

PROPOSAL FORM
BALTIMORE COUNTY
DEPARTMENT OF PUBLIC WORKS & TRANSPORTATION
TOWSON, MARYLAND

Division of Construction Contracts Administration

DESIGNER / PROJECT MANAGER

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Contract Number 24167 PO0
Property Management Project
Fullerton Utilities New Truck Garage –
4419A Buck Schoolhouse Road, Rosedale, Maryland 21237
Rosedale – District 14c5
Workday Number
PROJ-10000718

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 May 7, 2025 at 1:00 p.m. EST via WebEx. *Phone-In* (Audio Only) 1-415-655-0001, Meeting Number 2303 856 9370##. *Video Conference* go to <https://signin.webex.com/join> Meeting Number 2303 856 9370, **Password: nNeVAeSN339**, for Webex link go to: www.baltimorecountymd.gov/departments/public-works/engineering/contracts/current-solicitations

Baltimore County Prevailing Wage and Local Hiring Affidavit, Wage Rates & Requirements **see pages 558-565**

(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 566-580**

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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SECTION 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 TRANSPORTATION 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 \$640.00.

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.mmcapitalgroup.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, Obligees 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 Obligees under this bond until the notice of claim is mailed.
3. When the Obligees 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 Obligees 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 Obligees 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 downloading 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 not submit for approval, materials other than those specified without a written statement why such a Substitution 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.





PROJECT MANUAL

FULLERTON UTILITIES

JETTVAC TRUCK GARAGE

4421 Bucks School House Road, Baltimore, MD 21237

FOR

100% CONSTRUCTION DOCUMENTS

March 4, 2025



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SECTION 01 10 00 - SUMMARY**PART 1 - GENERAL****1.1 PROJECT**

- A. Project Name: Fullerton Utilities.
- B. Owner's Name: Baltimore County Property Management Division.
- C. Description:

Jettvac Truck Garage, 4421 Bucks School House Road, Baltimore, MD 21237

- a. Construction of a new facility complete; building enclosure to be delegated design metal building system.

1.2 CONTRACT DESCRIPTION

- A. Contract Type: Single Base Bid construction contract.

1.3 CONTRACTOR USE OF SITE AND PREMISES

- A. Construction Operations: Limited to areas noted on Drawings.
- B. Provide access to and from site as required by law and by Owner:
 - 1. Emergency Building Exits During Construction: Keep all exits required by code open during construction period; provide temporary exit signs if exit routes are temporarily altered.
 - 2. Do not obstruct roadways, sidewalks, or other public ways without permit.

1.4 WARRANTY

- A. Contractor must provide a 2-year warranty for all work, materials and equipment, unless a longer warranty is required by the specific specification sections.

1.5 CORRELATION AND INTENT OF THE CONSTRUCTION DOCUMENTS

- A. Design requirements when either drawn or specified, or both, shall prevail over the standard product of the companies specified. Any deviation from such must have the approval of the Architect and Owner.
- B. It is the responsibility of the Contractor to construct the work under this Contract so that it will be complete and finished in every detail. If mention has been omitted in the Contract Documents of any item of work or materials usually furnished or necessary for the completion or proper functioning of the project, it will be included without extra cost.
- C. All systems in all divisions are to be bid and constructed as wholly closed, connected and fully working systems. Any doubts by the Contractor as to the intent of the Contract Document requirements for such total system shall be verified before bidding.
- D. Whenever a conflict exists between drawings, drawings and specifications, or between specifications, the more stringent and costlier shall apply. Items specified but not shown on

drawings must be supplied. Items shown on the drawings but not specified must be supplied. The Architect is to be notified of the conflict to determine the final precedent to follow.

- E. If there is a conflict between the General Conditions and the Specifications, the more stringent and costlier shall apply unless clarified during bidding.
- F. Where a device or piece of equipment is referred to in the singular number, such reference shall be deemed to apply to as many devices as are required to complete the installation.

1.6 ADAAG

- A. Contractor to be aware of current ADA Standards for Accessible Design as indicated on the drawings and shall complete construction in compliance with these standards.

1.7 UTILITY COORDINATION

- A. Contractor bears the responsibility of being the main correspondent between the Project and all utilities inherent in the Project. The Contractor's duties shall include the following:
 - 1. Contractor is solely responsible for the coordination of all utilities inherent in the Project, both new and keeping the existing in operation. Any delay in response to the Contractor's requests and submittals by any of the project's utility companies will be considered non-compensable should the delay effect the construction critical path of the project's sequence of construction.
 - 2. Contractor is solely responsible for all bond and permit costs for all utilities required by the Project.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION - NOT USED

END OF SECTION 01 10 00

SECTION 01 20 00 - PRICE AND PAYMENT PROCEDURES**PART 1 - GENERAL****1.1 SECTION INCLUDES**

- A. Procedures for preparation and submittal of applications for progress payments.
- B. Documentation of changes in Contract Sum and Contract Time.
- C. Change procedures.
- D. Correlation of Contractor submittals based on changes.
- E. Procedures for preparation and submittal of application for final payment.

1.2 SCHEDULE OF VALUES

- A. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit draft to Architect for approval.
- B. Forms filled out by hand will not be accepted.
- C. Submit a printed schedule on AIA Form G703 - Application and Certificate for Payment Continuation Sheet. Contractor's standard form or electronic media printout will be considered.
- D. Submit Schedule of Values in duplicate within 5 days after date of Notice to Proceed.
- E. Format: Utilize the Table of Contents of this Project Manual. Identify each line item with number and title of the specification Section. Identify site mobilization and bonds and insurance.
 - 1. Identify site mobilization and bonds and insurance.
 - 2. Include additional line items identified by subsection titles, for Work exceeding \$15,000.
- F. Revise schedule to list approved Change Orders, with each Application for Payment.

1.3 APPLICATIONS FOR PROGRESS PAYMENTS

- A. Payment Period: Submit at intervals directed by Owner.
- B. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit sample to Architect for approval.
- C. Forms filled out by hand will not be accepted.
- D. Present required information in typewritten form.
- E. Form: Electronic form provided by Owner.
- F. Execute certification by signature of authorized officer.
- G. Use data from approved Schedule of Values. Provide dollar value in each column for each line item for portion of work performed and for stored products.
- H. List each authorized Change Order as a separate line item, listing Change Order number and dollar amount as for an original item of work.
- I. Unless otherwise agreed by all parties submit one electronic and three hard-copies of each Application for Payment.
- J. Include the following with the application:
 - 1. Revised Schedule of Values to list approved Change Orders.
 - 2. Transmittal letter as specified for submittals in Section 01 30 00.
 - 3. Construction progress schedule, revised and current as specified in 01 32 16.
 - 4. Current construction photographs specified in Section 01 30 00.
 - 5. Partial release of liens from major subcontractors and vendors.

-
6. Submittal for preliminary and monthly progress submittals for Building Product Calculator (BPC), Construction and Demolition Waste Management Plan and Indoor Air Quality Plan.
 7. Updated as-built drawings.
- K. When Architect requires substantiating information, submit data justifying dollar amounts in question. Provide one copy of data with cover letter for each copy of submittal. Show application number and date, and line item by number and description.
- L. Clearly indicate on the Application for Payment those line items which include materials or equipment, purchased or fabricated and stored, but not yet installed.
1. Differentiate between items stored on-site and items stored off-site.
 2. Payments for material and equipment stored off-site will be at the sole discretion of the Owner.
 - a. If required, Contractor will be responsible for all costs of travel and lodging for Architect, Engineers, and Owner to off-site storage locations to examine these items and the conditions of storage.
 - b. Owner requires photographic documentation of materials stored off site, to render decision.
 3. For items stored off-site, provide a bill of sale from supplier/Trade Contractors and certificates of insurance for the full value of stored materials with the Owner named as the insured.
 4. For items stored off-site show a separate line item for the value of delivering and unloading the items at the Project site.
 5. For items stored on or off-site, provide in a separate line item for the value of the installation of these items.
- M. 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. Staff names and assignments.
 3. Schedule of Values.
 4. Contractor's Construction Schedule (preliminary if not final).
 5. Products list.
 6. Schedule of unit prices.
 7. Submittal Schedule (preliminary if not final).
 8. Copies of building permits.
 9. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
 10. Initial progress report.
 11. Certificates of insurance and insurance policies.
 12. Performance and payment bonds.
 13. Data needed to acquire Owner's insurance.
 14. Submittal for preliminary and monthly progress submittals for Building Product Calculator (BPC), Low Emitting Materials (LEM) Calculator, Construction and Demolition Waste Management Plan and Indoor Air Quality Plan.
- N. Application for Payment at Substantial Completion: After issuing 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.
 2. This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

