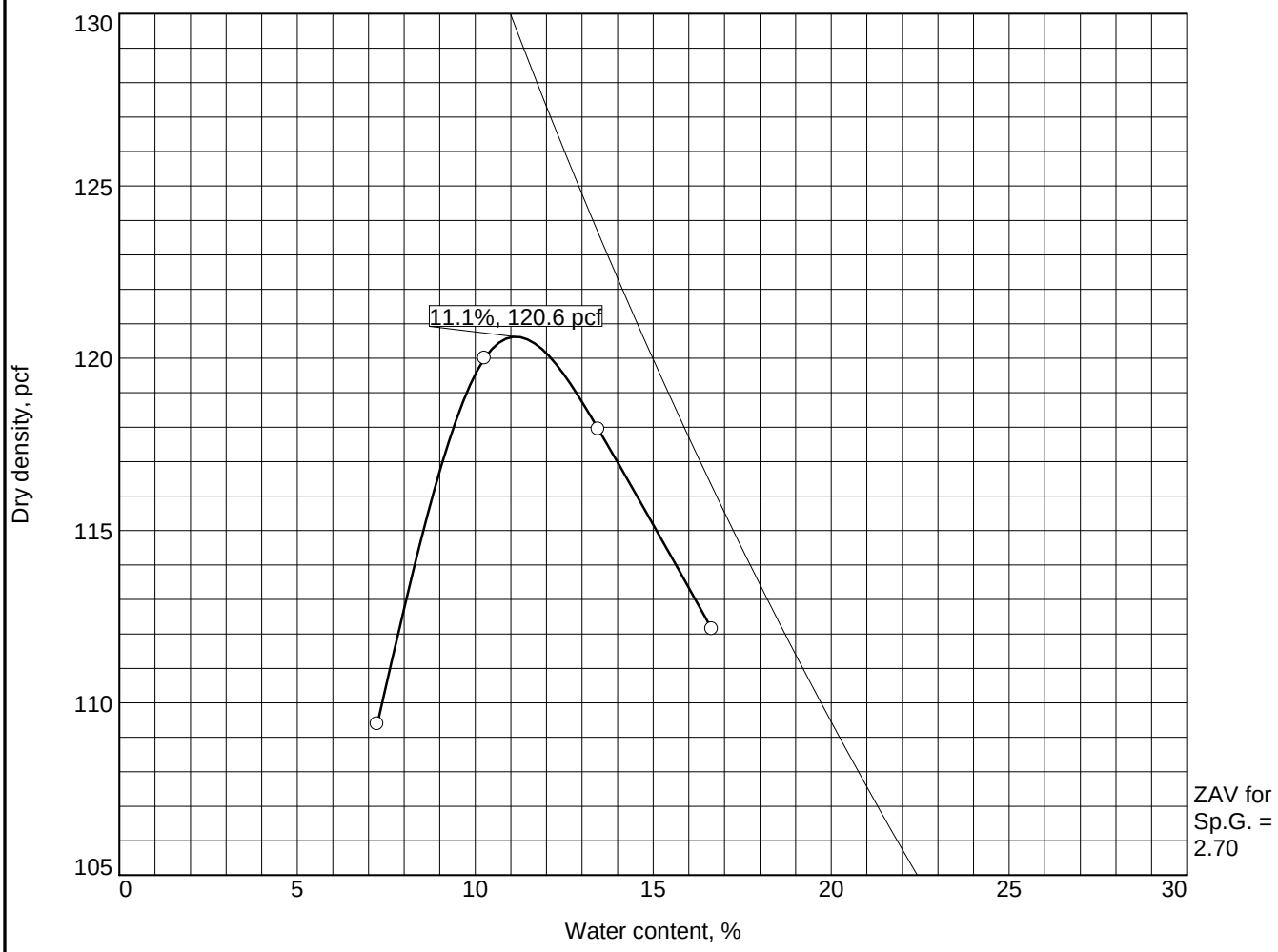
○**Location:** SB-1 **Sample Number:** Bag

Remarks:

AB Consultants, Inc.

Figure

COMPACTION TEST REPORT



Test specification: ASTM D 1557-12 Method A Modified

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > #4	% < No.200
	USCS	AASHTO						
1 to 5 ft	ML	A-4(4)	7.7	2.7	34	9	11.3	60.9

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 120.6 pcf Optimum moisture = 11.1 %	Brown sandy silt

Project No. 2021528-01 **Client:** Mahan Rykiel Associates Inc.
Project: Northwest Regional Park

○**Location:** SB-4 **Sample Number:** Bag

Remarks:

AB Consultants, Inc.

Figure

Borehole	Depth	Liquid Limit	Plastic Limit	Plasticity Index	Maximum Size (mm)	%<#200 Sieve	Class-ification	Water Content (%)	Dry Density (pcf)	Satur-ation (%)	Void Ratio
SB-1	1.0				4.75	81		23.5			
SB-1	3.5				38	37		16.0			
SB-1	6.0							15.2			
SB-1	8.5							31.0			
SB-2	1.0							16.7			
SB-2	3.5				4.75	57		21.2			
SB-2	6.0				0.075	51		22.4			
SB-2	8.5				0.075	76		31.6			
SB-2	13.5							37.5			
SB-3	1.0							12.8			
SB-3	3.5				9.5	48		19.1			
SB-3	6.0				0.075	56		56.1			
SB-3	8.5				0.075	67		35.0			
SB-3	13.5							33.3			
SB-4	1.0				19	65		14.5			
SB-4	3.5	45	25	20				12.9			
SB-4	6.0				0.075	54		25.9			
SB-4	8.5							34.9			
SWM-1	1.0							14.3			
SWM-1	3.5				19	63		20.0			
SWM-1	6.0				9.5	53		28.9			
SWM-1	8.5							43.7			
SWM-1	13.5							55.0			
SWM-2	1.0							18.9			
SWM-2	3.5	50	28	22				23.5			
SWM-2	6.0				9.5	70		29.0			
SWM-2	8.5							43.0			
SWM-2	13.5							36.4			

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Summary of Laboratory Results

CLIENT: Mahan Rykiel Associates Inc
PROJECT NO.: 2021528-01
PROJECT: Northwest Regional Park
SITE:
Baltimore County, Maryland

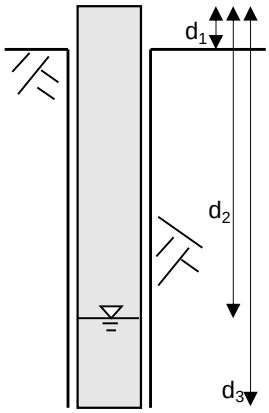
US LAB SUMMARY 2021528-01 NORTHWEST REGIONAL PARK.GPJ AB_CONS.GDT 8/8/24

F. FIELD INFILTRATION TEST RESULTS

ON-SITE INFILTRATION TEST

JOB NO.:	2021528-01	**DRILLED BY:**	WM
PROJECT:	Northwest Regional Park	**DATE:**	7/19/2024
LOCATION:	9912 Lyons Mill Rd, Owings Mills, MD 21117		

			Measurements (in.)
HOLE NO.:	SWM-1	d_1	11
HOLE DEPTH:	5 Feet		
HOLE DIAMETER:	6 Inch		
PRE-SOAK DATE:	7/19/2024	d_2	58 15/16
PIPE DIAMETER:	5"		
PIPE MATERIAL:	PVC		
TESTED BY:	TR		
TESTED DATE:	7/20/2024	d_3	70 3/16



Pre-soak water remaining in the hole: Yes / No **Depth:** (from bottom) 11 4/16

Time of Reading (Hr : Min)		Time Escaped	Water Level (Below Reference		Drop in Level	Infiltration Rate
Initial	final	(min)	Initial	Final	(in.)	(in./hr)
7:45	8:45	60	45 10/16	45 13/16	0.240	0.24
8:47	9:47	60	44 1/16	44 6/16	0.360	0.36
9:50	10:50	60	44 6/16	44 12/16	0.360	0.36
10:53	11:53	60	44 12/16	45 2/16	0.360	0.36

NOTE: * Reading accuracy to 1/16"

Average of 4-hr Monitoring Period: **0.33** **in./hr**

Recommended Infiltration Rate: **0.30** **in./hr**

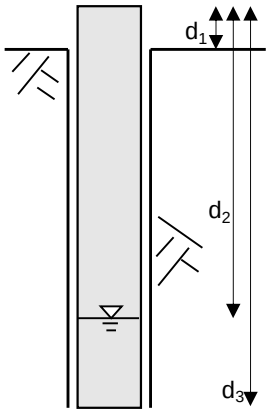
Report Reviewed and Prepared By: AT

REMARKS:

ON-SITE INFILTRATION TEST

JOB NO.:	2021528-01	**DRILLED BY:**	WM
PROJECT:	Northwest Regional Park	**DATE:**	7/19/2024
LOCATION:	9912 Lyons Mill Rd, Owings Mills, MD 21117		

			Measurements (in.)
HOLE NO.:	SWM-2	d_1	11
HOLE DEPTH:	5 Feet		
HOLE DIAMETER:	6 Inch		
PRE-SOAK DATE:	7/19/2024		
		d_2	44 6/16
PIPE DIAMETER:	5"		
PIPE MATERIAL:	PVC		
TESTED BY:	TR		
TESTED DATE:	7/20/2021	d_3	68 8/16



Pre-soak water remaining in the hole: Yes / No **Depth:** (from bottom) 24 2/16

Time of Reading (Hr : Min)		Time Escaped	Water Level (Below Reference		Drop in Level	Infiltration Rate
Initial	final	(min)	Initial	Final	(in.)	(in./hr)
7:59	8:59	60	43 5/16	43 7/16	0.120	0.12
9:00	10:00	60	43 7/16	43 9/16	0.120	0.12
10:02	11:03	61	43 9/16	43 9/16	0.000	0.00
11:06	12:06	60	43 9/16	43 9/16	0.000	0.00

NOTE: * Reading accuracy to 1/16"

Average of 4-hr Monitoring Period: **0.06** **in./hr**

Recommended Infiltration Rate: **0.10** **in./hr**

Report Reviewed and Prepared By: AT

REMARKS:

SPECIAL PROVISIONS

Builder's Risk Insurance

A. The Contractor shall, at his/her own cost, insure the work and keep it insured at all times during the period of construction, and until final acceptance of it by the County against loss of damage covered by an "All Risk" Builders Risk type of policy. The amount of insurance shall be the 100% estimated replacement cost of the work.

B. The policies shall be made payable to the County and the Contractor, as their interest may appear, and the policies shall be left in the possession of the Engineer, prior to the start of construction.

S E C T I O N I I I

Permits

Baltimore County, Maryland
Department of Permits, Approvals, and Inspections
BUILDING PERMIT

Permit Number: CEN25-000099

Permit Type: Commercial Environmental

Sub Type: Grading

Date Issued: 08/04/2025

Expiration Date: 08/03/2027

Property Information

Property Address: 4515 DEER PARK RD

City, State, Zip: OWINGS MILLS, MD, 21117

Tax ID: 2200028592

District: 02

Existing Use:

Proposed Use:

Is this property located in a Floodplain: NO

Sprinkler to be Installed?:

Plumbing Work?:

Electrical Work?:

Lot Size and Setbacks

Size:

Set Backs - Front Yard:

Set Backs - Rear Yard:

Set Backs - Right Side Yard:

Set Backs - Left Side Yard:

Owner Information

Owner: Baltimore County Property Management

Owner Address: 12200 Long Green Pike, Glen Arm, MD, 21057

Tenant:

Applicant: David Pilachowski

C. Pete Gutwald, AICP, Director

E. John Bryan, Building Engineer

***Please log into your account to get up-to-date information regarding the permit process and related inspections. Refer to the Permit Number when making inquires.**

Baltimore County, Maryland
Department of Permits, Approvals, and Inspections
BUILDING PERMIT

Permit Number: CEN25-000099

Permit Type: Commercial Environmental

Sub Type: Grading

Date Issued: 08/04/2025

Expiration Date: 08/03/2027

Building Permit Contractor

Name of Contractor: TBD

Phone Number:

Address:

City, State, Zip: , ,

Is Owner Contractor?:

Building Permit Information

Description of Work: Grade 51,700sf for public park. Permit expires two years from date of issue.
No construction to begin until pre-construction meeting. Failure to comply will result in penalties. Schedule your pre-construction meeting in your portal

C. Pete Gutwald, AICP, Director

E. John Bryan, Building Engineer

***Please log into your account to get up-to-date information regarding the permit process and related inspections. Refer to the Permit Number when making inquires.**

Baltimore County, Maryland
Department of Permits, Approvals, and Inspections
BUILDING PERMIT

Permit Number: CEN25-000100

Permit Type: Commercial Environmental

Sub Type: Storm Water

Date Issued: 07/20/2025

Expiration Date: 07/19/2027

Property Information

Property Address: 4515 DEER PARK RD

City, State, Zip: OWINGS MILLS, MD, 21117

Tax ID: 2200028592

District: 02

Existing Use:

Proposed Use:

Is this property located in a Floodplain: NO

Sprinkler to be Installed?:

Plumbing Work?:

Electrical Work?:

Lot Size and Setbacks

Size:

Set Backs - Front Yard:

Set Backs - Rear Yard:

Set Backs - Right Side Yard:

Set Backs - Left Side Yard:

Owner Information

Owner: Baltimore County Property Management

Owner Address: 12200 Long Green Pike, Glen Arm, MD, 21057

Tenant:

Applicant: David Pilachowski

C. Pete Gutwald, AICP, Director

E. John Bryan, Building Engineer

***Please log into your account to get up-to-date information regarding the permit process and related inspections. Refer to the Permit Number when making inquires.**

Baltimore County, Maryland
Department of Permits, Approvals, and Inspections
BUILDING PERMIT

Permit Number: CEN25-000100

Permit Type: Commercial Environmental

Sub Type: Storm Water

Date Issued: 07/20/2025

Expiration Date: 07/19/2027

Building Permit Contractor

Name of Contractor: TBD

Phone Number:

Address:

City, State, Zip: , ,

Is Owner Contractor?:

Building Permit Information

Description of Work: Storm Water Management for 0.73 acres drainage area. Permit expires two years from date of issue. NO CONSTRUCTION TO BEGIN UNTIL PRE-CONSTRUCTION MEETING. FAILURE TO COMPLY WILL RESULT IN PENALTIES. SCHEDULE YOUR PRE-CONSTRUCTION MEETING IN YOUR PORTAL.