1.4 MODIFICATION PROCEDURES

- A. For minor changes not involving an adjustment to the Contract Price or Contract Time, Architect will issue instructions directly to Contractor.
- B. Architect will advise of minor changes in the Work not involving an adjustment to Contract Sum or Contract Time as authorized by the Conditions of the Contract by issuing supplemental instructions on AIA Form G710.
- C. For other required changes, Architect will issue a document signed by Owner instructing Contractor to proceed with the change, for subsequent inclusion in a Change Order.
 - 1. The document will describe the required changes and will designate method of determining any change in Contract Sum or Contract Time.
 - 2. Promptly execute the change.
- D. For changes for which advance pricing is desired, Architect will issue a document that includes a detailed description of a proposed change with supplementary or revised drawings and specifications, a change in Contract Time for executing the change with a stipulation of any overtime work required and the period of time during which the requested price will be considered valid. Contractor shall prepare and submit a fixed price quotation within 7 days.
- E. Contractor may propose a change by submitting a request for change to Architect, describing the proposed change and its full effect on the work, with a statement describing the reason for the change, and the effect on the Contract Sum and Contract Time with full documentation. Document any requested substitutions in accordance with Section 01 60 00.
- F. Computation of Change in Contract Amount: As specified in the Agreement and Conditions of the Contract.
 - 1. For change requested by Architect for work falling under a fixed price contract, the amount will be based on Contractor's price quotation.
 - 2. For change requested by Contractor, the amount will be based on the Contractor's request for a Change Order as approved by Architect.
 - 3. For pre-determined unit prices and quantities, the amount will be based on the fixed unit prices.
 - 4. For change ordered by Architect without a quotation from Contractor, the amount will be determined by Architect based on the Contractor's substantiation of costs as specified for Time and Material work.
- G. Substantiation of Costs: Provide full information required for evaluation.
 - 1. On request, provide the following data:
 - a. Quantities of products, labor, and equipment.
 - b. Taxes, insurance, and bonds.
 - c. Overhead and profit.
 - d. Credit for deletions from Contract, similarly documented.
 - 2. Support each claim for additional costs with additional information:
 - a. Origin and date of claim.
 - b. Dates and times work was performed, and by whom.
 - c. Time records and wage rates paid.
 - d. Invoices and receipts for products, equipment, and subcontracts, similarly documented.
 - 3. For Time and Material work, submit itemized account and supporting data after completion of change, within time limits indicated in the Conditions of the Contract.
- H. Execution of Change Orders: Architect will issue Change Orders for signatures of parties as provided in the Conditions of the Contract.
- I. After execution of Change Order, promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order as a separate line item and adjust the Contract Sum.

J. Promptly enter changes in Project Record Documents.

1.5 APPLICATION FOR FINAL PAYMENT

- A. Prepare Application for Final Payment as specified for progress payments, identifying total adjusted Contract Sum, previous payments, and sum remaining due.
- B. Application for Final Payment will not be considered until the following have been accomplished:
1. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
 2. Updated final statement, accounting for final changes to the Contract Sum.
 3. AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."
 4. AIA Document G706A, "Contractor's Affidavit of Release of Liens."
 5. AIA Document G707, "Consent of Surety to Final Payment."
 6. Evidence that claims have been settled.
 7. 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.
 8. Final, liquidated damages settlement statement.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION - NOT USED

END OF SECTION 01 20 00

SECTION 01 25 00 - SUBSTITUTION PROCEDURES**PART 1 - GENERAL****1.1 SECTION INCLUDES**

- A. Procedural requirements for proposed substitutions.

1.2 DEFINITIONS

- A. Substitutions: Changes from Contract Documents requirements proposed by Contractor to materials, products, assemblies and equipment. Architect will not consider requests for substitution after defined time period, except for extenuating circumstances described below; requests may be considered or rejected at discretion of Architect.
 - 1. Substitutions for Cause: Proposed due to changed Project circumstances beyond Contractor's control.
 - a. The specification permits "Or Equal", or similar language defined in the project manual.
 - b. Unavailability.
 - c. Regulatory changes.
 - d. The specified product is identified as incompatible or inappropriate for the project.
 - e. The manufacturer or fabricator declares a specified product to be unsuitable for the use intended and refuses to warrant its installation, and where the Contractor certifies that the proposed substitution provides the required warranty.
 - f. The requested substitution offers the Owner a substantial advantage, in cost, time, energy conservation, or other considerations, after deducting additional responsibilities the Owner must assume. The Owner's additional responsibilities may include compensation to the Architect for redesign and evaluation services, increased cost of other construction by the Owner, and similar considerations.
 - 2. Substitutions for Convenience: Proposed due to possibility of offering substantial advantage to the Project.
 - a. Substitution requests offering advantages solely to the Contractor will not be considered.
 - 3. "Or Equal" Provision:
 - a. Similarly, a statement such as "equal product of other named manufacturers" will require compliance to the Comparable Product process, including the use of a Substitution Request Form. Refer to Section 01 60 00 Product Requirements for additional information.

PART 2 - PRODUCTS - NOT USED**PART 3 - EXECUTION****3.1 GENERAL REQUIREMENTS**

- A. A Substitution Request for products, assemblies, materials and equipment constitutes a representation that the submitter:
 - 1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product, equipment, assembly, or system.
 - 2. Agrees to provide the same warranty for the substitution as for the specified product.
 - 3. Agrees to provide same or equivalent maintenance service and source of replacement parts, as applicable.
 - 4. Agrees to coordinate installation and make changes to other work that may be required for the work to be complete, with no additional cost to Owner.

-
5. Waives claims for additional costs or time extension that may subsequently become apparent.
 6. Agrees to reimburse Owner and Architect for review or redesign services associated with re-approval by authorities.
- B. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents. Burden of proof is on proposer.
1. Note explicitly any non-compliant characteristics.
- C. Content: Include information necessary to provide an actionable response.
1. Use forms included in the Project Manual; requests without completed form will not be reviewed.
 2. Contractor's Substitution Request documentation must include the following:
 - a. Project Information:
 - 1) Official project name and number, and any additional required identifiers established in Contract Documents.
 - b. Substitution Request Information:
 - 1) Indication of whether the substitution is for cause or convenience.
 - 2) Issue date.
 - 3) Reference to particular Contract Document(s) specification section number, title, and article/paragraph(s).
 - 4) Description of Substitution.
 - 5) Reason why the specified item cannot be provided.
 - 6) Differences between proposed substitution and specified item.
 - 7) Description of how proposed substitution affects other parts of work.
 - c. Attached Comparative Data: Provide point-by-point, side-by-side comparison addressing essential attributes specified and provided by named products, as appropriate and relevant for the item:
 - 1) Physical characteristics.
 - 2) In-service performance.
 - 3) Expected durability.
 - 4) Visual effect.
 - 5) Sustainable design features.
 - 6) Warranties.
 - 7) Other salient features and requirements.
 - d. Include the following types of documentation:
 - 1) Product data.
 - 2) Samples.
 - 3) Certificates, test, reports or similar qualification data.
 - 4) Drawings, when required to show impact on adjacent construction elements.
 - 5) List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
 - 6) Research/evaluation reports evidencing compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.
 - 7) Detailed comparison of Contractor's construction schedule using proposed substitution 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 lack of availability or delays in delivery.
 - 8) Cost benefit to the Owner.
 - 9) Contractor's certification that proposed substitution complies with requirements in the Contract Documents and is appropriate for applications indicated.

- 10) 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.

e. Impact of Substitution:

- 1) Savings to Owner for accepting substitution.
- 2) Change to Contract Time due to accepting substitution.

- D. Limit each request to a single proposed substitution item.
- E. Submit an electronic document, combining the request form with supporting data into single document.

3.2 SUBSTITUTION PROCEDURES DURING CONSTRUCTION

- A. Submit request for Substitution for Cause within 14 days of discovery of need for substitution, but not later than 14 days prior to time required for review and approval by Architect, in order to stay on approved project schedule.
- B. Substitutions for Convenience: Architect will consider request for substitution if received within duration set for submission of Proposed Product List. Requests received after that time may be considered or rejected at discretion of Architect.
- C. Substitutions will not be considered under one or more of the following circumstances:
 1. When they are indicated or implied on shop drawing or product data submittals, without having received prior approval.
 2. Without a separate written request.
 3. Without substantial cost savings benefit to the Owner.

3.3 RESOLUTION

- A. Architect may request additional information and documentation prior to rendering a decision. Provide this data in an expeditious manner.

3.4 ACCEPTANCE

- A. Architects notification of acceptance will be in the following forms:
 1. During Bidding: Indicated within an Addendum.
 2. After Contract signing: Change Order.
- B. Use product specified if Architect cannot make a decision on use of a proposed substitution due to incomplete documentation.
- C. During bidding, absence or mention within Addenda is to be interpreted as rejection of proposed substitution.

3.5 CLOSEOUT ACTIVITIES

- A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.
- B. Include completed Substitution Request Forms as part of the Project record.

3.6 ATTACHMENTS

- A. Grimm + Parker Architects Substitution Request Form.

END OF SECTION 01 25 00

Substitution Request Form

IDENTIFICATION:

Contractor/CM: _____

Project Name: _____

Date: _____

REFERENCE:

Specification Title: _____

Specification No.: _____ Page: _____ Article/ Paragraph: _____

DESCRIPTION:

Proposed Substitution: _____

Manufacturer: _____

History: ☐ New Product ☐ 2-5 years old ☐ 5-10 years old ☐ More than 10 years old

Reason for requesting substitution: ☐ Cause ☐ Convenience

Explain: _____

Differences between proposed substitution and specified item: _____

(Use attachment for additional space, if required.)