C. Pete Gutwald, AICP, Director

E. John Bryan, Building Engineer

***Please log into your account to get up-to-date information regarding the permit process and related inspections. Refer to the Permit Number when making inquires.**

Baltimore County, Maryland
Department of Permits, Approvals, and Inspections
BUILDING PERMIT

Permit Number: C25-01208

Permit Type: Commercial New

Sub Type: New Structure - Shell

Date Issued: 12/31/2025

Expiration Date: 12/30/2026

Property Information

Property Address: 4515 DEER PARK RD

City, State, Zip: OWINGS MILLS, MD, 21117

Tax ID: 2200028592

District: 02

Existing Use: Other

Proposed Use: A

Is this property located in a Floodplain: NO

Sprinkler to be Installed?:

Plumbing Work?:

Electrical Work?:

Lot Size and Setbacks

Size: 1,342.00

Set Backs - Front Yard: 448.00

Set Backs - Rear Yard: 171.91

Set Backs - Right Side Yard: 232.25

Set Backs - Left Side Yard: 1,412.67

Owner Information

Owner: BALTIMORE COUNTY MARYLAND

Owner Address: 12-R-384, BALTIMORE, MD, 21204

Tenant:

Applicant: Mia Quinto

C. Pete Gutwald, AICP, Director

E. John Bryan, Building Engineer

***Please log into your account to get up-to-date information regarding the permit process and related inspections. Refer to the Permit Number when making inquires.**

Baltimore County, Maryland
Department of Permits, Approvals, and Inspections
BUILDING PERMIT

Permit Number: C25-01208

Permit Type: Commercial New

Sub Type: New Structure - Shell

Date Issued: 12/31/2025

Expiration Date: 12/30/2026

Building Permit Contractor

Name of Contractor: TBD

Phone Number:

Address:

City, State, Zip: , ,

Is Owner Contractor?:

Building Permit Information

Description of Work: CONSTRUCT 1STY STRUCTURE 43'X32'X19'=1342SF TO BE "COMFORT STATION" W/COVERED ENTRY ON SLAB W/RESTROOM & 2 FAMILY ROOMS W/SHOWERS FOR FUTURE SPLASH PAD IN EXISTING PLAYGROUND. EROSION AND SEDIMENT CONTROL INSPECTION MUST BE SCHEDULED AND PASSED PRIOR TO ANY BUILDING ACTIVITY. ADDITIONAL WORK REQUIRES SEPARATE PERMIT. PERMIT EXPIRES 2 YEARS FROM DATE OF ISSUE.

C. Pete Gutwald, AICP, Director

E. John Bryan, Building Engineer

***Please log into your account to get up-to-date information regarding the permit process and related inspections. Refer to the Permit Number when making inquires.**

Baltimore County, Maryland
Department of Permits, Approvals, and Inspections
BUILDING PERMIT

Permit Number: C25-01207

Permit Type: Commercial New

Sub Type: New Structure - Shell

Date Issued: 12/31/2025

Expiration Date: 12/30/2027

Property Information

Property Address: 4515 DEER PARK RD

City, State, Zip: OWINGS MILLS, MD, 21117

Tax ID: 2200028592

District: 02

Existing Use: Other

Proposed Use: A C

Is this property located in a Floodplain: NO

Sprinkler to be Installed?:

Plumbing Work?:

Electrical Work?:

Lot Size and Setbacks

Size: 623.00

Set Backs - Front Yard: 374.50

Set Backs - Rear Yard: 256.33

Set Backs - Right Side Yard: 351.25

Set Backs - Left Side Yard: 1,314.67

Owner Information

Owner: BALTIMORE COUNTY MARYLAND

Owner Address: 12-R-384, BALTIMORE, MD, 21204

Tenant:

Applicant: Mia Quinto

C. Pete Gutwald, AICP, Director

E. John Bryan, Building Engineer

***Please log into your account to get up-to-date information regarding the permit process and related inspections. Refer to the Permit Number when making inquires.**

Baltimore County, Maryland
Department of Permits, Approvals, and Inspections
BUILDING PERMIT

Permit Number: C25-01207

Permit Type: Commercial New

Sub Type: New Structure - Shell

Date Issued: 12/31/2025

Expiration Date: 12/30/2027

Building Permit Contractor

Name of Contractor: TBD

Phone Number:

Address:

City, State, Zip: , ,

Is Owner Contractor?:

Building Permit Information

Description of Work: CONSTRUCT 1STY STRUCTURE 27'X23'X14'=623SF ON SLAB TO BE MECHANICAL ROOM AND OFFICE FOR FUTURE SPLASH PAD IN EXISTING PLAYGROUND. EROSION AND SEDIMENT CONTROL INSPECTION MUST BE SCHEDULED AND PASSED PRIOR TO ANY BUILDING ACTIVITY. ADDITIONAL WORK REQUIRES SEPARATE PERMIT. PERMIT EXPIRES 2 YEARS FROM DATE OF ISSUE.

C. Pete Gutwald, AICP, Director

E. John Bryan, Building Engineer

***Please log into your account to get up-to-date information regarding the permit process and related inspections. Refer to the Permit Number when making inquires.**

Baltimore County, Maryland
Department of Permits, Approvals, and Inspections
BUILDING PERMIT

Permit Number: C25-01386

Permit Type: Commercial New

Sub Type: Swimming Pool

Date Issued: 10/22/2025

Expiration Date: 10/21/2026

Property Information

Property Address: 4515 DEER PARK RD

City, State, Zip: OWINGS MILLS, MD,

Tax ID: 2200028592

District: 02

Existing Use:

Proposed Use:

Is this property located in a Floodplain: NO

Sprinkler to be Installed?:

Plumbing Work?:

Electrical Work?:

Lot Size and Setbacks

Size:

Set Backs - Front Yard: 351.33

Set Backs - Rear Yard: 1,314.58

Set Backs - Right Side Yard: 256.33

Set Backs - Left Side Yard: 374.50

Owner Information

Owner: Baltimore County Property Management

Owner Address: 12200 Long Green Pike #A, Glen Arm, MD, 21057

Tenant:

Applicant: Mia Quinto

C. Pete Gutwald, AICP, Director

E. John Bryan, Building Engineer

***Please log into your account to get up-to-date information regarding the permit process and related inspections. Refer to the Permit Number when making inquires.**

Baltimore County, Maryland
Department of Permits, Approvals, and Inspections
BUILDING PERMIT

Permit Number: C25-01386

Permit Type: Commercial New

Sub Type: Swimming Pool

Date Issued: 10/22/2025

Expiration Date: 10/21/2026

Building Permit Contractor

Name of Contractor: TBD

Phone Number:

Address:

City, State, Zip: , ,

Is Owner Contractor?:

Building Permit Information

Description of Work: Construct a 64.5' X 44' splash pad on Baltimore County public park. Fence to be built to code per applicant. To be filled by hose, sand filter. 0' deep.

C. Pete Gutwald, AICP, Director

E. John Bryan, Building Engineer

***Please log into your account to get up-to-date information regarding the permit process and related inspections. Refer to the Permit Number when making inquires.**

SECTION I V

Proposal

This Section to be Completed by Time of Bid

S E C T I O N – I V
P R O P O S A L

DESCRIPTION OF WORK

Bid Opening via Teleconference WebEx: Thursday, March 5, 2026 @ 10:30 a.m. EST.
WebEx Phone Number 1-415-655-0001, Access Code Number 2301 174 1312##.

Begin Work Within Fifteen (15) Days After NOTICE TO PROCEED

Calendar Days for Completion: Three Hundred Seventy (370)

Liquidated and Other Damages: FIFTEEN HUNDRED DOLLARS ($1500.00 PER CALENDAR DAY)

Cost Group "E" ($2,500,001 to $5,000,000) (Prequalified contractors with a Cost Group restriction must bid within the dollar amount stated on their Certificate of Prequalification)

Work Classification: I1

TO BALTIMORE COUNTY, MARYLAND: Installation of an accessible splash feature and gender -neutral confort station located adjacent to an existing parking lot and provides a complementary attraction to the existing Ravens playground. A new network of accessible concrete walks and flexi-pave walks surrounding the splash feature and confort station will connect to the existing circulation within the park. Gathering areas provided around the perimeter of the splash feature include picnic tables and shade structures to provide relief and protection from the sun. Other amenities within the fenced zone include a drinking fountain and shower/foot wash. Amenities outside of the fenced zone include bike racks and benches. **Owings Mills - District 2c4.**

The following listed Drawing Number(s) are collectively the "Drawings", and are hereby incorporated in the Contract.

Workday Number	Drawing Number(s)
10000634	2025-2172 thru 2255, 2025-2321, 2025-2256 thru 2320 2025-1631

A pre-bid meeting will be held on Wednesday, February 18, 2026 at 10:00 a.m. EST via WebEx. *Phone-In (Audio Only)* – 1-415-655-0001, Meeting Number 2305 526 1239##. *Video Conference* – Meeting Number 2305 526 1239, **Password**: **KPy3V5UEG52,** go to https://signin.webex.com/join,or for the WebEx link go to www.baltimorecountymd.gov/departments/public-works/engineering/contracts/current-solicitations for Webex link.

NOTE: No successful bidder may withdraw their bid within NINETY (90) days after the opening thereof.

The Contractor hereby declares that it has carefully examined the solicitation, plans and specifications, form of contract, Special Provisions and Drawings (collectively the "Contract Documents"). The Contractor also hereby declares that it has carefully examined the September 2023 "Standard Specifications for Construction and Materials" and "Standard Details for Contraction", collectively the "Applicable County Law" and any and all Department of Public Works and Transportation revisions thereto as of the date of advertisement. The Contract Documents, the Applicable County Law and the Department of Public Works and Transportation revisions thereto are collectively the "Specifications" and are incorporated herein. Copies of any and all Department of Public Works and Transportation revisions including but not limited to the General Conditions Building Projects, are available online at www.baltimorecountymd.gov/departments/public-works/standards. Also, the Contractor has, to its satisfaction, examined the locality of the proposed work and agrees to furnish all labor, tools, materials, machinery, equipment, and other means of construction called for in the manner provided in the Specifications for the prices shown on the next page(s) and as evidenced by Contractor's signature on the last page thereof.

SCHEDULE OF PRICES

NOTE: The Bidder shall fill out this Proposal, write in the unit prices in clear numerals, and make the extensions.

For complete information concerning these items, see Specifications and contract forms.

CONTRACT PROPOSAL

Northwest Regional Park Slash Pad & Supporting Facilities - 4515 Deer Park Road, Owings Mills, Maryland 21117
CONTRACT NUMBER : 25114 GX0
WORKDAY NUMBER: 10000634
JOB ORDER NUMBER: N/A
CALENDAR DAYS: 370

CONTRACTOR: _____
ADDRESS: _____
PHONE: _____

BID ITEM	COMM. CODE		DESCRIPTION	UNIT	ESTIMATED QUANTITY	UNIT PRICE	TOTAL AMOUNT
1	0	0000	BASE BID - INSTALLATION OF SPLASH PAD, OFFICE & MECHANICAL VAULT & CONFORT STATION	LS	1		$
2	0	0000	ALLOWANCE #1 - 145 CY OF UNSATISFACTORY SOIL EXCAVATION & DISPOSAL	LS	1	$22524.00	$22,524.00
3	0	0000	ALLOWANCE #2 - 55 CY OF TRENCH ROCK REMOVAL	LS	1	$15601.00	$15,601.00
4	0	0000	BASE BID + ALLOWANCES 1 & 2 TOTAL	0	0		$
5	0	0000	ALTERNATE #1 - INTEGRAL COLOR IN P2 PAVING	LS	1		$
6	0	0000	BASE BID + ALLOWANCES 1 & 2 + ALT.#1 TOTAL	0	0		$
7	0	0000	ALTERNATE #2 - PT-1 PICNIC TABLES	LS	1		$
8	0	0000	BASE BID + ALLOWANCES 1 & 2 + ALT.#1 - ALT.#2 TOTAL	0	0		$
9	0	0000	ALTERNATE #3 - PT-2 PICNIC TABLES	LS	1		$
10	0	0000	BASE BID + ALLOWANCES 1 & 2 + ALT.#1 - ALT.#3 TOTAL	0	0		$
11	0	0000	ALTERNATE #4 - UMBRELLAS	LS	1		$
12	0		BASE BID + ALLOWANCES 1 & 2 + ALT.#1 - ALT.#4 TOTAL	0	0		$

13	0	0000	ALTERNATE #5 - SHADE STRUCTURES	LS	1		$
14	0	0000	BASE BID + ALLOWANCES 1 & 2 + ALT.#1 - ALT.#5 TOTAL	0	0		$
15	0	0000	ALTERNATE #6 - LIFE FLOOR @ SPLASHPAD	LS	1		$
16	0	0000	BASE BID + ALLOWANCES 1 & 2 + ALT.1 - ALT.#6 TOTAL	0	0		$
17	0	0000	ALTERNATE #7 - HEATER (CLOWARD H20'S DRAWINGS)	LS	1		$
18	0	0000	BASE BID + ALLOWANCE 1 & 2 + ALT.#1 - ALT.#7 TOTAL	0	0		$
19	0	0000	ALTERNATE #8 - SPLASH PAD AREA TREES	LS	1		$
20	0	0000	BASE BID + ALLOWANCES 1 & 2 + ALT.#1 - ALT.#8 TOTAL	0	0		$
21	0	0000	ALTERNATE #9 - CONFORT STATION TREES	LS	1		$
22	0	0000	BASE BID + ALLOWANCES 1 & 2 + ALT.#1 - ALT.#9 TOTAL	0	0		$
23	0	0000	ALTERNATE #10 - SPLASH PAD AREA GROUND PLANE PLANTING	LS	1		$
24	0	0000	BASE BID + ALLOWANCES 1 & 2 + ALT.#1 - ALT.#10 TOTAL	0	0		$
25	0	0000	ALTERNATE #11 - CONFORT STATION GROUND PLANE PLANTING	LS	1		$
TOTAL COST FOR CONTRACT (BASE BID + ALLOWANCES 1 & 2 + ALT.#1 - ALT.#11 TOTAL)							$

TOTAL COST FOR CONTRACT IN WORDS

OFFICER SIGNATURE

TITLE

UNIT PRICING SCHEDULE (Spec Section 312000 – Earth Moving):

Furnish the requested unit price(s), which will be used for Project, where applicable:

LINE NO.	COMMODITY/SERVICE DESCRIPTION	QUANTITY	UNIT	UNIT RATE
1	CONTINGENT - REMOVAL OF UNSATISFACTORY SOIL & REPLACE WITH SATISFACTORY SOIL MATERIAL		CY	$
2	CONTINGENT – CL.3 SOIL EXCAV. & DISPOSAL OFF-SITE REPL. W/MATERIALS FROM CONTRACT EXPORT		CY	$
3	CONTINGENT – CL.3 SOIL EXCAV. & DISPOSAL OFF-SITE REPL. W/SELECT BACKFILL MATERIAL OFF-SITE		CY	$
4				$
5				$
6				$
7				$
8				$

PROPOSAL AFFIDAVIT

1. AUTHORIZED REPRESENTATIVE

I HEREBY AFFIRM THAT:

I am the [title]_____and the duly authorized representative of [business]_____(the "Business") and that I possess the legal authority to make this Affidavit on behalf of myself and the Business for which I am acting.