Proposed substitution affects other parts of Work or applicable Code requirements as follows: _____

(Use attachment for additional space, if required.)

Post-Bid Savings to Owner for accepting substitution: (N/A Pre-Bid) _____

Change to Contract Time due to accepting substitution: _____

LEED Contribution (if applicable to Project) - Explain effects to LEED Action Plan: _____

(Use attachment for additional space, if required.)

Will undersigned pay any costs caused by the substitution necessitating changes to the building design, construction, engineering and detailing, including additional Architect, inspection and testing fees? ☐ Yes ☐ No

Does the undersigned waive rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results? ☐ Yes ☐ No

Submitted by: _____
(Contractor or CM Only)

Signed by: _____

Firm: _____

Address: _____

Telephone: _____

SUPPORTING DATA ATTACHED:

☐ **Point-by-Point Comparative Data Attached (Required)**

☐ Drawings ☐ Product Data ☐ Samples ☐ Tests ☐ Reports ☐ _____

CERTIFICATION:

The Undersigned certifies:

- Proposed substitution has been investigated and determined that it meets or exceeds the quality level of the specified product.
- Same warranty will be furnished for proposed substitution as for specified product; **provide attachment if different.**
- Same maintenance service and source of replacement parts, as applicable, is available.
- Proposed substitution will have no adverse effect on other trades and will not affect or delay progress schedule.
- Cost data as stated above is complete. Claims for additional costs related to accepted substitution which may subsequently become apparent are to be waived.
- Proposed substitution does not affect dimensions and functional clearances; **provide attachment if otherwise.**
- Payment will be made for changes to building design, including A/E design, detailing, and construction costs caused by the substitution.
- Coordination, installation, and changes in the Work as necessary for accepted substitution will be complete in all respects.
- Neither the Owner and Architect will be liable for license fees or royalties.

A/E's REVIEW AND ACTION:

- ☐ Substitution approved - Make submittals in accordance with Specification Section 01 60 00.
- ☐ Substitution approved as noted - Make submittals in accordance with Specification Section 01 60 00.
- ☐ Substitution rejected - Use specified materials.
- ☐ Substitution Request received too late - Use specified materials.

Signed by: _____

Date: _____

ADDITIONAL COMMENTS:

Contractor:

Architect:

Approvals are based upon the opinion, knowledge, information, and belief of Architect at time of decision and reliance upon data submitted. Approvals are therefore interim and subject to reconsideration as additional data, materials, workmanship and coordination with other Work are observed and reviewed. In proposing items, Contractor assumes risks, costs and responsibilities for items integration into Work and performance.

END OF FORM

SECTION 01 30 00 - ADMINISTRATIVE REQUIREMENTS**PART 1 - GENERAL****1.1 SECTION INCLUDES**

- A. Project coordination.
- B. Requests for interpretation (RFI).
- C. Subcontract list.
- D. Staff names and assignments.
- E. Preconstruction meeting.
- F. Progress meetings.
- G. Contractor's daily reports.
- H. Progress photographs.
- I. Submittals for review, information and project closeout.
- J. Number of copies of submittals.
- K. Submittal procedures.
- L. Contractor's use of Architect's CAD files.
- M. Delegated design.
- N. Contractor's review.
- O. Architect's action.

1.2 PROJECT COORDINATOR

- A. Project Coordinator: General Contractor.
- B. Cooperate with the Project Coordinator in allocation of mobilization areas of site, subject to review and approval of the Owner; for field offices and sheds, for access, traffic, and parking facilities.
- C. During construction, coordinate use of site and facilities through the Project Coordinator, subject to review and approval of the Owner.
- D. Comply with Project Coordinator's procedures for intra-project communications; submittals, reports and records, schedules, coordination drawings, and recommendations; and resolution of ambiguities and conflicts.
- E. Comply with instructions of the Project Coordinator for use of temporary utilities and construction facilities. Responsibility for providing temporary utilities and construction facilities is identified in Section 01 50 00 - Temporary Facilities and Controls.
- F. Coordinate field engineering and layout work under instructions of the Project Coordinator.
- G. Make the following types of submittals to Owner and Architect through the Project Coordinator:
 - 1. Requests for Interpretation.
 - 2. Requests for substitution.
 - 3. Shop drawings, product data, and samples.
 - 4. Test and inspection reports.
 - 5. Design data.
 - 6. Manufacturer's instructions and field reports.
 - 7. Applications for payment and change order requests.
 - 8. Closeout submittals.

1.3 SUBCONTRACT LIST

- A. 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. Use form reviewed and accepted by Owner and Architect. Include the following information in tabular form:
1. Name, address, and telephone number 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.
 4. Number of Copies: Submit four copies of subcontractor list, unless otherwise indicated. Architect will return two copies.
 - a. Mark up and retain one returned copy as a Project Record Document.

1.4 STAFF NAMES AND ASSIGNMENTS

- A. Submit a list of principal staff assignments, including superintendent and other personnel to be in attendance at Project site, within one week of Notice to Proceed.
- B. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home and office telephone numbers.
- C. Provide names, addresses, and telephone numbers of individuals assigned as standbys in the absence of individuals assigned to Project.
- D. Post copies of list in Project meeting room, in temporary field office, and by each temporary phone.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 ADMINISTRATIVE SUBMITTAL MILESTONE SCHEDULE

- A. This list of administrative submittals includes, but not limited to, requirements included by Contract and this Project Manual.
- B. Failure to make critical administrative submittals, tied to specified payment applications, can result in held payment applications; Architect may recommend full or partial withholding of stipulated payment application, until submission of required administrative submittals.
- C. Milestone Schedule does not include itemized closeout submittals by section reference.
- D. Milestones:
1. Schedule of Values; Section 01 20 00 - Price and Payment Procedures.
 - a. Prior to Preconstruction meeting.
 - b. Revise schedule to list approved Change Orders, with each Application for Payment.
 2. Section 01 30 00 - Administrative Requirements.
 - a. Change Order Request resulting from RFI Response:
 - 1) 10 days of receipt of the RFI response.
 - 2) Contractor waives any right to make a claim by not initiating action within this 10-day duration of time.
 - b. Subcontract List: Submit prior to or with first full-month Application for Payment.
 - c. Staff Names and Assignments: Submit a list of principal staff assignments, including superintendent and other personnel to be in attendance at Project site, within a week of Notice to Proceed.

- d. Daily Construction Reports: Submit electronically via County's secure FTP site at a weekly interval.
 - e. Progress Photographs: Submit photographs with each application for payment, taken not more than 3 days prior to submission of application for payment.
- 3. Coordination Drawings; Section 01 31 14 - Facility Services Coordination.
 - a. Complete the requirements for Coordination Drawings within 75 days of starting construction operations.
- 4. Section 01 32 16 - Construction Progress Schedule.
 - a. Construction Progress Schedule:
 - 1) Within 30 days after date of Notice of Award, submit preliminary schedule defining planned operations for the first 60 days of Work, with a general outline for remainder of Work.
 - 2) If preliminary schedule requires revision after review, submit revised schedule within 10 days.
 - 3) Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review.
 - 4) Within 10 days after joint review, submit complete schedule.
 - 5) Submit updated schedule with each Application for Payment.
 - b. Submittal Schedule:
 - 1) Submit prior to or with second full month Application for Payment.
 - 2) All submittals must be submitted prior to 50 percent completion of project.
- 5. Section 01 40 00 - Quality Requirements.
 - a. Schedule of Tests and Inspections: Prepare in tabular form, within 30 days following mobilization Preconstruction Conference.
 - b. Test Reports: Submit report within 15 days after each test or inspection.
 - c. Manufacturer's Field Reports: Submit report in duplicate within 30 days of observation to Architect for information.
- 6. Section 01 60 00 - Product Requirements.
 - a. Proposed Product List: Submit prior to or with second full-month Application for Payment. Failure to comply with submission date will obligate Contractor to providing Basis-of-Design products where named in the specification, in order to allow associated trades to determine their coordination issues.
 - b. Comparable Product Request Submittals: Submit Comparable Product requests before scheduled submittal dates in Contractor's companion schedule to the construction schedule; refer to Section 01 32 16.
 - c. Substitution Requests: Architect will not consider requests for substitution, after Bid, except for extenuating circumstances described within referenced section.
- 7. Section 01 71 23 - Field Engineering.
 - a. Submit daily reports, with content as indicated in this section.
 - b. Closeout Submittal: Final property survey.
- 8. Section 01 74 19 - Construction Waste Management and Disposal.
 - a. Submit plan within 30 days of date established for commencement of the Work.
- 9. Section 01 78 00 - Closeout Submittals.
 - a. With each application for payment, provide written certification that Project Record Documents are current at time application is submitted.
 - b. Reports: Submit written report weekly indicating items incorporated into project record documents concurrent with progress of the Work.
 - c. Operation and Maintenance Data:

- 1) Manual Content Submittal: Operations and maintenance manual content is specified in individual Specification Sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
 - 2) Initial Manual Submittal: Submit draft copy of each manual at least 90 days calendar days before commencing demonstration and training.
 - 3) Final Draft Manual Submittal: Submit revised draft copy of each manual that was found unacceptable by Architect or Owner at least 30 calendar days before commencing demonstration and training.
- d. Warranties and Bonds: Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Substantial completion is determined.

3.2 PRECONSTRUCTION MEETING

- A. Owner will schedule a meeting after Notice of Award.
- B. Attendance Required:
1. Owner.
 2. Architect.
 3. Contractor.
 4. Construction Manager.
- C. Agenda:
1. Designation of personnel representing the parties to Contract, Owner and Architect.
 2. Project dates.
 3. Administrative and submittal milestones.
 4. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
 5. Scheduling.
 6. Architect's CAD sharing.
 7. Testing and laboratory services; Special Inspections.
 8. Temporary facilities and controls.
 9. Use of site.
- D. Owner will record minutes and post to County's secure FTP site within five days after meeting.

3.3 PROGRESS MEETINGS

- A. Project Coordinator will make arrangements for meetings, prepare agenda with copies for participants, preside at meetings.
- B. Attendance Required: Contractor's project manager and job superintendent, major Subcontractors and suppliers, Owner, Architect, as appropriate to agenda topics for each meeting.
- C. Agenda:
1. Review minutes of previous meetings.
 2. Review of work progress.
 3. Field observations, problems, and decisions.
 4. Identification of problems that impede, or will impede, planned progress.
 5. Review of submittals schedule and status of submittals.
 6. Review of off-site fabrication and delivery schedules.
 7. Maintenance of progress schedule.
 8. Corrective measures to regain projected schedules.
 9. Planned progress during succeeding work period.
 10. Maintenance of quality and work standards.

11. Effect of proposed changes on progress schedule and coordination.
12. Other business relating to work.

D. Project Coordinator to record minutes and post within five days after meeting.

3.4 DAILY CONSTRUCTION REPORTS

- A. Submit electronically via County's secure FTP site at a weekly interval.
- B. Prepare a daily construction report recording the following information concerning events at Project site and project progress:
 1. Date.
 2. High and low temperatures, and general weather conditions.
 3. List of subcontractors at Project site.
 4. Approximate count of personnel at Project site for each trade.
 5. List of construction activities performed (for each trade).
 6. Major equipment at Project site.
 7. Safety, environmental, or industrial relations incidents.
 8. Meetings and significant decisions.
 9. Accidents and unusual events (submit a separate special report).
 10. Stoppages, delays, shortages, and losses. Include comparison between scheduled work activities (in Contractor's most recently updated and published schedule) and actual activities. Explain differences, if any. Note days or periods when no work was in progress and explain the reasons why.
 11. Meter readings and similar recordings.
 12. Emergency procedures.
 13. Directives and requests of Authority(s) Having Jurisdiction (AHJ).
 14. Change Orders received and implemented.
 15. Testing and/or inspections performed.
 16. Services connected or disconnected.
 17. Equipment or systems tests and start-ups.
 18. Partial completions, occupancies.
 19. Signature of Contractor's authorized representative.

3.5 PROGRESS PHOTOGRAPHS

- A. Submit photographs with each application for payment, taken not more than 3 days prior to submission of application for payment.
- B. Photography Type: Digital; electronic files.
- C. Provide photographs of site and site and construction throughout progress of Work produced by photographer, acceptable to Architect.
- D. In addition to periodic, recurring views, take photographs of each of the following events:
 1. Excavations in progress.
 2. Foundations in progress and upon completion.
 3. Structural framing in progress and upon completion.
 4. Enclosure of building, upon completion.
 5. Final completion, minimum of ten (10) photos.
- E. Views:
 1. Provide non-aerial photographs from four cardinal views at each specified time, until date of Substantial Completion.
 2. Consult with Architect for instructions on views required.
 3. Provide factual presentation.
 4. Provide correct exposure and focus, high resolution and sharpness, maximum depth of field, and minimum distortion.
- F. Digital Photographs: 24 bit color, minimum resolution of 1600 by 1200 ("2 megapixel"), in JPG format; provide files unaltered by photo editing software.

1. Delivery Medium: Via email.
2. File Naming: Include project identification, date and time of view, and view identification.
3. PDF File: Assemble all photos into printable pages in PDF format, with 2 to 3 photos per page, each photo labeled with file name; one PDF file per submittal.
4. Hard Copy: Printed hardcopy (grayscale) of PDF file and point of view sketch.

- G. Additional Photographic Requirements: Refer to Section 01 57 21 for photographic documentation requirements for Indoor Air Quality Controls.

3.6 REQUESTS FOR INTERPRETATION (RFIS)

- A. Procedure: Immediately on discovery of the need for interpretation of the Contract Documents, and if not possible to request interpretation at Project meeting, prepare and submit an RFI in the form specified.
1. RFIs shall originate with Contractor. RFIs submitted by entities other than Contractor will be returned with no response.
 2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.
 3. Frivolous RFIs: The Contractor will compensate the Owner for the Architect's time and expenses to process RFIs resulting from the Contractor's lack of studying and comparing the Contract Documents, coordinating their own Work, or repeating previous RFIs.
 4. Submit RFIs in PDF format.
- B. Content of the RFI: Include a detailed, legible description of item needing interpretation and the following:
1. Project name.
 2. Date.
 3. Name of Contractor.
 4. Name of Architect.
 5. RFI number, numbered sequentially.
 6. Specification Section number and title and related paragraphs, as appropriate.
 7. Drawing number and detail references, as appropriate.
 8. Field dimensions and conditions, as appropriate.
 9. Contractor's suggested solution(s). If Contractor's solution(s) impact the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
 10. Contractor's signature.
 11. Attachments: Include drawings, descriptions, measurements, photos, Product Data, Shop Drawings, and other information necessary to fully describe items needing interpretation.
 - a. Supplementary drawings prepared by Contractor shall include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments.
- C. Format of RFIs:
1. Software-Generated RFIs:
 - a. Preferred format.
 - b. Software-generated form with substantially the same content as indicated above.
 - c. Photographs shall be electronic files in JPG format.
 - d. Attachments shall be electronic files in Adobe Acrobat PDF format.
 2. Hard-Copy RFIs:
 - a. Permitted under conditions where electronic RFI is not feasible.
 - b. Identify each page of attachments with the RFI number and sequential page number.
- D. Architect's Action: Architect will review each RFI, determine action required, and return it. Allow seven working days for Architect's response for each RFI. RFIs received after 1:00 p.m. will be considered as received the following working day.

1. The following RFIs may be returned without action:
 - a. Requests for approval of submittals.
 - b. Requests for approval of substitutions.
 - c. Requests for coordination information already indicated in the Contract Documents.
 - d. Requests for adjustments in the Contract Time or the Contract Sum.
 - e. Requests for interpretation of Architect's actions on submittals.
 - f. Incomplete RFIs or RFIs with numerous errors.
 2. Architect's action may include a request for additional information, in which case Architect's time for response will start again.
 3. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, submit Change Order Request within 10 days of receipt of the RFI response as provided by General Conditions of the Contract.
- E. Architect's Action: Architect will review each RFI, determine action required, and respond; allow ten working days for Architect's response for each RFI. RFIs received after 1:00 p.m. will be considered as received the following working day.
1. The following RFIs may be returned without action:
 - a. Requests for approval of submittals.
 - b. Requests for approval of substitutions.
 - c. Requests for coordination information already indicated in the Contract Documents.
 - d. Requests for adjustments in the Contract Time or the Contract Sum.
 - e. Requests for interpretation of Architect's actions on submittals.
 - f. Incomplete RFIs or RFIs with numerous errors.
 2. Architect's action may include a request for additional information, in which case Architect's time for response will start again.
 3. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, submit Change Order Request within 10 days of receipt of the RFI response as provided by General Conditions of the Contract. Contractor waives any right to make a claim by not initiating action within this 10-day duration of time.
- F. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within seven days if Contractor disagrees with response.
- G. On receipt of Architect's action, immediately distribute the RFI response to affected parties. Review response and notify Architect within seven days if Contractor disagrees with response.
- H. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Software log with not less than the following:
1. Project name.
 2. Name and address of Contractor.
 3. Name and address of Architect.
 4. RFI number including RFIs that were dropped and not submitted.
 5. RFI description.
 6. Date the RFI was submitted.
 7. Date Architect's response was received.
 8. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
- I. RFI Log: Prepared and maintained by the Architect; Contractor to maintain a separate RFI log with subcontractors.
- 3.7 SUBMITTALS FOR REVIEW
- A. When the following are specified in individual sections, submit them for review:

1. Product data.
 2. Shop drawings.
 3. Samples for selection.
 4. Samples for verification.
- B. Package these submittals by specification section, except closeout submittals or Work performed by separate trades, in a single delivery to the Architect; failure of the Contractor to package these submittals in a single delivery may cause the Architect to withhold action on submittal until associated submittals required by the particular specification section are received.
- C. Submit to Architect for review for the limited purpose of checking for compliance with information given and the design concept expressed in Contract Documents.
- D. Samples will be reviewed for aesthetic, color, or finish selection.
- E. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below and for record documents purposes described in Section 01 78 00 - Closeout Submittals.

3.8 SUBMITTALS FOR INFORMATION

- A. When the following are specified in individual sections, submit them for information:
1. Design data.
 2. Certificates.
 3. Test reports.
 4. Inspection reports.
 5. Manufacturer's instructions.
 6. Manufacturer's field reports.
 7. Other types indicated.
- B. Submit for Architect's knowledge as contract administrator or for Owner.