2. PROPOSAL CERTIFICATION

THE UNDERSIGNED HEREBY ACKNOWLEDGES receipt of the following Addenda (list by number and date):

_____

_____

Accompanying this Proposal is a Bid Bond in an amount of 5% of the bid, the exact amount to be determined by the difference between the low bid and the next lowest bid, if two or more bids are received, or 5% of the bid if one bid is received. This guarantees payment to Baltimore County of the amount thus determined as liquidated damages in case of default in any matter specified as required before award or in any matter resulting in failure to execute and deliver an Agreement, together with Payment and Performance Bonds, after award.

3. AFFIRMATION REGARDING BRIBERY CONVICTIONS

I FURTHER AFFIRM THAT:

Neither I, nor to the best of my knowledge, information, and belief, the Business, nor any of its officers, directors, partners, or any of its employees directly involved in obtaining or performing contracts with public bodies (as is defined in Section 16-101(f) of the State Finance and Procurement Article of the Annotated Code of Maryland), has been convicted of, or has had probation before judgment imposed pursuant to Section 6-225 of the Criminal Procedure Article of the Annotated Code of Maryland, or has pleaded nolo contendere to a charge of, bribery, attempted bribery, or conspiracy to bribe in violation of Maryland law, or of the law of any other state or federal law, except as follows [indicate the reasons why the affirmation cannot be given and list any conviction, plea, or imposition of probation before judgment with the date, court, official or administrative body, the sentence or disposition, the name(s) of person(s) involved, and their current positions and responsibilities with the Business]:

_____

_____

4. AFFIRMATION REGARDING OTHER CONVICTIONS

I FURTHER AFFIRM THAT:

Neither I, nor to the best of my knowledge, information, and belief, the Business, nor any of its officers, directors, partners, or any of its employees directly involved in obtaining or performing contracts with public bodies, has:

(1) Been convicted under state or federal statute of a criminal offense incident to obtaining, attempting to obtain, or performing a public or private contract, fraud, embezzlement, theft, forgery, falsification or destruction of records, or receiving stolen property;

(2) Been convicted of any criminal violation of a state or federal antitrust statute;

(3) Been convicted under the provisions of Title 18 of the United States Code for violation of the Racketeer Influenced and Corrupt Organization Act, 18 U.S.C. §1961, et seq., or the Mail Fraud Act, 18 U.S.C. §1341, et seq., for acts arising out of the submission of bids or proposals for a public or private contract;

(4) Been convicted of a violation of the State Minority Business Enterprise Law, Section 14-308 of the State Finance and Procurement Article of the Annotated Code of Maryland;

(5) Been convicted of conspiracy to commit any act or omission that would constitute grounds for conviction or liability under any law or statute described in subsection (1), (2), (3), or (4) above;

(6) Been found civilly liable under a state or federal antitrust statute for acts or omissions in connection with the submission of bids or proposals for a public or private contract;

(7) Admitted in writing or under oath, during the course of an official investigation or other proceedings, acts or omissions that would constitute grounds for conviction or liability under any law or statute described above, except as follows [indicate reasons why the affirmations cannot be given, and list any conviction, plea, or imposition of probation before judgment with the date, court, official or administrative body, the sentence or disposition, the name(s) of the person(s) involved and their current positions and responsibilities with the Business, and the status of any debarment]:

_____

_____

5. AFFIRMATION REGARDING DEBARMENT

I FURTHER AFFIRM THAT:

Neither I, nor to the best of my knowledge, information, and belief, the Business, nor any of its officers, directors, partners, or any of its employees directly involved in obtaining or performing contracts with public bodies, has ever been suspended or debarred (including being issued a limited denial of participation) by any public entity, except as follows [list each debarment or suspension providing the dates of the suspension or debarment, the name of the public entity and the status of the proceeding, the name(s) of the person(s) involved and their current positions and responsibilities with the Business, the grounds of the debarment or suspension, and the details of each person's involvement in any activity that formed the grounds of the debarment or suspension]:

_____

_____

6. AFFIRMATION REGARDING DEBARMENT OF RELATED ENTITIES

I FURTHER AFFIRM THAT:

(1) The Business was not established and it does not operate in a manner designed to evade the application of or defeat the purpose of debarment pursuant to Sections 16-101, et seq., of the State Finance and Procurement Article of the Annotated Code of Maryland; and

(2) The Business is not a successor, assignee, subsidiary, or affiliate of a suspended or debarred business, except as follows: [you must indicate the reasons why the affirmations cannot be given without qualification]:

_____

_____

7. SUB-CONTRACT AFFIRMATION

I FURTHER AFFIRM THAT:

Neither I, nor to the best of my knowledge, information, and belief, the Business, has knowingly entered into a contract with a public body under which a person debarred or suspended under Title 16 of the State Finance and Procurement Article of the Annotated Code of Maryland will provide, directly or indirectly, supplies, services, architectural services, construction related services, leases of real property, or construction.

8. AFFIRMATION REGARDING COLLUSION

I FURTHER AFFIRM THAT:

Neither I, nor to the best of my knowledge, information, and belief, the Business, nor any of its officers, directors, members or partners, nor any of its employees, have in any way:

(1) Agreed, conspired, connived, or colluded to produce a deceptive show of competition in the compilation of the accompanying bid or offer that is being submitted;

(2) In any manner, directly or indirectly, entered into any agreement of any kind to fix the bid price or price proposal of the bidder or offeror or of any competitor, or otherwise take any action in restraint of free competitive bidding in connection with the contract for which the accompanying bid or offer is submitted;

(3) Colluded with anyone to obtain information concerning the bid that would give the Business an unfair advantage over others.

9. POLITICAL CONTRIBUTION DISCLOSURE AFFIRMATION

I FURTHER AFFIRM THAT:

The Business affirms that it is aware of, and will comply with, the provisions of Sections 14- 101 through 14-108 of the Election Law Article of the Annotated Code of Maryland, which require that every person who makes, during any 12-month period, one or more contracts, with one or more Maryland governmental entities involving cumulative consideration, or at least $200,000.00, shall file with the State Board of Elections certain specified information to include disclosure of attributable political contributions in excess of $500 during defined reporting periods.

l0. CERTIFICATION OF CORPORATION REGISTRATION AND TAX PAYMENT

I FURTHER AFFIRM THAT:

(1) The Business is a _____ *(State)* (Corporation), (LLC), (Partnership), (Sole Proprietor/Individual), (Other:_____), that it **is** registered in accordance with the Corporations and Associations Article of the Annotated Code of Maryland, that it **is** in good standing in the State of Maryland, and that it **has** filed all of its annual reports, together with filing fees, with the Maryland State Department of Assessments and Taxation, and that the name and address of its resident agent filed with the State Department of Assessments and Taxation is:

Name: _____

Address: _____

_____

(If none, so state)

(2) Except as validly contested, the Business has paid, or has arranged for payment of, all taxes due the State of Maryland and Baltimore County, and has filed all required returns and reports with the Comptroller of the Treasury, the State Department of Assessments and Taxation, and the Employment Security Administration, as applicable, and will have paid all withholding taxes due the State of Maryland prior to final settlement.

11. CONTINGENT FEES

I FURTHER AFFIRM THAT:

The Business has not employed or retained any person, partnership, corporation, or other entity, other than a bona fide employee or agent working for the Business, to solicit or secure the Contract, and that the Business has not paid or agreed to pay any person, partnership, corporation, or other entity, other than a bona fide employee or agent, any fee or other consideration contingent on the making of the Contract.

12. NONDISCRIMINATION IN EMPLOYMENT STATEMENT

I FURTHER AFFIRM THAT:

During the performance of any contract awarded of which this affidavit is a part:

(1) The Business will not discriminate against any employee or applicant for employment because of race, color, religion, sex, age, national origin, marital status, sexual orientation, genetic information, or disability unrelated in nature and extent so as to reasonably preclude the performance of the employment, or because of the individual's refusal to submit to a genetic test or make available the results of a genetic test. The Business will take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, color, religion, sex, age, national origin, marital status, sexual orientation, genetic information, or disability unrelated in nature and extent so as to reasonably preclude the performance of the employment, or because of the individual's refusal to submit to a genetic test or make available the results of a genetic test. Such action shall include, but not be limited to the following: employment, promotion, upgrading, demotion or transfer, rates of pay or other forms of compensation; and selection for training, including apprenticeship. The Business agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided by the owner setting forth provisions of this nondiscrimination clause.

(2) The Business will, in all solicitations or advertisements for employees placed by or on behalf of the Business, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, age, national origin, marital status, sexual orientation, genetic information, or disability unrelated in nature and extent so as to reasonably preclude the performance of the employment, or because of the individual's refusal to submit to a genetic test or make available the results of a genetic test.

(3) The Business shall send to each labor union or representative of workers with which the Business has a collective bargaining agreement or other contract or understanding, a notice, to be provided by the owner, advising the said labor union or workers' representative of these commitments, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

(4) The Business shall furnish, if requested by the County, a compliance report concerning our employment practices and policies in order for the County to ascertain compliance with the special provisions of this affidavit concerning nondiscrimination in employment.

(5) In the event of the Business's noncompliance with the nondiscrimination clause of this affidavit, the contract may be canceled, terminated, or suspended in whole or in part, and the Business may be declared ineligible for further County work.

(6) The Business shall include the special provisions outlined herein pertaining to nondiscrimination in employment in every subcontract, so that such nondiscrimination in employment provisions shall be binding on each subcontractor or vendor.

13. FOREIGN CONTRACTS

I FURTHER AFFIRM THAT:

The Business affirms that it is aware of, and will comply with, the provisions of Sections 10-2-110 Article 10. Finance, Title 2 – Purchasing, Baltimore County Code 2003, which requires that prior to the award of a contract for services under the provisions of this title, and during the entire term of a contract award, the bidder or vendor shall disclose to the County whether any services covered by the bid or contract, including any subcontracted services, will be performed outside the United States. The disclosure shall be made to the Office of Budget and Finance, Purchasing Bureau.

14. MINORITY BUSINESS ENTERPRISE AND FEMALE CONTRACTORS

THIS BUSINESS INTENDS to affirmatively seek out and consider minority business enterprises to participate in this contract as subcontractors and/or suppliers of materials and services.

THE UNDERSIGNED UNDERSTANDS AND AGREES: that any and all subcontracting of supplies and services in connection with this contract, whether undertaken before or after award of contract, will be in accordance with the Minority Business Enterprise and Female Contractor requirement included in the Bid Proposal package and incorporated herein as if fully set forth; and

THE UNDERSIGNED ALSO UNDERSTANDS AND AGREES that no subcontracting will be approved until Baltimore County has reviewed and approved the affirmative actions taken by this firm.

15. REQUIREMENTS FOR EXECUTING AFFIDAVIT & PROPOSAL

The Affidavit must be signed in ink in order for the bid to be accepted and that the Proposal must be typewritten or filled out in ink.

THE UNDERSIGNED ALSO UNDERSTANDS that:

Proposals submitted by an INDIVIDUAL must be signed by an individual.

Proposals submitted by a PARTNERSHIP must be signed by the partner who is legally authorized authority to bind the partnership. Attach a copy of the Partnership Agreement and a duly certified resolution evidencing the authority of the partner so signing on behalf of the partnership.

Proposals submitted by a CORPORATION must be signed by a legally authorized officer of the corporation and attested to by the Corporate Secretary. Attach a copy of the Articles of Incorporation, By-Laws and a duly certified Board Resolution evidencing the authority of the officer so signing on behalf of the corporation.

Proposals submitted by a LIMITED LIABILITY COMPANY must be signed by a legally authorized member of the company and attested to. Attach a copy of the Operating Agreement, Articles of Organization and a duly certified resolution evidencing the authority of the member so signing on behalf of the limited liability company.

NOTE: The contractor may file with the County a list of the names of those officers, partners or members, as applicable, having legal authority to execute documents on behalf of and legally bind the contractor, duly certified, as applicable and legally required, together with the aforesaid corporate documents, which shall remain in full force and effect until such time as the County Department of Public Works and Transportation, Construction Contract Administration is advised in writing to the contrary.

16. ACKNOWLEDGMENT

I ACKNOWLEDGE THAT this Affidavit is to be furnished to the County and may be distributed to units of (1) Baltimore County; (2) the State of Maryland; (3) other counties or political subdivisions of the State of Maryland; (4) other states; and (5) the federal government. I further acknowledge that this Affidavit is subject to applicable laws of the United States and the State of Maryland, both criminal and civil, and that nothing in this Affidavit or any contract resulting from the submission of this bid or proposal shall be construed to supersede, amend, modify or waive, on behalf of Baltimore County, or the State of Maryland or any unit of the State of Maryland having jurisdiction, the exercise of any statutory right or remedy conferred by the Constitution and the laws of Maryland with respect to any misrepresentation made or any violation of the obligations, terms and covenants undertaken by the Business with respect to (a) this Affidavit, (b) the contract, and (3) other Affidavits comprising part of the contract.

I DO SOLEMNLY DECLARE AND AFFIRM UNDER THE PENALTIES OF PERJURY THAT THE CONTENTS OF THIS AFFIDAVIT ARE TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE, INFORMATION, AND BELIEF.

WITNESS/ATTEST:

_____ By: _____

Name: _____

Date: _____ Title: _____

(Authorized Representative and Affiant)

BID BOND

Principal | **Business Address of Principal**

Surety

Obligee: **BALTIMORE COUNTY, MARYLAND**
A body corporate and politic

A Corporation of the State of _____ **and authorized to do business in Maryland**

Five Percent of Bid Amount **$** **5% of Bid**
Penal Sum of Bond [shall be determined pursuant to latest revised Specification / G.P. 2.07 (2000 Ed.)]

Northwest Regional Park Splash Pad & Supporting Facilities
Contract Name

25114 GX0
Contract Number/Proposal Item Number

KNOW ALL MEN BY THESE PRESENTS, that we, the Principal, above named, and Surety, above named, and authorized to do business in the State of Maryland, are held and firmly bound unto the Obligee, above named, in the penal sum of the amount stated above, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION is such that if the aforesaid Principal is the apparent low bidder and complies with all specified matters required before award or if the aforesaid Principal is awarded the contract, the said Principal will, within the time required, execute and deliver to the Obligee a formal contract and good and sufficient payment and performance bonds in the form provided by the Obligee, then, this obligation to be void; otherwise the Principal and Surety will, upon demand, pay unto the Obligee the entire Penal Sum of this Bid Bond as liquidated damages.