3.9 SUBMITTALS FOR PROJECT CLOSEOUT

- A. Submit Correction Punch List for Substantial Completion.
- B. Submit Final Correction Punch List for Substantial Completion.
- C. When the following are specified in individual sections, submit them at project closeout in compliance with requirements of Section 01 78 00 - Closeout Submittals:
1. Project record documents.
 2. Operation and maintenance data.
 3. Warranties.
 4. Bonds.
 5. Other types as indicated.
- D. Submit for Owner's benefit during and after project completion.

3.10 NUMBER OF COPIES OF SUBMITTALS

- A. Electronic Documents: Submit one electronic copy in PDF format; an electronically-marked up file will be returned. Create PDFs at native size and right-side up; illegible files will be rejected.
- B. Documents for Project Closeout: Make one reproduction of submittal originally reviewed. Submit one extra of submittals for information.
- C. Samples: Submit the number specified in individual specification sections; one of which will be retained by Architect.
1. After review, produce duplicates.
 2. Retained samples will not be returned to Contractor unless specifically so stated.

3.11 SUBMITTAL PROCEDURES

- A. General Requirements:
- B. Submittals Schedule: Comply with requirements in Division 01 Section "Construction Progress Documentation" for list of submittals and time requirements for scheduled performance of related construction activities.
- C. Processing Time: Allow enough 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 21 days for initial review of each submittal; duration of time is defined by date received in Architect's office until the day sent from the Architect's office. 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 21 days for review of each resubmittal; duration of time is defined by date received in Architect's office until the day sent from the Architect's office.
 - 4. Concurrent Review: Where concurrent review of submittals by Architect's consultants, Owner, or other parties is indicated, allow 21 days for initial review of each submittal; duration of time is defined by date received in consultant's office until the day sent to the Contractor. Submittals required within the following divisions to be sent directly to the Architect's consultants:
 - a. All required submittals indicated in Division 3 section.
 - b. The following required submittals indicated in Division 4:
 - 1) Product data, shop drawings, material certificates, mix designs, and cold-weather procedures.
 - c. All required submittals indicated in the following Division 5 Sections:
 - 1) Structural Steel
 - 2) Steel Joists
 - 3) Steel Decking
 - 4) Cold-Formed Metal Framing
 - 5) Metal Fabrications
 - d. All required submittals indicated in the following Division 8 Section:
 - 1) Door Hardware
 - e. All required submittals for Food Service Equipment.
 - f. All required submittals indicated in Mechanical Divisions 21 through 23 sections.
 - g. All required submittals indicated in Division 26 sections.
 - h. All required submittals indicated in Divisions 31 through 33 sections.
 - 5. Color Selection: Architect will select colors within 60 days (to allow time for presentation to Owner and for Owner comments) after all color samples have been submitted including, but not limited to items listed below. The submittal data shall be complete, including shop drawings, product data, and color samples, and all required submittals and materials shall be in compliance with the specifications and be subsequently approved by the Architect. Color samples shall be actual samples of the material and not photographs. If there is a variation in color, shade, texture, or pattern, submit multiple samples to show full range of variation.
 - a. Interior Items (including but not limited to):
 - 1) Plastic laminate and millwork.
 - 2) Wood door veneer.
 - 3) Ceramic tile.
 - 4) Resilient floor tile.

- 5) Resilient performance flooring.
 - 6) Resilient wall base and accessories.
 - 7) Resinous flooring.
 - 8) Acoustical wall panels.
 - 9) Paint.
 - 10) High-performance coatings.
 - 11) Toilet compartments.
 - 12) Signs and cast letters.
 - 13) Folding panel partition finishes.
- b. Prefinished Exterior Items (including but not limited to):
- 1) Metal roofing.
 - 2) Metal wall panels.
 - 3) Copings, perimeter edge systems.
 - 4) Site furnishings and equipment.
- D. Submittal Identification: Place a permanent label or title block on each submittal for identification.
1. Indicate name of firm or entity that prepared each submittal on label or title block.
 2. Provide a space approximately 6 by 8 inches on label or beside title block to record Contractor's review and approval markings and action taken by Architect.
 3. Include the following information on label for processing and recording action taken:
 - a. Project name.
 - b. Date.
 - c. Name and address of Architect.
 - d. Name and address of Contractor.
 - e. Name and address of subcontractor.
 - f. Name and address of supplier.
 - g. Name of manufacturer.
 - h. Submittal number or other unique identifier, including revision identifier.
 - 1) Submittal number shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 06 10 00.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., 06 10 00.01.A).
 - 2) Number and title of appropriate Specification Section.
 - 3) Drawing number and detail references, as appropriate.
 - 4) Location(s) where product is to be installed, as appropriate.
 - 5) Other necessary identification.
- E. Deviations: Encircle or otherwise specifically identify deviations from the Contract Documents on submittals.
- F. 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.
- G. Use for Construction: Use only final submittals with mark indicating "No Exceptions Taken" or "Note Markings" taken by Architect.
- 3.12 USE OF ARCHITECT'S AND ARCHITECT'S CONSULTANTS' DRAWING FILES REQUIRING RELEASE FORMS
- A. Copies of Architect's drawing files, listed within required release forms, will be provided to Contractor for Contractor's and trade contractors' use in connection with Project; Contractor must sign and return the release form at the end of this Section. As applicable, the Architect's consultants may require their own releases to be signed and included with the executed Architect's form, and the Architect's consultant may charge a fee for releasing electronic files.
 - B. Allow one week for processing and delivery after Architect receives the signed form.

- C. Only the files indicated on Agreement(s) included at end of this Section shall be made available for use as backgrounds for preparation of shop drawings, fabrication drawings and coordination drawings. No other drawing files, for this Project, will be made available.
- D. Contractor does not have the right to release drawing files without first securing a signed Architect's release and, as applicable, the Architect's consultants' forms. Submit executed forms to the Architect by subsequent Application for Payment, with consultant fees as applicable.
- E. Any entity receiving the drawing files shall, to the fullest extent permitted by law, indemnify, defend and hold harmless the Architect, and its consultants from all claims, damages, losses, expenses, penalties and liabilities of any kind, including attorney's fees, arising out of or resulting from the use of the drawing files by the Contractor, or by third party recipients of the drawing files from the Contractor.
- F. Drawing files must not be considered to be Contract Documents as defined by the General Conditions of Contract.

3.13 DELEGATED DESIGN

- 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 Submittal: In addition to Shop Drawings, Product Data, and other required submittals, submit three copies of a statement, signed and sealed by the responsible design professional licensed in the State in which the Project is located, 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.

3.14 CONTRACTOR'S REVIEW

- A. 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. Verify:
 - 1. Field Measurements.
 - 2. Field Construction Criteria.
 - 3. Catalog Numbers and Similar Data.
 - 4. Quantities.
- C. Contractor's responsibility regarding errors and omissions in submittals is not relieved by Architect's review of submittals.
- D. Contractor's responsibility regarding deviations in submittals from requirements of Contract Documents is not relieved by Architect's review of submittals, unless Architect gives written acceptance of specific deviations as approved by Owner.
- E. When work is directly related and involves more than one trade, coordinate submittal with other trades and submit under one cover.
- F. After a submittal has been submitted for review, no changes may be made to that Submittal other than changes resulting from review notes made by the Architect unless such changes are clearly identified and circled before being resubmitted. Any failure to comply with this requirement shall nullify and invalidate the Architect's review.

- G. Approval Stamp: Stamp each submittal. Include Project name and location, submittal number, Specification Section title and number, 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 as follows:

THIS IS TO CERTIFY THAT THE SPECIFICATION REQUIREMENTS HAVE BEEN MET
AND ALL DIMENSIONS, CONDITIONS, AND QUANTITIES ARE VERIFIED AS SHOWN
AND/OR CORRECTED ON THESE DRAWINGS.

SIGNED _____

3.15 ARCHITECT'S/ACTION

- A. General: Architect will not review submittals that do not bear Contractor's approval stamp and will return them without action.
- B. Action Submittals: Architect will review each submittal, make marks to indicate corrections or modifications required, and return it; except where indicated otherwise. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action taken, as follows:
1. NO EXCEPTION TAKEN: The Work covered by the submittal is accepted as specified and the Work may proceed provided it complies with requirements of the Contract Documents.
 2. NOTE MARKINGS: The Work covered by the submittal is accepted as noted and the Work may proceed provided it complies with notations or corrections on the submittal and requirements of the Contract Documents.
 3. REVISE AND RESUBMIT: Do not proceed with the Work covered by the submittal. Revise or prepare a new submittal according to the notations and requirements of the Contract Documents, and resubmit without delay. Unmarked items may be fabricated if indicated.
 4. REJECTED: Architect will list reasons for rejection on the submittal or in the transmittal letter accompanying the submittal. Do not proceed with the Work covered by the submittal. Prepare new submittal according to the notations and requirements of the Contract Documents, and resubmit without delay.
 5. ACTION NOT REQUIRED: Either the submittal was not requested or the submittal was for information only or for record purposes.
- C. 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.
- D. Partial submittals are not acceptable, will be considered nonresponsive, and will be returned without review.
- E. Submittals not required by the Contract Documents may not be reviewed and may be discarded.