THE SURETY FURTHER GUARANTEES No Proposal will be considered unless accompanied by a guaranty of the amount specified in the Proposal in the form of either a certified check, bank cashier's check or a Bid Bond on the form provided therein or an exact facsimile thereof. The Bid Bond must be executed by a Surety that is, as of the date of the Bid: (a) licensed in the State of Maryland, (b) rated "B" or better by the A.M. Best Company, (c) on federal funded projects, authorized by the underwriting limitation contained in the U.S. Department of the Treasury Circular 570, as amended, to guaranty the amount of the Bid, and (d) in good standing as determined by the County's Engineer. The Bid Bond must guaranty payment to the County of liquidated damages as follows: (a) if only one Bid is received, the guaranteed payment shall be five (5%) percent of the Bidder's Bid amount, (b) if two or more Bids are received, the guaranteed payment shall be the difference between the Bidder's Bid amount and the next lowest Bid amount, subject to the limitation that the guaranteed payment not be greater than five (5%) percent of the Bidder's Bid amount. This Bid Bond is required in case the successful Bidder, after issuance of notice of Award, fails to comply, timely and completely, with each of the requirements set forth under Section GP-3.04.

Signed and sealed _____
Date

IN WITNESS WHEREOF, the above-bounded parties have executed this instrument under their several seals on the date indicated above, the name and corporate seal of each corporate party being hereto affixed and these presents duly signed by its undersigned representative, pursuant to authority of its governing body.

In Presence of: **Individual Principal**

Witness: _____ **as to:** _____ **(SEAL)**

Print Name: _____ **Print Name:** _____

In Presence of: **Corporate Principal**

_____
(Name of Corporation)

Witness: _____ **By:** _____

Print Name: _____ **Print Name:** _____ **(SEAL)**

Title: _____

Surety

_____
(Name of Surety)

Business Address: _____

Witness: _____ **By:** _____ Affix

Print Name: _____ **Print Name:** _____ Corporate

Title: _____ Seal

Revised
February 4, 2015

First Source Hiring Agreement Overview

What is First Source Hiring?

Baltimore County's First Source Hiring Agreement requires that developers, contractors, and employers utilize good faith efforts toward employing economically disadvantaged Baltimore County residents in newly created positions on applicable projects. These efforts are supported by Baltimore County's workforce development system, a partnered network of business and economic development professionals, education and training providers, and human service agencies working together systematically to provide a ready supply of qualified workers to employers with hiring needs. The intent of First Source is to connect these individuals with new jobs that are generated by the County's investment in contracts or public works; or by business activity that requires approval by the County's Department of Economic and Workforce Development.

The goals of the First Source Hiring Agreement are to:

- Increase awareness of the resources, services and potential benefits available to help Baltimore County employers meet their workforce needs; and,
- Give economically disadvantaged individuals the first opportunity to apply for new jobs in Baltimore County.

Which businesses can participate in First Source Hiring?

1. Businesses who have leases with the County or on County property; or,
2. Businesses with County contracts for goods, services, and grants under $300,000 which are projected to create new jobs/positions to fulfill contract terms

How can first source help your business?

Baltimore County Department of Economic & Workforce Development's (DEWD's) Business Services Team can help coordinate recruitment services with our workforce partners in collaboration with our three Baltimore County Career Center locations to assist with finding pre-screened, qualified candidates.

Available services may include but are not limited to:

- Posting and promotion of employment opportunities through our network of service providers
- Access to diverse talent pools from within Baltimore County's workforce system
- Access to Baltimore County Career Centers for coordinated recruitment/interviewing activities
- Referral of pre-screened, qualified candidates for employer consideration
- Assistance with using the Maryland Workforce Exchange - a statewide job database and candidate matching platform
- Information on earning tax credits and other employer benefits for new hires (if applicable)
- Workforce and Business Services staff to assist you throughout your recruitment efforts

I'd like to participate in First Source Hiring…Where do I start?

Step #1: Register your business with the Maryland Workforce Exchange. This is an online database to track First Source Hiring job opportunities. As an employer, the Maryland Workforce Exchange can help you promote job openings, search for qualified candidates and share placement information.

Step #2: Businesses or non-profits who receive a non-construction or professional services contract from Baltimore County under $300,000 are required to project the number of job openings they expect during the contract period. After registering your business with Maryland Workforce Exchange, complete the **First Source Hiring Description Form** and email it to the Baltimore County Department of Economic and Workforce Development (DEWD) at firstsourcehire@baltimorecountymd.gov . If you have any questions about registering with MWE or completing the form, contact our office at 410-887-8000.

Step #3: Once you are registered in MWE and Baltimore County receives your **First Source Hiring Description Form** via email, you will be contacted by a member of the Business Development Team to assist with recruitment for your open positions.

Helpful Tips:

Businesses that qualify are asked to post their openings with Baltimore County's First Source Hiring network of service providers, and offer the County the first opportunity to refer qualified candidates to those positions. While the agreement does not require an employer to hire a specific candidate, it does ask that employers make a good faith effort to hire referrals from the County's workforce development system. We ask that employers would report basic information for any new hires by entering the placement data in the Maryland Workforce Exchange, or by completing an Employment Verification and Employer Survey Form (see FORM 2 attached) or via email at the completion of your recruitment activities.

_____	_____
Company Name	Contact Name
_____	_____
Company Address	City, MD
_____	_____
E-mail Address	Telephone
_____	_____
Acknowledgment Signature	Date

STATE OF MARYLAND

DEPARTMENT OF LABOR
DIVISION OF LABOR AND INDUSTRY
PREVAILING WAGE SECTION
10946 Golden West Drive, Suite 160
Hunt Valley, MD 21031
(410) 767-2342

01/22/2026

REQUEST FOR ADVERTISEMENT AND NOTICE TO PROCEED

Heather Panowicz - Procurement Officer
Dept of Public Works and Transportation
111 West Chesapeake Ave Room 300B
Towson, MD 21204

Re: Northwest Regional Park Splash Pad

Project No: 25114 GX0

Enclosed please find the Prevailing Wage Determination and Instructions for Contractors for the project referenced above.

Upon advertisement for bid or proposal of this project, you are requested to submit to this office the date and name of publication in which such advertisement appeared.

Once awarded, you are further directed to submit to this office, the NOTICE TO PROCEED for the project, complete with the date of notice, the name of the general contractor, and the dollar amount of the project. In addition, we ask that a representative of the prevailing wage Unit be invited to attend the Pre-Construction Conference.

Any questions concerning this matter may be referred to PrevailingWage@dllr.state.md.us

Sincerely,

Enclosures
Wage Determination
Instruction for the Contractor

Prevailing Wage Unit

PREVAILING WAGE INSTRUCTIONS FOR THE CONTRACTOR & SUBCONTRACTOR

The contractor shall electronically submit completed copies of certified payroll records to the Commissioner of Labor & Industry, Prevailing Wage Unit by going on-line to https://www.dllr.state.md.us/prevwage and following the instructions for submitting payroll information (NOTE: A contractor must register prior to submitting on-line certified payroll information).

If you have technical questions regarding electronic submittal, contact the Department at dldliprevailingwage-dllr@maryland.gov.

All certified payroll records shall have an accurate week beginning and ending date. The contractor shall be responsible for certifying and submitting to the Commissioner of Labor and Industry, Prevailing Wage Unit all of their subcontractors' payroll records covering work performed directly at the work site. By certifying the payroll records, the contractor is attesting to the fact that the wage rates contained in the payroll records are not less than those established by the Commissioner as set forth in the contract, the classification set forth for each worker or apprentice conforms with the work performed, and the contractor or subcontractor has complied with the provisions of the law.

A contractor or subcontractor may make deductions that are (1) required by law; (2) required by a collective bargaining agreement between a bona fide labor organization and the contractor or subcontractor; or (3) contained in a written agreement between an employee and an employer undertaken at the beginning of employment, if the agreement is submitted by the employer to the public body awarding the public work and is approved by the public body as fair and reasonable.

A contractor or subcontractor is required to submit information on-line on their fringe benefit packages including a list of fringe benefits for each craft employed by the contractor or subcontractor, by benefit and hourly amount. Where fringe benefits are paid in cash to the employee or to an approved plan, fund, or program, the contribution is required to be indicated.

Payroll records must be electronically submitted and received within 14 calendar days after the end of each payroll period. If the contractor is delinquent in submitting payroll records, processing of partial payment estimates may be held in abeyance pending receipt of the records. In addition, if the contractor is delinquent in submitting the payroll records, the contractor shall be liable to the contracting public body for liquidated damages. The liquidated damages are $10.00 for each calendar day the records are late.

Only apprentices registered with the Maryland Apprenticeship and Training Council shall be employed on prevailing wage projects. Apprentices shall be paid a percentage of the determined journey person 's wage for the specific craft.

Overtime rates shall be paid by the contractor and any subcontractors under its contracts and agreements with their employees which in no event shall be less than time and one-half the prevailing hourly rate of wages for all hours worked in excess of ten (10) hours in any one calendar day; in excess of forty (40) hours per workweek; and work performed on Sundays and legal holidays.

Contractors and subcontractors employing a classification of worker for which a wage rate was not issued SHALL notify the Commissioner of Labor & Industry, Prevailing Wage Unit, for the purpose of obtaining the wage rate for said classification PRIOR TO BEING EMPLOYED on the project. To obtain a prevailing wage rate which was NOT listed on the Wage Determination, a contractor or subcontractor can look on the LABOR webpage under prevailing wage.

Contractors and subcontractors shall maintain a valid copy of proper State and county licenses that permit the contractor and a subcontractor to perform construction work in the State of Maryland. These licenses must be retained at the worksite and available for review upon request by the Commissioner of Labor and Industry’s designee.

**Each contractor under a public work contract subject to Section 17-219 shall:

1. Post a clearly legible statement of each prevailing wage rate to be paid under the public work contract; and
2. Keep the statement posted during the full time that any employee is employed on the public work contract.
3. The statement of prevailing wage rates shall be posted in a prominent and easily accessible place at the site of the public work.

****Penalty - Subject to Section 10-1001 of the State Goverment Article, the Commissioner may impose on a person that violates this section a civil penalty of up to $50.00 per violation.**

Under the Maryland Apprenticeship and Training Council requirements, consistent with proper supervision, training and continuity of employment and applicable provisions in collective bargaining agreements, a ratio of one journey person regularly employed to one apprentice shall be allowed. No deviation from this ratio shall be permitted without prior written approval from the Maryland Apprenticeship and Training Council.

Laborers may NOT assist mechanics in the performance of the mechanic's work, NOR USE TOOLS peculiar to established trades.

ALL contractors and subcontractors shall employ only competent workers and apprentices and may NOT employ any individual classified as a HELPER or TRAINEE on a prevailing wage project.

The State Apprenticeship and Training Fund (Fund) law provides that contractors and certain subcontractors performing work on certain public work contracts are required to make contributions toward apprenticeship. See §17-601 through 17-606, State Finance and Procurement, Annotated Code of Maryland. Contractors and subcontractors have three options where they can choose to make their contributions: (1) participate in a registered apprenticeship training program; (2) contribute to an organization that has a registered apprenticeship training program; or (3) contribute to the State Apprenticeship and Training Fund.

The Department of Labor (LABOR) is moving forward with final adoption of regulations. The regulations were published in the December 14, 2012 edition of the Maryland Register.

IMPORTANT: Please note that the obligations under this law will become effective on JULY 1, 2013. This law will require that contractors and certain subcontractors make contributions toward apprenticeship and report those contributions on their certified payroll records that they submit pursuant to the prevailing wage law.

The Department is offering outreach seminars to any interested parties including contractors, trade associations, and any other stakeholders. Please contact the Department at dldliprevailingwage-dllr@maryland.gov or (410) 767-2968 for seminar times and locations. In addition, information regarding this law will be provided at pre-construction meetings for projects covered by the Prevailing Wage law.

For additional information, contact:
Division of Labor and Industry
Maryland Apprenticeship and Traning
1100 North Eutaw Street, Room 606
Baltimore, Maryland 21201
(410) 767-2246
E-Mail Address: matp@dllr.state.md.us.

STATE OF MARYLAND

DEPARTMENT OF LABOR
DIVISION OF LABOR AND INDUSTRY
PREVAILING WAGE SECTION
1100 N. Eutaw Street, Room 607
Baltimore, MD 21201
(410) 767-2342

The wage rates to be paid laborers and mechanics for the locality described below is announced by order of Commissioner of Labor and Industry.

It is mandatory upon the successful bidder and any subcontractor under him, to pay not less than the specific rates to all workers employed by them in executing contracts in this locality. Reference: Annotated Code of Maryland State Finance and Procurement, Section 17-201 thru 17-226.

These wage rates were taken from the locality survey of 2025 for Baltimore County, issued pursuant to the Commissioner's authority under State Finance and Procurement Article Section 17-209, Annotated Code of Maryland or subsequent modification.

**Note: If additional Prevailing Wage Rates are needed for this project beyond those listed below, contact the Prevailing Wage Unit. Phone: (410) 767-2342, email: prevailingwage@dllr.state.md.us.

Name and Title of Requesting Officer: Heather Panowicz - Procurement Officer

Department, Agency or Bureau: Dept of Public Works and Transportation
111 West Chesapeake Ave Room 300B Towson, MD 21204

Project Number
25114 GX0

Location and Description of work:

Baltimore County: Design improvements including water play facilities with supporting developments such as a comfort station with changing rooms and expanded parking to accommodate growth.

Determination Number
64861

Date of Issue: Jan 22, 2026

BUILDING CONSTRUCTION

CLASSIFICATION	MODIFICATION REASON	BASIC HOURLY RATE	BORROWED FROM	FRINGE BENEFIT PAYMENT
BALANCING TECHNICIAN	AD	$50.92		$24.61
BRICKLAYER	AD	$37.39		$15.25
CARPENTER	AD	$35.89		$14.60
CARPENTER - SHORING SCAFFOLD BUILDER	AD	$35.89		$14.60
CARPET LAYER	AD	$35.89		$14.60
COMMUNICATION INSTALLER TECHNICIAN	AD	$34.10		$17.42
DRYWALL - SPACKLING, TAPING, & FINISHING	AD	$35.89		$14.60
ELECTRICIAN	AD	$48.25		$21.14
ELEVATOR MECHANIC	AD	$58.81		$46.61
FIREPROOFER - BY HAND	AD	$17.00	510	$2.24
FIREPROOFER - SPRAYER	AD	$29.70		$7.48

FIRESTOPPER	AD	$30.21		$10.68
GLAZIER	AD	$36.65		$14.61
INSULATION WORKER	AD	$40.77		$20.42
IRONWORKER - FENCE ERECTOR	AD	$48.25	003	$21.11
IRONWORKER - ORNAMENTAL	AD	$39.30		$27.14
IRONWORKER - REINFORCING	CR	$30.18		$24.09
IRONWORKER - STRUCTURAL	AD	$39.01		$29.53
MILLWRIGHT	AD	$39.50		$17.52
PAINTER	AD	$29.16		$12.01
PAINTER-INDUSTRIAL	AD	$36.37	510	$16.21
PILEDRIVER	AD	$37.74		$17.64
PLASTERER - MIXER	AD	$20.00	510	$2.24
PLUMBER	AD	$47.78		$25.93
POWER EQUIPMENT OPERATOR - BACKHOE	AD	$35.18		$15.12
POWER EQUIPMENT OPERATOR - BROOM / SWEEPER	AD	$33.23	510	$15.12
POWER EQUIPMENT OPERATOR - BULLDOZER	AD	$35.18		$15.12
POWER EQUIPMENT OPERATOR - CONCRETE PUMP	AD	$35.18	510	$15.12
POWER EQUIPMENT OPERATOR - CRANE	AD	$42.00		$19.10
POWER EQUIPMENT OPERATOR - CRANE - TOWER	AD	$42.00	510	$19.10
POWER EQUIPMENT OPERATOR - DRILL - RIG	AD	$35.18	510	$0.00
POWER EQUIPMENT OPERATOR - EXCAVATOR	AD	$35.18		$15.12
POWER EQUIPMENT OPERATOR - FORKLIFT	AD	$35.18		$15.12
POWER EQUIPMENT OPERATOR - LOADER	AD	$35.18		$15.12
POWER EQUIPMENT OPERATOR - MECHANIC	AD	$37.24		$15.12
POWER EQUIPMENT OPERATOR - ROLLER - ASPHALT	AD	$22.00		$3.58
POWER EQUIPMENT OPERATOR - ROLLER - EARTH	AD	$29.60		$15.12
POWER EQUIPMENT OPERATOR - SKID STEER (BOBCAT)	AD	$33.23		$15.12
POWER EQUIPMENT OPERATOR-VACUUM TRUCK	AD	$38.60		$15.75
RESILIENT FLOOR	AD	$35.10		$15.33
ROOFER/WATERPROOFER	AD	$34.76	510	$14.91
SHEETMETAL WORKER (INCLUDING METAL ROOFING)	AD	$50.92		$24.61
SPRINKLERFITTER	AD	$42.32		$26.64
STEAMFITTER/PIPEFITTER	AD	$47.78		$25.93
STONE MASON	AD	$45.65	510	$21.51
TILE & TERRAZZO FINISHER	AD	$28.85		$12.85
TILE & TERRAZZO MECHANIC	AD	$34.34		$14.50
TRUCK DRIVER - DUMP	AD	$26.73		$7.65
TRUCK DRIVER - FLATBED	AD	$26.25	025	$7.60
TRUCK DRIVER - LOWBOY	AD	$31.50	027	$9.19
LABORER GROUP II				
LABORER - ASPHALT RAKER	AD	$19.73		$4.61
LABORER - COMMON	AD	$19.73		$4.61
LABORER - CONCRETE PUDDLER	AD	$19.73		$4.61
LABORER - CONCRETE TENDER	AD	$19.73		$4.61
LABORER - CONCRETE VIBRATOR	AD	$19.73		$4.61
LABORER - DENSITY GAUGE	AD	$19.73		$4.61

LABORER - FIREPROOFER - MIXER	AD	$19.73	$4.61
LABORER - FLAGGER	AD	$19.73	$4.61
LABORER - GRADE CHECKER	AD	$19.73	$4.61
LABORER - HAND ROLLER	AD	$19.73	$4.61
LABORER - JACKHAMMER	AD	$19.73	$4.61
LABORER - LANDSCAPING	AD	$19.73	$4.61
LABORER - LAYOUT	AD	$19.73	$4.61
LABORER - LUTEMAN	AD	$19.73	$4.61
LABORER - MORTAR MIXER	AD	$19.73	$4.61
LABORER - PLASTERER - HANDLER	AD	$19.73	$4.61
LABORER - TAMPER	AD	$19.73	$4.61
LABORERS GROUP I			
LABORER - AIR TOOL OPERATOR	AD	$28.00	$6.84
LABORER - ASPHALT PAVER	AD	$28.00	$6.84
LABORER - BLASTER - DYNAMITE	AD	$28.00	$6.84
LABORER - BURNER	AD	$28.00	$6.84
LABORER - CONCRETE SURFACER	AD	$28.00	$6.84
LABORER - HAZARDOUS MATERIAL HANDLER	AD	$28.00	$6.84
LABORER - MASON TENDER	AD	$28.00	$6.84
LABORER - PIPELAYER	AD	$28.00	$6.84
LABORER - SCAFFOLD BUILDER	AD	$28.00	$6.84

Incidental Craft Data: Caulker, Man Lift Operator, Rigger, Scaffold Builder, and Welder receive the wage and fringe rates prescribed for the craft performing the operation to which welding, scaffold building, rigging, operating a Man Lift, or caulking is incidental.

These **Informational Prevailing Wage Rates** may not be substituted for the requirements of pre-advertisement or onsite job posting for a public work contract that exceeds $250,000 in value and either of the following criteria are met: (1) the contracting body is a unit of State government or an instrumentality of the State and there is any State funding for the project; or (2) the contracting body is a political subdivision, agency, person or entity (such as a county) and the State funds 25% or more of the project.

Modification Codes:

(AD) 17-209 Annual Determination from Survey Wage Data Received
(CH) 17-211 Commissioners' Hearing
(CR) 17-208 Commissioners' Review
(SR) 17-208 Survey Review by Staff

Each "Borrowed From" county is identified with the FIPS 3-digit county code unique for the specific jurisdiction in Maryland.

For additional information on the FIPS (Federal Information Processing Standard) code, see http://www.census.gov/datamap/fipslist/AllSt.txt

The Prevailing Wage rates appearing on this form were originally derived from Maryland's annual Wage Survey. The Commissioner of Labor & Industry encourages all contractors and interested groups to participate in the voluntary Wage Survey, detailing wage rates paid to workers on various types of construction throughout Maryland.

A mail list of both street and email addresses is maintained by the Prevailing Wage Unit to enable up-to-date prevailing wage information, including Wage Survey notices to be sent to contractors and other interested parties. If you would like to be included in the mailing list, please forward (1) your Name, (2) the name of your company (if applicable), (3) your complete postal mailing address, (4) your email address and (5) your telephone number to PWMAILINGLIST@dllr.state.md.us. Requests for inclusion can also be mailed to: Prevailing Wage, 1100 N. Eutaw Street - Room 607, Baltimore MD 21201-2201.

BALTIMORE COUNTY, MARYLAND

USE OF MINORITY BUSINESS ENTERPRISES AND WOMEN'S BUSINESS ENTERPRISES

IN
COUNTY CONTRACTS

MWBE Plan Package

Division of Diversity, Equity and Inclusion
The Jefferson Building
105 West Chesapeake Avenue
Towson, Maryland 21204
410-887-3407
www.baltimorecountymd.gov/go/mwbe

PROSPECTIVE BIDDERS/OFFERORS

Baltimore County Executive Order 2022-005 Use of Minority Business Enterprises and Women's Business Enterprises states:

SECTION 6. BID REQUIREMENTS.
(A)(l) All bidders shall submit a list of all subcontractors contacted in preparation of their bid package or proposal.
(2) The list shall include the service to be performed, bid amount, and the race/ethnicity/gender of the business owner(s).
(B)(l) All bidders shall submit a list of all subcontractors to be used on a county contract in the bid package.
(2) This list shall include all subcontractors (both MWBE and non-MWBE) used, the service to be performed, the total amount to be paid, and the race/ethnicity/gender of the owner.

If the solicitation includes a MWBE **subcontracting** goal, you **MUST** demonstrate **"Good Faith" effort** either by**:**

1. Complete and sign FORM A, FORM B (to include FORM B-Prime if MWBE Prime wishes to count towards the goal) and FORM C **listing all subcontractors** with the initial bid submission.
    a. *All Forms must be completed and signed. However, FORM C **MUST** be completed and signed by both the prime and the MWBE subcontractor.*

OR

2. If you are unable to meet any portion of the goal, you **MUST** do one of the following**:**

    a. If you are requesting a **partial waiver**, complete and sign FORM A with initial bid submission. FORM B (to include FORM B-Prime if MWBE Prime wishes to count towards the goal) and FORM C **(listing all subcontractors**). In addition, complete, sign and submit FORM D and FORM E **accompanied with all supporting documentation** for the portion of the goal that will not be achieved as specified on FORM A.
    b. If you are requesting a **full waiver**, complete and sign FORM A indicating your intent to request a full waiver **accompanied with a completed and signed FORM C listing all subcontractors**, FORM D and FORM E **accompanied with all supporting documentation**. **This MUST be submitted with the initial bid as specified on FORM A.**
    c. *All Forms must be completed and signed. FORM C and FORM D **MUST** be completed and properly signed **by both** the Prime **AND the MWBE subcontractor(s).***

NOTE: The MWBE **subcontracting** goal applies to **ALL** prime/general contractors including certified and non-certified minority and women owned firms. **However, a Minority-owned or a Women-owned prime may self-perform up to 50% of MWBE subcontracting goal set in the solicitation. The MWBE primes that wish to count towards the goal must list themselves on all appropriate forms.**

12/2023

BALTIMORE COUNTY, MARYLAND
MWBE PARTICIPATION SUMMARY

Executive Order: Minority Business Enterprises and Women Business Enterprises (MWBE) shall have the maximum opportunity to participate in the performance of contracts financed in whole, or in certain circumstances, in part with County funds. Accordingly, on December 6, 2022, the County Executive adopted the EXECUTIVE ORDER No. 2022-005 addressing MWBE participation in County contracts. The December 6, 2022 Executive Order may be found on the Baltimore County website at www.baltimorecountymd.gov/go/mwbe.

Each Contract: The County shall establish a minimum MWBE participation amount for each contract, as applicable.

Bidder/Offeror Responsibility: The bidder/offeror shall ensure that MWBE participation occurs in accordance with the contract requirements and the County Executive's Executive Order. All bidder/offerors shall ensure that MWBE have the maximum opportunity to compete for and perform County contracts, as applicable. Baltimore County, Maryland, and/or its bidder/offerors and contractors shall not discriminate on the basis of race, color, national origin, disability or sex in the award and performance of any County contract.

Mobilization Payments: For subcontractors, project start-up costs can also be significant. A subcontractor that has limited resources and access to credit may find that start-up expenses inhibit its ability to bid County contracts. Under circumstances where mobilization payments are approved for the prime contractor, the subcontractor should be paid an amount equal to their participation percentage no later than five (5) business days before they are required to mobilize to perform the contracted work.

Mobilization costs represent pre-contract costs incurred by a contractor to prepare a job site before the actual commencement of the contract. These costs can include movement of personnel and equipment to the project site and for the establishment of the Contractor's offices, buildings, and other facilities necessary to begin work.

APPROVED MWBE LISTINGS

Published compilations of approved and certified MWBE, contractors, subcontractors, material suppliers, etc. include:

DIRECTORY OF MINORITY BUSINESS ENTERPRISE (MDOT):

https://marylandmdbe.mdbecert.com

MINORITY BUSINESS DIRECTORY OF THE CITY OF BALTIMORE:

https://baltimorecity.diversitycompliance.com

BIDDER/OFFEROR'S ACTIONS

Seeking Firms:

The bidder/offeror will seek commitments by subcontract or otherwise from MWBE firms for supplies and/or services, any combined value of which equals or exceeds the required percentage of MWBE participation goal for the County contract. However a MWBE Prime that affirms its MWBE status on the Minority and/or Women Prime Participation Affidavit may count up to 50% of the goal.

Expenditures for Materials and Supplies:
A bidder/offeror may count toward its MWBE contract requirements all expenditures for materials and supplies obtained from MWBE suppliers and manufacturers, provided that the MWBE firm is furnishing and installing the materials and is certified to perform these services. If the MWBE firm is only being used as a supplier, wholesaler and/or regular dealer or is not certified to install the supplies/materials, for purposes of achieving the MWBE participation goal, you may only count sixty percent (60%) of the value of the subcontract for these supplies/products (60% Rule). To apply the 60% Rule, first divide the amount of the subcontract for these supplies/products only (not installation) by the total Contract value. Then, multiply the result by sixty percent (60%) and insert the percentage in the Percent of Total Contract field of Form B Subcontractor Participation Schedule.

BALTIMORE COUNTY, MARYLAND
MWBE PARTICIPATION SUMMARY

Information to be supplied: All bidder/offerors shall submit the following information to the County at the time of bid submission:

1. The name of an employee designated as the bidder/offeror's liaison to the County's Minority Business Enterprise Office.

2. The following forms shall be completed and submitted:
   - Certified MWBE Utilization and Fair Solicitation Affidavit (**Form A);** from among those names appearing in the Approved MWBE Listings (excepting Federal Highway Administration projects, which exclusively require DBE approved and certified by the Maryland Department of Transportation MBE Advisory Committee);
   - A Subcontractor Participation Schedule (**Form B**) completed by the prime contractor for each MWBE listed on the Form.
   - A MWBE Prime Participation Schedule (Form B-Prime) completed by a MWBE prime contractor if the firm wishes to self-perform up to 50% of the MBE/WBE goal.
   - A MWBE Disclosure and Participation Statement (**Form C**) completed and signed by the prime contractor and MWBE firm for each MWBE listed on the Form. Form C **must match** what is stated on Form B.

   - If applicable, MWBE Subcontractor Unavailable Certificate (**Form D**) completed and signed by the prime contractor and MWBE for each MWBE listed on the Form.

3. If applicable, MWBE Outreach Efforts - Compliance Statement (**Form E**) completed and signed by the Bidder/Offeror. The prime shall submit a list of all subcontractors.

4. For DPW contracts, if the bidder/offeror intends to fulfill the MWBE requirements by use of a joint venture, he/she must submit a Joint Venture Disclosure Affidavit (**Form D-EEO-006-A** and **B** showing the extent of MWBE participation. If a bidder/offeror intends to use a MWBE joint venture as a subcontractor to meet its MWBE requirements, the affidavit must be submitted through the bidder/offeror by the proposed subcontractors and signed by all parties.