END OF SECTION 01 30 00

SECTION 01 31 14 - FACILITY SERVICES COORDINATION**PART 1 - GENERAL****1.1 SECTION INCLUDES****A. Coordination Drawings and Schedules:**

1. Coordination drawings and schedules must be represented within the Contractor's separate schedule of submittal dates required by Section 01 32 16, Construction Progress Schedule.
2. Schedule submittals (product data, shop drawings, etc.) for work to be represented in coordination drawings, prior to completion of coordination drawings as possible.
3. Accepted submittals prior to completion of coordination drawings to be considered "As Noted" – notation being that coordination drawings must be completed; this condition supersedes any action by Architect within submittal process.
4. Proceeding with work prior to completion of coordination drawings, including procurement of products or equipment, is at Contractor's risk; no additional costs to coordinate and fit work contrary or absent of coordination drawings will be the Owner's responsibility.

1.2 SUBMITTALS**A. Submit coordination drawings and schedules prior to submitting shop drawings, product data, and samples.****B. Areas of Work requiring Coordination Drawings include all areas and rooms in this building. Complete the requirements for Coordination Drawings within 75 days of starting construction operations. Prepare Coordination Drawings since limited space availability necessitates maximum utilization of space for efficient installation of different components.**

1. Content: Project-specific information, drawn accurately to scale.
2. Do not base Coordination Drawings on reproductions of the Contract Documents or standard printed data. The Construction Documents in their original, copies or electronic file form are the Architect's instrument of service and are protected under copyright laws.
3. Include the following information, as applicable:
 - a. Follow routing shown on Contract Drawings for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance and for repairs.
 - b. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
 - c. Indicate required installation sequences.
 - 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 considered changes to the Contract.
4. Number of Copies: Submit digitally via the web-based project management software system.
 - a. Submit five copies where Coordination Drawings are required for operation and maintenance manuals. Architect will retain two copies; remainder will be returned. Mark up and retain one returned copy as a Project Record Drawing.
5. Refer to individual Sections for Coordination Drawing requirements for Work in those Sections.
6. Each trade shall sign and date the Coordination Drawings after the addition of their information.

7. Do not begin fabrication until receipt of completed Coordination Drawings are acknowledged by the each contractor in writing to the Architect.
8. No progress payments will be made for any work affected by coordination drawings until coordination drawings governing that work have been accepted.
9. Any work installed prior to approval of coordination drawings shall be modified or replaced, as necessary, to conform to subsequently-approved construction drawings, at no additional cost to Owner.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 COORDINATION REQUIRED

- A. Coordinate the work listed below:
 1. Fire Suppression: Division 21.
 2. Plumbing: Division 22.
 3. Heating, Ventilating, and Air Conditioning: Division 23.
 4. Integrated Automation: Division 25.
 5. Electrical: Division 26.
 6. Communications: Division 27.
 7. Electronic Safety and Security: Division 28.
 8. Site Utilities: Division 33.
- B. Coordinate progress schedules, including dates for submittals and for delivery of products.
- C. Conduct meetings among subcontractors and others concerned, to establish and maintain coordination and schedules, and to resolve coordination matters in dispute.
- D. Participate in progress meetings. Report on progress of work to be adjusted under coordination requirements, and any required changes in schedules. Transmit minutes of meetings and reports to concerned parties.
- E. 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.
- F. 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.
- G. Coordinate installation of different components with other contractors to ensure maximum accessibility for required maintenance, service, and repair.
- H. Make adequate provisions to accommodate items scheduled for later installation.

3.2 COORDINATION DOCUMENTS

- A. Prepare coordination drawings to organize installation of products for efficient use of available space, for proper sequence of installation, and to identify potential conflicts.
 1. Priority of Construction Space:
 - a. Coordinate installation of different components to ensure performance and accessibility for required maintenance, service, and repair of all components, including mechanical and electrical.
 - b. Following is the Order of Priority of construction space:
 - 1) First: Ductwork.
 - 2) Second: Fire protection piping.
 - 3) Third: Other piping.
 - 4) Fourth: Conduit.

- B. Prepare a master schedule identifying responsibilities for activities that directly relate to this work, including submittals and temporary utilities; organize by specification section.
- C. Identify electrical power characteristics and control wiring required for each item of equipment.
- D. Maintain maximum headroom at all locations without finished ceilings.
- E. Maintain finished ceiling heights as indicated.
- F. Coordinate installations with other trades to prevent conflict with Work of other trades and cooperate in making reasonable modifications in layout as needed.
- G. Where conflicts occur with placement of mechanical and electrical materials as they relate to placement of other building materials, the Architect shall be consulted for assistance in coordination of the available space to accommodate all trades.
- H. Maintain documents for the duration of the work, recording changes due to site instructions, modifications or adjustments.
- I. Any construction delays required to accomplish coordination, approval of submittals or re-submittals, or consequent to coordination work, shall be incurred at no additional cost to Owner; such delays may include, but not be limited to , the following:
 - 1. Time taken for preparation and submission of acceptable coordination drawings, including a reasonable period for Architect's review and approval.
 - 2. Time taken for preparation and approval of acceptable mock-ups.
 - 3. Time taken for modifications and replacements of non-conforming work.

3.3 COORDINATION OF SUBMITTALS

- A. Review shop drawings, product data, and samples for compliance with Contract Documents and for coordination with related work. Transmit copies of reviewed documents to Architect.
- B. Check field dimensions and clearances and relationship to available space and anchors.
- C. Check compatibility with equipment and work of other sections, electrical characteristics, and operational control requirements.
- D. Check motor voltages and control characteristics.
- E. Coordinate controls, interlocks, wiring of switches, and relays.
- F. Coordinate wiring and control diagrams.
- G. When changes in the work are made, review their effect on other work.
- H. Verify information and coordinate maintenance of record documents.

3.4 COORDINATION OF SUBSTITUTIONS AND MODIFICATIONS

- A. Review proposals and requests for substitution prior to submission to Architect.
- B. Verify compliance with Contract Documents and for compatibility with work of other sections.

3.5 ABOVE-CEILING PRE-CONSTRUCTION CONFERENCE

- A. Schedule and conduct with all affected parties present to review procedures for addressing potential conflicts, review of Coordination Drawings and obtain approval of each affected trade to ensure components, materials, and systems can be installed as intended prior to the Work being performed.
 - 1. Identify Above-Ceiling Pre-Construction Conference on the Construction Schedule as a "milestone" date.
 - 2. Advise the Architect of potential conflicts identified in the Coordination Drawings (if furnished) and Above-Ceiling Pre-Construction Conference.

- 3. Do not proceed with construction or installation of the components, materials, and systems until potential conflicts identified have been resolved and affected parties have agreed to a remedy.
 - B. Remedies to address conflicts not identified in the Coordination Drawings, Above-Ceiling Pre-Construction Conference, or otherwise addressed prior to construction or installation of the affected components, materials, and systems; or discovery of a non-workable situation without Coordination Drawings on file with the Owner will not be considered as a basis of delay, time extension, or additional cost to the Contract.
- 3.6 OBSERVATION OF WORK
- A. Observe work for compliance with Contract Documents.
 - B. Maintain a list of observed deficiencies and defects; promptly submit.
- 3.7 EQUIPMENT START-UP
- A. Verify utilities, connections, and controls are complete and equipment is in operable condition as required by Section 01 70 00.
 - B. Observe start-up and adjustments, test run, record time and date of start-up, and results.
 - C. Observe equipment demonstrations made to Owner; record times and additional information required for operation and maintenance manuals.
- 3.8 INSPECTION AND ACCEPTANCE OF EQUIPMENT
- A. Prior to inspection, verify that equipment is tested, operational, clean, and ready for operation.
 - B. Assist Architect with review. Prepare list of items to be completed and corrected.

END OF SECTION 01 31 14

SECTION 01 32 16 - CONSTRUCTION PROGRESS SCHEDULE**PART 1 - GENERAL****1.1 SECTION INCLUDES**

- A. Preliminary schedule.
- B. Construction progress schedule, with network analysis diagrams and reports.
- C. Responsibility for completion of Work per schedule and preparation of recovery schedules.

1.2 SUBMITTALS

- A. Within 30 days after date of Notice of Award, submit preliminary schedule defining planned operations for the first 60 days of Work, with a general outline for remainder of Work defining planned operations for the first 60 days of Work, with a general outline for remainder of Work.
- B. If preliminary schedule requires revision after review, submit revised schedule within 10 days.
- C. Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review.
 - 1. Include written certification that major contractors have reviewed and accepted proposed schedule.
- D. Within 10 days after joint review, submit complete schedule.
- E. Submit updated schedule with each Application for Payment.
- F. Submit the number of opaque reproductions that Contractor requires, plus two copies that will be retained by Architect.
- G. Submit under transmittal letter form specified in Section 01 30 00 - Administrative Requirements.

1.3 QUALITY ASSURANCE

- A. Scheduler: Contractor's personnel or specialist Consultant specializing in CPM scheduling with one years minimum experience in scheduling construction work of a complexity comparable to this Project, and having use of computer facilities capable of delivering a detailed graphic printout within 48 hours of request.