5. If the bidder/offeror's proposed MWBE participation does not meet the MWBE contract requirements, information sufficient to demonstrate that the bidder/offeror has made every effort to meet the requirements must be submitted. (See DETERMINATION OF BID RESPONSIVENESS hereafter)

RECORDS AND REPORTS

Returning Records: The bidder/offeror must keep such records as are necessary to determine compliance with its MWBE utilization requirements:

1. The MWBE and non-minority contractors, type of work being performed, actual values of work and services.

2. Documentation of all correspondence, contacts, telephone calls, etc., to obtain MWBE services for the contract.

3. All prime contractors and MWBE sub-contractors are required to report monthly, by the 10th of each month, to the County through an online system called PRISM. If the contractor cannot submit his/her report on time, he/she will notify the County MWBE office and request additional time to submit the report. Failure of the contractor to report in a timely manner may result in a finding of noncompliance. The County in its sole discretion and/or upon written request may require additional reports regarding MWBE. In the event you are not able to enter your payments in PRiSM, a spreadsheet is attached for your use. Please be sure to list the PO for each invoice/ payment reported and include in your submission any corresponding documentation (e.g. copies of invoices or cancelled checks).

Retaining Records: All MWBE records must be retained for 3 years following the expiration or any earlier termination of the contract and shall be available for inspection and photocopying by the County.

Investigation and Notification: Whenever the County believes the bidder/offeror, contractor, or any subcontractor may not be operating in compliance with the MWBE requirements, the County may, in its sole discretion, conduct an investigation. If the County finds the bidder/offeror, contractor, or any subcontractor is not in compliance with the MWBE requirements, the County may exercise any and all rights and remedies available to the County, under the contract, at law or equity, as deemed applicable and appropriate by the County in its sole discretion.

BALTIMORE COUNTY, MARYLAND
MWBE PARTICIPATION SUMMARY

DETERMINATION OF BID RESPONSIVENESS

Request for Deviation: If the bidder/offeror is unable to procure from MWBE firms (by subcontract or otherwise), supplies and services, any combined value of which equals the required percentage of the total value of the contract, the bidder/ offeror may request, in writing, a deviation or waiver of the contract requirements. To obtain such a waiver, the bidder/ offeror must submit the following information at the time bids are due:

1. The request for waiver request shall include (1) a signed unavailability statement (Form D) executed by all MBEs and WBEs that the bidder/offeror solicited for participation and (2) Outreach Efforts/Compliance Statement (Form E) that demonstrates the bidder/offeror's good faith efforts to comply with the contract requirements, including copies of solicitation documentation to all potential subcontractors:

2. Emails, letters, facsimile transmittals and confirmations containing plans, specifications, and anticipated time schedule for portions of the work to be performed and meeting notes and agendas clearly identifying the certified MBE or WBE classification and dates that the bidder/offeror contacted each MWBE; and

3. Telephone logs containing names, addresses, dates, telephone numbers, work to be performed, anticipated time schedule and classification of certified MBEs and WBEs contacted.

Bid Rejection: The failure of any bidder/offeror (including the apparent low bidder/offeror) to provide a responsive MWBE Plan as required by the solicitation may result in the bidder/offeror being deemed non-responsive and the County's rejection of the bid.

Liquidated Damages If the County issues a notice of intent to awards contract to the apparent low bidder/offeror who provided a responsive MWBE Plan, but, if after said notice and before execution of Contract Documents, it is determined by the County that the apparent low bidder/offeror has failed to comply with the MWBE Plan, such failure may result in the recommendation by the appropriate Procurement Official to annul the award and forfeit the bidder/offeror's Proposal Guaranty to the County, not as a penalty, but as liquidated damages, it being acknowledged that actual damages will be difficult if not impossible to accurately measure. In addition, the County may proceed as it determines to be in its best interest, including but not limited to, the Notice of Award may be made to the next lowest responsive and responsible bidder/offeror or the work may be re-advertised.

Contract Breach: If, after execution of a County contract, the contractor becomes aware it may or will fail to fulfill the applicable MWBE requirements and/or may or will deviate from the contractor's bid response/contract terms, the contractor shall promptly advise the County of this in writing. Thereafter, the County will determine what action or remedy is appropriate on a case-by-case basis, in the County's sole discretion.

Approval Required for Changes: Any and all changes to the MWBE subcontractors or the type or amount of work to be performed by such subcontractors during the contract term must be mutually agreeable to the County and the contractor and shall be documented via a contract amendment, executed by legally authorized representatives of the County and the contractor.

Cooperation in Reviews: The bidder/offeror will cooperate with the County in any reviews of the contractor's procedures and practices with respect to MBE or WBE firms, which the County may from time to time conduct in its sole discretion.

Other: If the documents used to determine the contractor's efforts, achievement of, and/or the status of an MWBE requirement or fulfillment thereof contain false, misleading or misrepresented information, the contractor may be declared in breach of the contract and the County may take any and all actions and/or remedies available to the County under the contract, at law, or in equity. If an MWBE is disqualified by any public entity, including but not limited to, Baltimore City, the State or MDOT, at any time after award or during the term of the contract, the County may, in its sole discretion, require the prime contractor to promptly submit for County approval, the contractor's plans for fulfilling the required MWBE participation under the contract, and/or request such detail and additional information as the County, in its discretion deems appropriate.

PRIME CONTRACTOR MINORITY AND WOMEN PARTICIPATION AFFIDAVIT

A. AUTHORIZED REPRESENTATIVE

I HEREBY AFFIRM THAT:

I am the [title]_____and the duly authorized representative of [business] _____ (the "Business") and that I possess the legal authority to make this Affidavit on behalf of myself and the Business for which I am acting.

B. AFFIRMATION REGARDING MINORITY AND WOMEN PARTICIPATION

I FURTHER AFFIRM THAT:

I am aware that, pursuant to the December 6, 2022 Executive Order of Baltimore County, Maryland, the following words have the meanings indicated.

(A) "Minority Business Enterprise" or "MBE" means a business enterprise that is owned, operated and controlled by one or more minority group members (African American, Hispanic American, Asian American, or Native American) who have at least 51% ownership and in which the minority group members have operational and managerial control, interest in capital and earnings commensurate with their percentage of ownership.

(B) "Women's Business Enterprise" or "WBE" means a business enterprise that is owned, operated and controlled by one or more women who have at least 51% ownership and in which the women have operational and managerial control, interest in capital and earnings commensurate with their percentage of ownership.

____ The Prime is a MBE ☐ or WBE ☐

☐ Maryland State Department of Transportation (MDOT) #_____

☐ City of Baltimore #_____

☐ Name Other Jurisdiction:_____#_____

☐ The ownership of the Noncertified MWBE business consists of___ ___% minorities and ___% women (for a total of____ %), each of which has operational and managerial control, interest in capital and earnings commensurate with their percent ownership.

_____ % African American_____% Hispanic American_____% Women
_____ % Asian American _____% Native American _____% Disadvantaged (DBE)

___The MWBE prime anticipates meeting up to 50% of the stated participation goal with its own workforce. **MWBE primes percentage must be stated on the MWBE PRIME PARTICIPATION SCHEDULE (FORM B-PRIME) to count towards the goal**.

___The prime anticipates ☐ does not anticipate ☐ utilizing subcontractors for_____% of the work of the contract requirements, of which it anticipates_____% will be MBEs and____% will be WBEs.

I DO SOLEMNLY DECLARE AND AFFIRM UNDER THE PENALTIES OF PERJURY THAT THE CONTENTS OF THIS AFFIDAVIT ARE TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE, INFORMATION, AND BELIEF.

Date: _____ By:_____
(Authorized Representative and Affiant's Name and Title)

BALTIMORE COUNTY, MARYLAND
Certified MWBE Utilization and Fair Solicitation Affidavit
(FORM A)

This document must be completed and submitted with Bid/Proposal to Baltimore County.

NOTE: If you do not complete and submit this form with your bid or offer to the County, the County may, in its sole discretion, deem your bid or offer NON-RESPONSIVE and accordingly the COUNTY WILL NOT CONSIDER YOU FOR CONTRACT AWARD.

* * * * * * * * * * * * * * *

I acknowledge the goal for solicitation #25114 GX0 is a minimum of 30 %. This goal must be met by any combination of the MWBE subcontractors. However, for instances where the Prime is counting up to 50% of the goal, the remaining goal balance must be met by any combination of the MWBE subcontractors.

- The goal breakdown is as follows:
  - ____% Minority/Women Prime
  - ____ % for certified MBE-owned businesses and/or
  - ____ % for certified WBE-owned businesses.

I have made a good-faith effort to achieve this MWBE solicitation requirement. If awarded the contract, I will comply with this MWBE contract requirement and will continue to use my best efforts to increase MWBE participation during the contract term.

PLEASE CHECK ONE BOX (EITHER 1, 2, OR 3)

1 ☐ Prime has met the MWBE contract requirements for this solicitation and contract. I submit the Subcontractor Participation Form B and Form C, along with this Affidavit, which details how the Prime will achieve the contract requirements. Submit a complete list of all additional subcontractors

Or

2 ☐ After having made a good-faith effort to achieve the MWBE requirements, the Prime can only achieve partial success. I submit the Subcontractor Participation Form B, Form C, Form D and Form E along with this Affidavit, which details how the Prime will partially achieve the contract requirements. Submit a complete list of all additional subcontractors

I request a partial waiver and will meet the following MWBE participation goals:

- Partial waiver of MWBE subcontract participation:
  - ____% Minority/Women Prime
  - ____ % for certified MBE-owned businesses and/or
  - ____ % for certified WBE-owned businesses.

Or

3 ☐ After having made a good faith effort to achieve the MWBE requirements for this contract, the Prime is unable to achieve the requirements and/or sub requirements for this contract. I submit the MWBE Participation Form D and Form E, along with this Affidavit, which details the steps the Prime has taken in an attempt to achieve the contract requirements. Therefore, I request a full waiver.

IF YOU HAVE CHECKED BOX 2 OR 3, THE FOLLOWING IS APPLICABLE:

1) If a bidder is unable to comply with the goals established in a bid for a project, the bidder may submit a request for a waiver at the time of bid submission. However, occasions for granting waivers will be limited.

2) The request for waiver shall include documentation that demonstrates the bidder's good faith efforts to comply with the goals, including:
   a. Signed unavailability statements from all MBEs and WBEs that the bidder solicited for participation; and
   b. Copies of solicitation documentation to include the scope of services to be performed by the subcontractors accompanied with the following:
      i. Emails, letters, facsimile transmittals and confirmations containing plans, specifications, and anticipated time schedule for portions of the work to be performed and meeting notes and agendas clearly identifying the certified MBE or WBE classification and dates that the bidder contacted each; and
      ii. Telephone logs containing names, addresses, dates, telephone numbers, work to be performed, anticipated time schedule and classification of certified MBEs and WBEs contacted.
      iii. Responses from MWBE firms contacted to fulfill the goal.

As I have checked Box 2 or 3 of this Affidavit, I understand I must submit the following supporting documentation with the bid:

- *Subcontractor Participation Schedule* (Form B)
- *MWBE Subcontractor Disclosure and Participation Statement* (Form C)
- *MWBE Subcontractors Unavailable Certificate* (Form D) (if applicable)
- *MWBE Outreach Efforts – Compliance Statement* (Form E) (if applicable)

I acknowledge that the MWBE subcontractors/suppliers listed on the *Subcontractor Participation Schedule* (Form B) will be used to accomplish the percentage of MWBE participation that the Prime shall achieve. A fully executed Form C must match Form B.

In the solicitation of subcontract quotations or offers, MWBE subcontractors were provided the same information and amount of time to respond, as were non-MWBE subcontractors.

The solicitation process was conducted in such a manner so as to not place MWBE subcontractors at a competitive disadvantage to non-MWBE subcontractors.

I solemnly affirm under the penalties of perjury that this Affidavit is true to the best of my knowledge, information, and belief.

Bidder/Offeror Name	Phone Number
Address	Affiant Signature
Address (continued)	Printed Name & Title
E-mail address	Date

BALTIMORE COUNTY, MARYLAND
SUBCONTRACTOR PARTICIPATION SCHEDULE (FORM B)

**This document must be completed and submitted with Bid/Proposal to Baltimore County.*

NOTE: If you do not complete and submit this form with your bid or offer to the County, the County may, in its sole discretion, deem your bid or offer NON-RESPONSIVE and accordingly the COUNTY WILL NOT CONSIDER YOU FOR CONTRACT AWARD.

Prime Name	**Prime Address, Telephone Number and Email**
Bid/Proposal Name and Number	**Project Location**
	Base Bid $_____
1. Subcontractor Name and Tax ID	**Subcontractor Address**
Telephone Number _____ **Email Address** _____ **Select One:** ☐ **MBE** ☐ **WBE** ☐ **SBE** ☐ **N/A** **Provide if Applicable:** ☐ **MDOT** ☐ **Baltimore City** **#**_____	**Minority Status (If applicable):** ☐ **African American** ☐ **Female** ☐ **Asian American Pacific** ☐ **Native American** ☐ **Asian American Sub-continent** ☐ **Hispanic American** ☐ **Supplier, Wholesaler and/or Regular Dealer - 60% Rule**
NAICS Code(s), Work to be Performed and Subcontract Dollar Amount	**Percent of Total Contract (See instructions on Page 1 of the MWBE PARTICIPATION SUMMARY for 60% rule)** _____%
2. Subcontractor Name and Tax ID	**Subcontractor Address**
Telephone Number _____ **Email Address** _____ **Select One:** **MBE** ☐ **WBE** ☐ **SBE** ☐ **N/A** ☐ **Provide if Applicable:** ☐ **MDOT** ☐ **Baltimore City** **#**_____	**Minority Status (If applicable):** ☐ **African American** ☐ **Female** ☐ **Asian American Pacific** ☐ **Native American** ☐ **Asian American Sub-continent** ☐ **Hispanic American** ☐ **Supplier, Wholesaler and/or Regular Dealer - 60% Rule**
NAICS Code(s), Work to be Performed and Subcontract Dollar Amount	**Percent of Total Contract (See instructions on Page 1 of the MWBE PARTICIPATION SUMMARY for 60% rule)** _____%
3. Subcontractor Name and Tax ID	**Subcontractor Address**
Telephone Number _____ **Email Address** _____ **Select One:** **MBE** ☐ **WBE** ☐ **SBE** ☐ **N/A** ☐ **Provide if Applicable:** ☐ **MDOT** ☐ **Baltimore City** **#**_____	**Minority Status (If applicable):** ☐ **African American** ☐ **Female** ☐ **Asian American Pacific** ☐ **Native American** ☐ **Asian American Sub-continent** ☐ **Hispanic American** ☐ **Supplier, Wholesaler and/or Regular Dealer - 60% Rule**
NAICS Code(s), Work to be Performed and Subcontract Dollar Amount	**Percent of Total Contract (See instructions on Page 1 of the MWBE PARTICIPATION SUMMARY for 60% rule)** _____%
Subcontractor Total Dollar Amount $_____	**Total Subcontractor Percent of Entire Contract** _____%
Form Prepared by: **Name/Date:** _____ **Title:** _____ **Email:** _____	**Reviewed and Accepted by Baltimore County Minority Business Enterprise Office** **Name** _____ **Title** _____ **Date** _____

MBE or WBE Prime Participation Total	_____%	$_____
MBE Subcontracting Participation Total	_____%	$ _____
WBE Subcontracting Participation	_____%	$ _____
Total MWBE Participation	_____%	$ _____
Total SBE Participation	_____%	$ _____

BALTIMORE COUNTY, MARYLAND

MWBE PRIME PARTICIPATION SCHEDULE
(Form B-Prime)

PLEASE COMPLETE AND SUBMIT THIS FORM TO ATTEST EACH SPECIFIC ITEM OF WORK THAT YOU AS THE MWBE PRIME FIRM WILL PERFORM USING ITS OWN WORKFORCE PERTAINING TO THE PERCENTAGE STATED ON THE SUBCONTRACTOR PARTICIPATION SCHEDULE (FORM B) FOR PURPOSES OF MEETING THE MWBE PARTICIPATION GOALS.

This document must be completed and submitted with Bid/Proposal to Baltimore County.

NOTE: If you do not complete and submit this form with your bid or offer to the County, the County may, in its sole discretion, deem your bid or offer NON-RESPONSIVE and accordingly the COUNTY WILL NOT CONSIDER YOU FOR CONTRACT AWARD.

Provided that_____(Prime Contractor's Name) with Certification Number _____ is awarded the County contract in conjunction with Solicitation No._, such MWBE Prime Contractor intends to count the distinct, clearly defined portion of the work of the contract that the MBE/WBE Prime Contractor performs with its own forces toward fulfilling **up to fifty-percent (50%) of the MWBE participation goal**, at least $_____ which equals to___% of the Total Contract Amount for performing the following products/services for the Contract:

NAICS CODE	WORK ITEM, SPECIFICATION NUMBER, LINE ITEMS OR WORK CATEGORIES (IF APPLICABLE). FOR CONSTRUCTION PROJECTS, GENERAL CONDITIONS MUST BE LISTED SEPARATELY.	DESCRIPTION OF SPECIFIC PRODUCTS AND/OR SERVICES	VALUE OF THE WORK

MWBE PRIME CONTRACTOR

Signature of Representative:

_____

Printed Name and Title:_____

_____

Firm's Name: _____

Federal Identification Number: _____

Address: _____

_____

Telephone:_____

Email Address: _____

Certified Yes ☐ No ☐

Certifying Jurisdiction _____
Date:_____

MWBE PRIME CONTRACTOR

Minority Status:

☐ African American

☐ Hispanic American

☐ Women

☐ Asian American

☐ Native American

Reviewed and Accepted by Baltimore County Minority Business Enterprise Office

Name _____

Title _____

Date _____

Rev 12/2024

BALTIMORE COUNTY, MARYLAND

MWBE SUBCONTRACTOR DISCLOSURE AND PARTICIPATION STATEMENT (FORM C)

This document must be completed and submitted with Bid/Proposal to Baltimore County.

NOTE: If you do not complete and submit this form with your bid or offer to the County, the County may, in its sole discretion, deem your bid or offer NON-RESPONSIVE and accordingly the COUNTY WILL NOT CONSIDER YOU FOR CONTRACT AWARD.

NOTE: ANY INCONSISTENCY BETWEEN THIS FORM AND FORM B *MWBE PARTICIPATION* MAY RENDER A BID/PROPOSAL NON-RESPONSIVE AND THE COUNTY WILL NOT CONSIDER YOU FOR CONTRACT AWARD.

Contract Name, Bid/Proposal Number: _____

Prime Contractor Name: _____

Name of MWBE Subcontractor: _____

_____ _____

Subcontractor Contact Name, Title Subcontractor Email Address

☐ MDOT ☐ Baltimore City

_____

Certification Number

☐ MBE ☐ WBE ☐ SBE ☐ N/A

1. NAICS Code(s), Work/Services to be performed by MWBE Subcontractor: _____

_____

Percent of Total Contract (See instructions on Page 1 of the MWBE PARTICIPATION SUMMARY for 60% rule)

2. Subcontract Amount: $ _____ or _____ % of the County contract cost.

3. Bonds - Amount and type required of Subcontractor if any: _____

4. MWBE Anticipated Commencement Date: _____ Completion Date: _____

Mobilization Cost Amount $_____

5. This is a MBE-Owned Business Firm: Yes _____ No _____

6. This is a WBE-Owned Business Firm: Yes _____ No _____

****

NOTE: If the Prime is notified that it will be awarded the above referenced contract, the undersigned MWBE subcontractor and Prime must enter into a subcontract for the work/service indicated above upon the Prime's execution of a contract for the above referenced project with Baltimore County, and provide a copy of the fully executed MWBE SUBCONTRACTOR PARTICIPATION NOTICE OF INTENT TO AWARD (FORM C-Subcontractor) accompanied with the anticipated Work Breakdown Schedule (providing the subcontractor's mobilization timeframe) to mwbe@baltimorecountymd.gov **within 10 calendar days of receipt by the Prime of FORM C- Subcontractor from the County.** The undersigned subcontractor is an MDOT or Baltimore City certified MWBE firm. The terms and conditions stated above are consistent with our agreements.

Signature of MWBE Subcontractor: _____ Date: _____

Prime's Printed Name and Title: _____ Email: _____

The terms and conditions stated above are consistent with our agreements.

Signature of Prime: _____ Date: _____

Revised 12/2024

BALTIMORE COUNTY, MARYLAND

MWBE –UNAVAILABILITY CERTIFICATE

(FORM D)

If applicable, this document must be completed and submitted with Bid/Proposal to Baltimore County.

NOTE: If you do not complete and submit this form with your bid or offer to the County, the County may, in its sole discretion, deem your bid or offer NON-RESPONSIVE and accordingly the COUNTY WILL NOT CONSIDER YOU FOR CONTRACT AWARD.

1. It is hereby certified that the firm of _____
(Name of Minority firm)

located at _____
(Number) (Street)

_____
(City) (State) (Zip)

was offered an opportunity to bid on the_____contract.

2. The_____(MWBE Firm), is either unavailable for the work/service or unable to prepare a bid for this project for the following reason(s):

_____

_____

_____

_____ _____ _____
Signature of Subcontractor MWBE Representative Title Date

_____ _____ _____
MDOT/Baltimore City Certification # Email Address # Telephone #

3. PRIME'S SIGNATURE AND CERTIFICATION

I certify under oath that I contacted the Certified MWBE and they advised me that they are unavailable, unable to perform the work/services for the above-contract or failed to respond to repeated requests for a price proposal for the above-contract.

_____ _____ _____
Signature of Prime Title Date

Rev 12/2024

BALTIMORE COUNTY, MARYLAND
MWBE - OUTREACH EFFORTS - COMPLIANCE STATEMENT
(FORM E)

This document must be completed and submitted with Bid/Proposal to Baltimore County.

NOTE: If you do not complete and submit this form with your bid or offer to the County, the County may, in its sole discretion, deem your bid or offer NON-RESPONSIVE and accordingly the COUNTY WILL NOT CONSIDER YOU FOR CONTRACT AWARD.

In conjunction with the bid or offer submitted in response to Solicitation Number_____, I state the following:

1. Bidder/Offeror identified opportunities to subcontract in these specific work categories:

   _____
   _____
   _____
   _____

2. Attached to this form are copies of the solicitation documentation in accordance with Section 6 (E) Bid Requirements of the Executive Order, used to solicit certified MWBEs for the subcontract opportunities accompanied with the signed MWBE Subcontractor Unavailability Certificate (Form D).

   _____
   _____
   _____
   _____

3. Bidder/Offeror made the following attempts to solicit MWBEs:

   _____
   _____
   _____
   _____

_____
Signature – Bidder Offeror

_____
Print or Type Name of Firm

_____
Street Address

_____
City State Zip Code

_____
Date

JOHN A. OLSZEWSKI, JR.
County Executive

SEVETRA PEOPLES-BROWN
Executive Director
Chief of Diversity, Equity and Inclusion

To: Contractors/Consultants

From: Minority and Women Business Enterprise Office

Date: December 13, 2024

Subject: Compliance Reporting and Penalties

Baltimore County, Maryland (the "County") requires all Prime Contractors and all Subcontractors to submit payment reports by the 10th of each month through an online MWBE Compliance Portal (PRISM). The Portal can be found under Compliance Reporting for Primes and Subcontractors at www.baltimorecountymd.gov/ go/mwbe. In the event you are not able to enter your payments in PRiSM, a spreadsheet is attached for your use. Please be sure to list the PO for each invoice/ payment reported and include in your submission any corresponding documentation (e.g. copies of invoices or canceled checks).

The County has found that a number of companies are failing to file reports in a timely manner, which makes it difficult for the County to verify compliance. As a result, the County has determined to assess penalties for non-compliance, effective September 1, 2018, as follows:

(a) For failure to file timely monthly reports:
   a. Assessment of a late fee of $10 per day per task, up to a maximum of $1,500 per task; and/or
   b. For multiple violations, termination of the contract for convenience or for default, with the contractor suspended from participating in County contracts for five (5) years.

(b) For failure to meet MWBE requirements:
   a. Assessment of a penalty of up to 10% of the contract value; and/or
   b. Termination of the contract for convenience, with the contractor suspended from participating in County contracts for five (5) years together with assessment of a penalty of up to 10% of the contract value; and/or
   c. Termination of the contract for default together with assessment of a penalty of 10% of the contract value.

Each action and/or remedy described above is at the sole discretion of the County, and is in addition to any damages which the County may be entitled to under the contract.
This short video can be used as guidance on submitting the Prime to Subcontractor Payment Reporting:
http://stage.prismcompliance.com/etc/movies/vendor_contractpayment_tutorial.htm

If after contract expiration, it has been determined the MWBE firms named were not used or were under used, by the contractor and supporting documentation was not provided and approved by the County the contractor may be assessed a penalty of up to 10% of the contract value and/or suspended from participating in County contracts for 5 years.

Questions regarding this correspondence and/or the use of this system can be directed to the MWBE Office at mwbe@baltimorecountymd.gov or call (410) 887-3407.

Attachment: MWBE Payment Report Form
MWBE Payment Acknowledgement Form

Cc: File

S E C T I O N V

POST AWARD DOCUMENTS

This Section to be Completed
by Successful Bidder after Award

CONTRACT AGREEMENT

THIS CONTRACT AGREEMENT ("Contract"), IS MADE THIS _____ day of _____ 20_____, by and between Baltimore County, Maryland, a body corporate and politic ("County"), and _____, ("Contractor").

WITNESSETH, that the Contractor, for and in consideration of the payment or payments herein specified and agreed to by the County, hereby covenants and agrees to furnish and deliver all the materials and to do and perform all the work, services, and labor in fulfillment of the requirements of Contract Number **25114 GX0** "Project") in strict conformity with the solicitation, plans, specifications, special provisions, any and all addenda, and the proposal, at the prices named therein, and all of which are collectively the Proposal, and said Proposal is attached hereto and made a part thereof.

The Project shall be done in strict compliance with (i) the Proposal, (ii) the Baltimore County Department of Public Works and Transportation September 2023 "Standard Specifications for Construction and Materials" and "Standard Details for Construction" (iii) and any and all revisions thereto as of the date of advertisement, including but not limited to the General Conditions Building Projects, as applicable, and all of which (i-iii) are made a part hereof and incorporated herein (collectively, the "Specifications"). Contractor understands and agrees it is Contractor's responsibility and obligation to obtain a copy of the "Specifications" and agrees the Specifications are incorporated herein. Copies are available on the County's website at www.baltimorecountymd.gov/departments/public-works/standards.

The Project shall be subject to the inspection and approval of the Office of Budget and Finance – Property Management for Baltimore County, or his authorized representative, and in the event any portion thereof shall be rejected by said Director or his representative as defective or unsuitable, then the said portion shall be removed and replaced and be performed anew to the satisfaction and approval of the said Director or his representative at the cost and expense of the Contractor.

THE CONTRACTOR AFFIRMS that it is aware of, and will comply with, the provisions of Sections 14-101 through 14-108 of the Election Law Article of the Annotated Code of Maryland, as the same may be amended from time to time, which require that every person who makes, during any 12-month period, one or more contracts, with one or more Maryland governmental entities involving cumulative consideration, of at least $200,000.00, to file with the State Board of Elections certain specified information to include disclosure of attributable political contributions in excess of $500 during defined reporting periods.

THE CONTRACTOR FURTHER COVENANTS AND AGREES that all the Project shall be furnished, performed and delivered, in every respect, to the satisfaction and approval of the Office of Budget and Finance – Property Management, aforesaid, on or before the expiration of **Three Hundred Seventy (370) CALENDAR DAYS** (the "Contract Period") after written notice has been given by the Director or their authorized representative to begin the work.

IT IS AGREED THAT TIME IS OF THE ESSENCE. In the event the Contractor fails to achieve Final Completion and Final Acceptance of the Contract work within the Contract Period specified herein, plus any extensions thereto agreed to in writing by a legally authorized representative of the County pursuant to the terms of this Contract, then Contractor shall pay the County the sum of **FIFTEEN HUNDRED DOLLARS ($1500.00)** as Liquidated Damages for each **CALENDAY DAY** after the expiration of the Contract Period, as may be extended by the County, until the Contractor achieves Final Completion and Final Acceptance of the Project.

_____

Contractor's Initials

_____

Date

IT IS FURTHER AGREED that:

(a) These Liquidated Damages are a reasonable estimate of the County's damages solely due to the public's loss of use of the Project during the delay period and is not a penalty.

(b) It is very difficult, if not impossible, to accurately measure the damages to the County due to the public's loss of use of the Project during the delay period.

(c) Notwithstanding GP 8.09 of the Baltimore County Standard Specification for Construction, in addition to the damages due to the public's loss of use of the Project during the delay period, the County is likely to incur additional direct costs during the delay period, including but not limited to, costs for construction management, consultants, architectural services, office trailer and supplies, utilities, County employees' time, County vehicles, and such other costs that the County will incur to continue administration of the construction and the Contract during the delay period, all of which will be monitored by the County, and if so required by the County, the Contractor shall pay such actual damages incurred during the delay period. THE PARTIES HERETO UNDERSTAND AND AGREE THAT CONTRACTOR'S OBLIGATION TO PAY THE COUNTY FOR ACTUAL DAMAGES DURING THE DELAY PERIOD SHALL BE IN ADDITION TO THE CONTRACTOR'S OBLIGATION TO PAY THE LIQUIDATED DAMAGES DUE TO THE PUBLIC'S LOSS OF USE OF THE PROJECT.