PART 2 - PRODUCTS - NOT USED**PART 3 - EXECUTION****3.1 PRELIMINARY SCHEDULE**

- A. Prepare preliminary schedule in the form of a preliminary network diagram.

3.2 CONTENT

- A. Show complete sequence of construction by activity, with dates for beginning and completion of each element of construction.
- B. Show accumulated percentage of completion of each item, and total percentage of Work completed, as of the first day of each month.
- C. Provide separate Submittal Schedule of submission dates for action and information submittals including, but not limited to, shop drawings, product data, samples, test and inspection reports, owner-furnished products, products identified under Allowances. Include dates reviewed submittals will be required from Architect, indicate decision dates for selection of finishes.

1. Submit prior to or with second full-month Application for Payment.
2. All submittals must be submitted prior to 50 percent completion of the project.
3. No work can be performed without accepted submittal of all submittals relevant to the work; Contractor bears the risk of ordering materials without accepted submittal of relevant action submittals.
 - a. In accordance with Section 01 30 00, the Architect has 60 days to select colors for components requiring color selection, after required submittals for all components requiring color selection are submitted; scheduling must account for this provision.
 - b. Contractor cannot request delay change in contract amount or completion, resulting from omission of this process within the construction progress schedule.
4. Coordinate with construction schedule and schedule of values.
5. Format schedule to allow tracking of status of submittals throughout duration of construction.
6. Arrange information to include scheduled date for initial submission, specification number and title, description of item of work covered, and role and name of subcontractor.
7. Account for time required for preparation, review, manufacturing, fabrication and delivery when establishing submittal delivery and review deadline dates.
 - a. For assemblies, equipment, systems comprised of multiple components and/or requiring detailed coordination with other work, allow for additional time to make connections or revisions to initial submittals, and time for their review.
- D. Coordinate content with schedule of values specified in Section 01 20 00 - Price and Payment Procedures.
- E. Provide legend for symbols and abbreviations used.

3.3 NETWORK ANALYSIS

- A. Prepare network analysis diagrams and supporting mathematical analyses using the Critical Path Method.
- B. Illustrate order and interdependence of activities and sequence of work; how start of a given activity depends on completion of preceding activities, and how completion of the activity may restrain start of subsequent activities.
- C. Mathematical Analysis: Tabulate each activity of detailed network diagrams, using calendar dates, and identify for each activity:
 1. Preceding and following event numbers.
 2. Activity description.
 3. Estimated duration of activity, in maximum 15 day intervals.
 4. Earliest start date.
 5. Earliest finish date.
 6. Actual start date.
 7. Actual finish date.
 8. Latest start date.
 9. Latest finish date.
 10. Total and free float; float time shall accrue to Owner and to Owner's benefit.
 11. Monetary value of activity, keyed to Schedule of Values.
 12. Percentage of activity completed.
 13. Responsibility.
- D. Analysis Program: Capable of compiling monetary value of completed and partially completed activities, accepting revised completion dates, and recomputation of all dates and float.
- E. Required Reports: List activities in sorts or groups:
 1. By preceding work item or event number from lowest to highest.
 2. By amount of float, then in order of early start.

3.4 REVIEW AND EVALUATION OF SCHEDULE

- A. Participate in joint review and evaluation of schedule with Architect at each submittal.
- B. Evaluate project status to determine work behind schedule and work ahead of schedule.
- C. After review, revise as necessary as result of review, and resubmit within 10 days.

3.5 FLOAT TIME

- A. Float is not for the exclusive benefit of either Contractor or Owner.
- B. Manage work according to early start dates, by commencing activities on the early start date (calculated by the latest approved Contract Schedule) or earlier if possible, unless constrained by a bona fide resource limitation.
- C. Owner may reserve and apportion float time according to the needs of the Project.
- D. Actual or projected Owner-caused delays that do not exceed available float time shall not have any effect upon Contractor's adherence to specified time constraints and shall not be a basis for any time extension.
- E. Contractor acknowledges the following:
 - 1. Activity delays shall not automatically result in adjustment of specified time constraints.
 - 2. A Change Order or other Owner action or inaction may not affect existing critical activities or cause non-critical activities to become critical.
 - 3. A Change Order or delay may result in only absorbing a part of the available total float that may exist within an activity chain of the network, thereby not causing any effect on specified time constraints.
- F. Pursuant to the above float sharing requirements, use of float released by elimination of float suppression techniques such as preferential sequencing, special lead/lag logic restraints, unreasonably extended activity durations, or imposed dates shall be distributed by Owner to the benefit of Owner and Contractor.
- G. In the event of the Contractor wishes to complete the Work earlier than the time specified therefore:
 - 1. Continue to calculate float based on the Work completion date specified as of Contract execution, by maintaining the specified Work completion date as a "finish-no-later-than" constraint.
 - 2. The completion time for the Work shall be amended by Owner's acceptance of or acquiescence to Contractor's proposed earlier completion date.
 - 3. Contractor shall not, under any circumstances, receive additional compensation for indirect, general, administrative or other forms of overhead costs, for the period between the time of earlier completion proposed by Contractor and the completion time for the Work specified as of NTP.

3.6 UPDATING SCHEDULE

- A. Maintain schedules to record actual start and finish dates of completed activities.
- B. Indicate progress of each activity to date of revision, with projected completion date of each activity.
- C. Annotate diagrams to graphically depict current status of Work.
- D. Identify activities modified since previous submittal, major changes in Work, and other identifiable changes.
- E. Indicate changes required to maintain Date of Substantial Completion.
- F. Submit reports required to support recommended changes.

- G. Provide narrative report to define problem areas, anticipated delays, and impact on the schedule. Report corrective action taken or proposed and its effect including the effects of changes on schedules of separate contractors.

3.7 RESPONSIBILITY FOR COMPLETION

- A. Take a combination of the following actions, at no additional cost to the Owner, when the progress schedule illustrates that the Contract Substantial Completion date can not be met:
 - 1. Increase construction manpower in such quantities and trades to substantially eliminate the backlog of Work.
 - 2. Increase the number of work hours per shift, shifts per working day, working days per week, or the amount of construction equipment, or any combination to substantially eliminate the backlog of Work.
 - 3. Reschedule activities to achieve maximum practical concurrency of accomplishment of activities.
- B. Recovery Schedule: Prepare a recovery schedule from all trades to accelerate progress, if a milestone is missed, a single duration work activity is incomplete for ten work days, or overall work progress is deemed insufficient by the Owner/Architect.
 - 1. A recovery schedule must be initiated by the Contractor, reviewed by effected trade contractors and submitted ten working days after one of the above conditions occurs.
 - 2. Submit recovery schedule in same number of copies as original.
 - 3. Trades must execute means necessary to bring the Project back on schedule using the recovery schedule; accelerated Work and additional overhead necessary to keep the Project on schedule is included in the Contract.
 - 4. Recovery schedule to be double the size of the original diagram, as a minimum, illustrating existing and revised activities alongside original data; revised activities must be easily differentiated from original schedule.
- C. Failure of the Contractor to comply with requirements of this subsection may be a basis for determination that the Contractor is not prosecuting the Work with such diligence as will ensure completion within the time stipulated; upon such determination, the Owner may take such action deemed appropriate.

3.8 DISTRIBUTION OF SCHEDULE

- A. Distribute copies of updated schedules to Contractor's project site file, to subcontractors, suppliers, Architect, Owner, and other concerned parties.
- B. Instruct recipients to promptly report, in writing, problems anticipated by projections indicated in schedules.

END OF SECTION 01 32 16

SECTION 01 35 53 - SECURITY PROCEDURES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Security measures including formal security program, entry control, personnel identification and miscellaneous restrictions.

1.2 SECURITY PROGRAM

- A. Protect Work, existing premises and Owner's operations from theft, vandalism, and unauthorized entry.
- B. Initiate program at project mobilization.
- C. Maintain program throughout construction period until Owner occupancy.

1.3 ENTRY CONTROL

- A. Restrict entrance of persons and vehicles into Project site and existing facilities.
- B. Allow entrance only to authorized persons with proper identification.
- C. Maintain log of workers and visitors, make available to Owner on request.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION - NOT USED

END OF SECTION

SECTION 01 40 00 - QUALITY REQUIREMENTS**PART 1 - GENERAL****1.1 SECTION INCLUDES**

- A. Submittals.
- B. Quality assurance.
- C. References and standards.
- D. Testing and inspection agencies and services.
- E. Contractor's construction-related professional design services.
- F. Contractor's design-related professional design services.
- G. Control of installation.
- H. Mock-ups.
- I. Tolerances.
- J. Manufacturers' field services.
- K. Defect Assessment.

1.2 REFERENCE STANDARDS

- A. ASTM C1021 - Standard Practice for Laboratories Engaged in Testing of Building Sealants.
- B. ASTM C1077 - Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation.
- C. ASTM C1093 - Standard Practice for Accreditation of Testing Agencies for Masonry.
- D. ASTM D3740 - Standard Practice for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.
- E. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection.
- F. ASTM E543 - Standard Specification for Agencies Performing Nondestructive Testing.
- G. IAS AC89 - Accreditation Criteria for Testing Laboratories.