(d) The County shall have the right, but not the obligation, to deduct the Liquidated Damages due to the public's loss of use of the Project, and the County's actual costs and costs to continue administration of the construction and the Contract, from any monies due or any monies that may become due to the Contractor.

IT IS DISTINCTLY UNDERSTOOD AND AGREED that no claim for extra work, material or overhead not specifically provided for in the Contract will be allowed by the County, nor shall the Contractor do any work or furnish any materials not covered by this Contract and the Specifications, unless the same is ordered in writing by a legally authorized representative of the Office of Budget and Finance – Property Management in accordance with the terms of the Contract. Any such work or materials which may be done or furnished by the Contractor without any such written order first being given shall be at said Contractor's sole risk, cost and expense and Contractor hereby covenants and agrees that without such written order, Contractor shall make no claim for compensation for work, materials, or overhead so done or furnished.

NOTWITHSTANDING GP 4.06 OF THE BALTIMORE COUNTY STANDARD SPECIFICATIONS FOR CONSTRUCTION, IT IS SPECIFICALLY AGREED that the Contractor shall have no entitlement to damages arising out of delay, disruption, interference or hindrance from any cause whatsoever. However, this provision shall not preclude recovery or damages by the Contractor for hindrances or delays due solely to fraud or gross negligence on the part of the County or its agents.

IT IS FURTHER DISTINCTLY AGREED that the said Contractor shall not assign this Contract, nor any part thereof, nor any right to any of the monies to be paid hereunder, nor shall any part of the work to be done or material furnished under said Contract be sublet without the prior written consent of a legally authorized representative of the Office of Budget and Finance – Property Management in accordance with the terms of this Contract. Further, the acceptance of the final payment by the Contractor shall effectuate a release in full of all claims against County and its officials, employees, representatives, and agents arising out of, or by reason of the Project and this Contract.

The Contractor shall review government issued identification and badge all employees of the Contractor and its subcontractors. The Contractor shall also review all federal forms, including but not limited to I-9's, for compliance as well as copies of all employment eligibility and identity documentation maintained to the extent required by law.

The Bonds, given by the Contractor in a sum equal to the total contract price of the Project in compliance with the terms and provisions of this Contract, are hereby attached and incorporated herein.

IT IS AGREED that in the event that the County is delayed or prevented from timely execution of this Contract, the Contractor releases County and agrees Contractor shall have no action, claim or demand against County therefore.

Contractor's Initials

Date

THE CONTRACTOR HEREBY FURTHER AGREES to receive the prices set forth in the Proposal incorporated herein as full compensation for the completion of the Project and, in all respects, to complete said Contract to the satisfaction of the County.

THE CONTRACTOR REPRESENTS AND WARRANTS:

(i) it is duly formed and validly existing under the laws of the State of _____;

(ii) it is in good standing in the State of Maryland;

(iii) it has the power and authority to consummate the obligations and responsibilities contemplated hereby, and has taken all necessary action to authorize the execution, delivery and performance required under this Contract;

(iv) the Contractor and the person executing this Contract for the Contractor each warrant that he/she is duly authorized by the Contractor to execute and seal this Contract on the Contractor's behalf;

(v) the warranties of merchantability and fitness for a particular purpose and use and warranties of title and against infringement, and all express warranties contained in this Contract, including but not limited to the Proposal (and any sample or model presented by Contractor and expressly accepted by the County) shall apply to the portion of this Contract pertaining to or for goods;

(vi) all representations and warranties made in the Proposal and herein remain true and correct in all respects when made, as of the date of this Contract, and throughout the term of this Contract; and

(vii) there exists no actual or potential conflict of interest between its performance under this Contract and its engagement or involvement in any other personal or professional activities and in the event such conflict or potential conflict arises during the term of this Contract, the Contractor shall immediately advise the County in writing thereof.

THE CONTRACTOR shall not disclose any documentation and information of any kind or nature disclosed to the Contractor in the course of its performance of duties hereunder without the express prior written consent of the County.

Those sections in this Contract which by their nature are intended to survive, including but not limited to, Contractor's representations and warranties, confidential information, and indemnification shall survive the termination of this Contract.

IN WITNESS WHEREOF, the Contractor has hereunto set its hand and seal the day and year first above written.

CONTRACTOR NAME: _____

WITNESS

_____

_____
Type (Print) Name

FEDERAL TAX ID or SS #: _____

By: _____ (Seal)

Name: _____

Title: _____ Date: _____

WITNESS:

BALTIMORE COUNTY, MARYLAND

_____
Executive Secretary

_____
D'Andrea L. Walker, County Administrative Officer

APPROVED FOR FORM AND LEGAL AND SUFFICIENCY* (Subject to execution by the duly authorized Administrative official and Chairperson of the County Council, as indicated).

APPROVED:

_____ Date: _____
Kevin D. Reed, Director
Office of Budget and Finance

_____
Office of the County Attorney

*Approval of Form and Legal Sufficiency does not convey approval or disapproval of the substantive nature of this transaction. Approval is based upon typeset documents. All modifications require re-approval.

Rev. 09/2024

P E R F O R M A N C E B O N D Bond No._____

Principal	**Business Address of Principal**
Surety	**Obligee:** **BALTIMORE COUNTY, MARYLAND** A body corporate and politic

A Corporation of the State of _____ and authorized to do business in Maryland

Penal Sum of Bond (express in words and figures) DOLLARS	$_____
Northwest Regional Park Splash Pad & Supporting Facilities **Contract Name**	_____ **20** _____ **Date of Contract**
25114 GX0 **Contract Number**	_____ **20** _____ **Date Bond Executed**

KNOW ALL MEN BY THESE PRESENTS, that we, the PRINCIPAL, above-named, and SURETY, above-named, and authorized to do business in the State of Maryland, are held and firmly bound unto the OBLIGEE, above-named, in the penal sum of the amount stated above, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, THE PRINCIPAL entered into a certain contract with the OBLIGEE described and dated as shown above and is required to provide this bond pursuant to Maryland State law and/or County law and the contract.

NOW, THEREFORE, if the aforesaid PRINCIPAL shall well and truly perform and fulfill all the undertakings, covenants, terms, conditions, and agreements of said contract during the original term of said contract and any extensions thereof that may be granted by the OBLIGEE with or without notice to the SURETY, and during the life of any guaranty required under the contract, and shall also well and truly perform and fulfill all the undertakings covenants, terms, conditions and agreements of any and all duly authorized modifications of said contract that may hereafter be made, notice of which modifications to the SURETY being hereby waived, then, this obligation to be void; otherwise to remain in full force and effect.

THE SURETY FURTHER GUARANTEES That it is (a) licensed in the State of Maryland, (b) rated "B" or better by the A.M. Best Company, (c) on federal funded projects, authorized by the underwriting limitation contained in the U.S. Department of the Treasury Circular 570, as amended, to guaranty the amount of the Bid, and (d) in good standing as determined by the County's Engineer. A Performance Bond is required for each and every Contract in excess of twenty-five thousand ($25,000). A Performance Bond shall be in the amount equal to at least one hundred (100%) percent of the Contract price. The fully executed Performance Bond shall be delivered by the Bidder to the Department's Division of Construction Contracts Administration no later than the time the Contract is to be executed by the Contractor.

IN WITNESS WHEREOF, the above-bounded parties have executed this instrument under their several seals on the date indicated above, the name and seal of each party being hereto affixed and these presents duly signed by its undersigned representative, pursuant to authority of its governing body.

In Presence of: **Individual Principal**

Witness: _____ **as to:** _____ **(SEAL)**

Print Name: _____ **Print Name:** _____

Attest: **Corporate Principal**

_____
(Name of Corporation)

Witness: _____ **By:** _____ Affix

Print Name: _____ **Print Name:** _____ Corporate

Title: _____ Seal

Attest: **Surety**

_____
(Name of Surety)

Business Address: _____

Witness: _____ **By:** _____ Affix

Print Name: _____ **Print Name:** _____ Corporate

Title: _____ Seal

Reviewed for Baltimore County Requirements

_____
Office of the County Attorney

Revised
February 4, 2015

PAYMENT BOND

Bond Number_____

Principal | **Business Address of Principal**

Surety

Obligee: **BALTIMORE COUNTY, MARYLAND**
A body corporate and politic

A Corporation of the State of _____ and authorized to do business in Maryland

_____ DOLLARS $_____
Penal Sum of Bond (express in words and figures)

Northwest Regional Park Splash Pad & Supporting Facilities | _____ **20** _____
Contract Name | **Date of Contract**

25114 GX0 | _____ **20** _____
Contract Number | **Date Bond Executed**

KNOW ALL MEN BY THESE PRESENTS, that we, the PRINCIPAL, above-named, and SURETY, above-named, and authorized to do business in the State of Maryland, are held and firmly bound unto the OBLIGEE, above-named, in the penal sum of the amount stated above, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, THE PRINCIPAL entered into a certain contract with the OBLIGEE described and dated as shown above and is required to provide this bond pursuant to Maryland State law and/or County Law and the contract.

NOW, THEREFORE, the condition of this obligation is such that if the aforesaid PRINCIPAL shall promptly make payments to all persons supplying labor and/or material to the PRINCIPAL and to any subcontractor of the PRINCIPAL in the prosecution of the work provided for in said contract and any and all duly authorized modifications of said contract that may hereafter be made, notice of which modifications to the SURETY being hereby waived, then, this obligation to be void; otherwise to remain in full force and effect.

THE SURETY FURTHER GUARANTEES That it is (a) licensed in the State of Maryland, (b) rated "B" or better by the A.M. Best Company, (c) on federal funded projects, authorized by the underwriting limitation contained in the U.S. Department of the Treasury Circular 570, as amended, to guaranty the amount of the Bid, and (d) in good standing as determined by the County's Engineer. A Payment Bond is required for each and every Contract in excess of twenty-five thousand ($25,000). A Payment Bond shall be in the amount equal to at least one hundred (100%) percent of the Contract price. The fully executed Payment Bond shall be delivered by the Bidder to the Department's Division of Construction Contracts Administration no later than the time the Contract is to be executed by the Contractor.

IN WITNESS WHEREOF, the above-bounded parties have executed this instrument under their several seals on the date indicated above, the name and seal of each party being hereto affixed and these presents duly signed by its undersigned representative, pursuant to authority of its governing body.

In Presence of: | **Individual Principal**

Witness: _____ **as to:** _____ **(SEAL)**

Print Name: _____ **Print Name:** _____

Attest: | **Corporate Principal**

_____
(Name of Corporation)

Witness: _____ **By:** _____ Affix

Print Name: _____ **Print Name:** _____ Corporate

Title: _____ Seal

Attest: | **Surety**

_____
(Name of Surety)

Business Address: _____

Witness: _____ **By:** _____ Affix

Print Name: _____ **Print Name:** _____ Corporate

Title: _____ Seal

Reviewed for Baltimore County Requirements

_____Office of the County Attorney

Revised
February 4, 2015

BALTIMORE COUNTY, MARYLAND

INSURANCE PROVISIONS

1. **GENERAL REQUIREMENTS**

1.1 Coverages Required:
Unless otherwise required by the specifications or the contract, the Contractor/Vendor shall purchase and maintain the insurance coverage's listed herein.

1.2 Certificate of Insurance:
Before starting work on the contract, or prior to the execution of the Contract on those bid, the Contractor/Vendor shall provide Baltimore County, Maryland with verification of insurance coverage evidencing the required coverages.

1.3 Baltimore County as Insured:
The coverage required, excluding Workers' Compensation and Employers' Liability and Medical Malpractice Liability/Professional Liability/Errors and Omissions Liability, must include Baltimore County, Maryland and its agents, employees, officers, directors, and appointed and elected officials as an additional insured.

1.4 Contractor's/Vendor's Responsibility:
The providing of any insurance herein does not relieve the Contractor/Vendor of any of the responsibilities or obligations the Contractor/Vendor has assumed in the contract or for which the Contractor/Vendor may be liable by law or otherwise.

1.5 Failure to Provide Insurance:
Failure to provide and continue in force the required insurance shall be deemed a material breach of the contract. The Contractor/Vendor must maintain the insurance coverages required under the terms and conditions on this Contract while this Contract is in effect including renewal and extension terms.

2. **INSURANCE COVERAGES**

2.1 General Liability Insurance

2.1.1 Minimum Limits of Coverage:
Personal Injury Liability and Property Damage Liability Combined Single Limit - $500,000 each occurrence.

2.1.2 Such insurance shall protect the Contractor/Vendor from claims which may arise out of, or result from, the Contractor's/Vendor's operations under the contract, whether such operations be by the Contractor/Vendor, any subcontractor, anyone directly or indirectly employed by the Contractor/Vendor or Subcontractor, or anyone for whose acts any of the above may be liable.

2.1.3 Minimum Coverages to be Included:
(a) Independent Contractor's coverage;
(b) Completed Operations and Products Liability coverage;
(c) Contractual Liability coverage.

2.1.4 Damages not to be Excluded:
Such insurance shall contain no exclusions applying to operations by the Contractor/Vendor or any Subcontractor in the performance of the Contract including but not limited to:
(a) Collapse of, or structural injury to, any building or structure;
(b) Damage to underground property; or
(c) Damage arising out of blasting or explosion.

2.2 Automobile Liability Insurance

2.2.1 Minimum Limits of Coverage:
Bodily Injury Liability and Property Damage Liability
Combined Single Limit - $500,000 any one accident.

2.2.2 Minimum Coverages to be Included:
Such insurance shall provide coverage for all owned, non-owned and hired automobiles.

2.3 Workers' Compensation and Employers' Liability Insurance

Such insurance must contain statutory coverage, including
Employers' Liability insurance with limits of at least:
Bodily Injury by Accident - $250,000 each accident
Bodily Injury by Disease - $500,000 policy limit
Bodily Injury by Disease - $250,000 each employee

2.4 Valuable Papers and Records Coverage and Electronic Data Processing (Data and Media) Coverage

Minimum Limits of Coverage:
$100,000 Per Claim and Each Occurrence
$100,000 in the Aggregate

2.5 Other

Such other insurance in form and amount as may be customary for the type of business being under taken by the Contractor/Vendor.

2.6 Builder's Risk

See Special Provisions page 1219 and General Conditions page 34,35, Article 33.