1.3 DEFINITIONS

- A. Contractor's Quality Control Plan: Contractor's management plan for executing the Contract for Construction.
- B. Contractor's Professional Design Services: Design of some aspect or portion of the project by party other than the design professional of record. Provide these services as part of the Contract for Construction.
 - 1. Design Services Types Required:
 - a. Construction-Related: Services Contractor needs to provide in order to carry out the Contractor's sole responsibilities for construction means, methods, techniques, sequences, and procedures.
 - b. Design-Related: Design services explicitly required to be performed by another design professional due to highly-technical and/or specialized nature of a portion of the project. Services primarily involve engineering analysis, calculations, and design, and are not intended to alter the aesthetic aspects of the design.

- C. Design Data: Design-related, signed and sealed drawings, calculations, specifications, certifications, shop drawings and other submittals provided by Contractor, and prepared directly by, or under direct supervision of, appropriately licensed design professional.

1.4 CONTRACTOR'S CONSTRUCTION-RELATED PROFESSIONAL DESIGN SERVICES

- A. Coordination: Contractor's professional design services are subject to requirements of project's Conditions for Construction Contract.
- B. Provide such engineering design services as may be necessary to plan and safely conduct certain construction operations, pertaining to, but not limited to the following:
 - 1. Temporary sheeting, shoring, or supports.
 - 2. Temporary scaffolding.
 - 3. Temporary bracing.
 - 4. Temporary falsework for support of spanning or arched structures.
 - 5. Temporary stairs or steps required for construction access only.
 - 6. Temporary hoist(s) and rigging.
 - 7. Investigation of soil conditions to support construction equipment.

1.5 CONTRACTOR'S DESIGN-RELATED PROFESSIONAL DESIGN SERVICES

- A. Coordination: Contractor's professional design services are subject to requirements of project's Conditions for Construction Contract.
- B. Base design on performance and/or design criteria indicated in individual specification sections.
 - 1. Submit a Request for Interpretation to Architect if the criteria indicated are not sufficient to perform required design services.
- C. Scope of Contractor's Professional Design Services: Provide for the following items of work: Provide as indicated in Contract Documents including, but not limited to, assemblies indicated as Delegated Design.

1.6 SUBMITTALS

- A. Schedule of Tests and Inspections: Prepare in tabular form, within 30 days following Preconstruction Conference, and include the following:
 - 1. Specification section number and title.
 - 2. Description of test and inspection.
 - 3. Identification of applicable standards.
 - 4. Identification of test and inspection methods.
 - 5. Number of tests and inspections required.
 - 6. Time schedule or time span for tests and inspections.
 - 7. Entity responsible for performing tests and inspections.
 - 8. Requirements for obtaining samples.
 - 9. Unique characteristics of each quality-control service.
- B. Design Data: Submit for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents, or for Owner's information.
- C. Test Reports: Submit report to Architect and to Contractor within 15 days, after each test or inspection.
 - 1. Include:
 - a. Date issued.
 - b. Project title and number.
 - c. Name of inspector.
 - d. Date and time of sampling or inspection.
 - e. Identification of product and specifications section.
 - f. Location in the Project.

- g. Type of test/inspection.
 - h. Date of test/inspection.
 - i. Results of test/inspection.
 - j. Compliance with Contract Documents.
 - k. When requested by Architect, provide interpretation of results.
 - 2. Test report submittals are for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents, or for Owner's information.
 - D. Certificates: When specified in individual specification sections, submit certification by the manufacturer and Contractor or installation/application subcontractor to Architect, in quantities specified for Product Data.
 - 1. Indicate material or product complies with or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
 - 2. Certificates may be recent or previous test results on material or product, but must be acceptable to Architect.
 - E. Manufacturer's Instructions: When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, for the Owner's information. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.
 - F. Manufacturer's Field Reports: Submit reports for Architect's benefit as contract administrator or for Owner.
 - 1. Submit report in duplicate within 30 days of observation to Architect for information.
 - 2. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents.
- 1.7 QUALITY ASSURANCE
- A. Testing Agency Qualifications:
 - 1. Prior to start of work, submit agency name, address, and telephone number, and names of full time registered Engineer and responsible officer.
 - 2. Submit copy of report of laboratory facilities inspection made by NIST Construction Materials Reference Laboratory during most recent inspection, with memorandum of remedies of any deficiencies reported by the inspection.
 - 3. Qualification Statement: Provide documentation showing testing laboratory is accredited under IAS AC89.
 - B. Designer Qualifications: Where professional engineering design services and design data submittals are specifically required of Contractor by Contract Documents, provide services of a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.
 - C. Contractor's Quality Control (CQC) Plan:
 - 1. Prior to start of work, submit a comprehensive plan describing how contract deliverables will be produced. Tailor CQC plan to specific requirements of the project. Include the following information:
 - a. Management Structure: Identify personnel responsible for quality. Include a chart showing lines of authority.
 - 1) Include qualifications (in resume form), duties, responsibilities of each person assigned to CQC function.
 - b. Management Approach: Define, describe, and include in the plan specific methodologies used in executing the work.
 - 1) Management and control of documents and records relating to quality.
 - 2) Communications.

- 3) Coordination procedures.
 - 4) Resource management.
 - 5) Process control.
 - 6) Inspection and testing procedures and scheduling.
 - 7) Control of noncomplying work.
 - 8) Tracking deficiencies from identification, through acceptable corrective action, and verification.
 - 9) Control of testing and measuring equipment.
 - 10) Project materials certification.
 - 11) Managerial continuity and flexibility.
- c. Owner will not make a separate payment for providing and maintaining a Quality Control Plan. Include associated costs in Bid price.
 - d. Acceptance of the plan is required prior to start of construction activities not including mobilization work. Owner's acceptance of the plan will be conditional and predicated on continuing satisfactory adherence to the plan. Owner reserves the right to require Contractor to make changes to the plan and operations, including removal of personnel, as necessary, to obtain specified quality of work results.
- D. Quality-Control Personnel Qualifications. Engage a person with requisite training and experience to implement and manage quality assurance (QA) and quality control (QC) for the project.

1.8 REFERENCES AND STANDARDS

- A. For products and workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.
- B. Comply with reference standard of date of issue current on date of Contract Documents, except where a specific date is established by applicable code.
- C. Obtain copies of standards where required by product specification sections.
- D. Maintain copy at project site during submittals, planning, and progress of the specific work, until Substantial Completion.
- E. Should specified reference standards conflict with Contract Documents, request clarification from Architect before proceeding.
- F. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of Architect shall be altered from Contract Documents by mention or inference otherwise in any reference document.

1.9 TESTING AND INSPECTIONS AGENCIES AND SERVICES

- A. Contractor shall employ and pay for services of an independent testing agency to perform all specified testing.
- B. Employment of agency in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.
- C. Contractor Employed Agency:
 1. Testing agency: Comply with requirements of ASTM E329, ASTM E543, ASTM C1021, ASTM C1077, ASTM C1093 and ASTM D3740.
 2. Inspection agency: Comply with requirements of ASTM D3740 and ASTM E329.
 3. Laboratory: Authorized to operate in the State in which the Project is located.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 CONTROL OF INSTALLATION

- A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce work of specified quality.
- B. Comply with manufacturers' instructions, including each step in sequence.
- C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect before proceeding.
- D. Comply with specified standards as minimum quality for the work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
- E. Have work performed by persons qualified to produce required and specified quality.
- F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.
- G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

3.2 MOCK-UPS

- A. Before installing portions of the Work where mock-ups are required, construct mock-ups in location and size indicated for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work. The purpose of mock-up is to demonstrate the proposed range of aesthetic effects and workmanship.
- B. Accepted mock-ups establish the standard of quality the Architect will use to judge the Work.
- C. Integrated Exterior Mock-ups: Construct integrated exterior mock-up as indicated on drawings. Coordinate installation of exterior envelope materials and products as required in individual Specification Sections. Provide adequate supporting structure for mock-up materials as necessary.
- D. Tests shall be performed under provisions identified in this section and identified in the respective product specification sections.
- E. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.
- F. Accepted mock-ups shall be a comparison standard for the remaining Work.
- G. Where mock-up has been accepted by Architect and is specified in product specification sections to be removed, protect mock-up throughout construction, remove mock-up and clear area when directed to do so by Architect.

3.3 TOLERANCES

- A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.
- B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Architect before proceeding.
- C. Adjust products to appropriate dimensions; position before securing products in place.

3.4 TESTING AND INSPECTION

- A. Testing Agency Duties:

1. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
 2. Perform specified sampling and testing of products in accordance with specified standards.
 3. Ascertain compliance of materials and mixes with requirements of Contract Documents.
 4. Promptly notify Architect and Contractor of observed irregularities or non-compliance of Work or products.
 5. Perform additional tests and inspections required by Architect.
 6. Submit reports of all tests/inspections specified.
- B. Limits on Testing/Inspection Agency Authority:
1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
 2. Agency may not approve or accept any portion of the Work.
 3. Agency may not assume any duties of Contractor.
 4. Agency has no authority to stop the Work.
- C. Contractor Responsibilities:
1. Deliver to agency at designated location, adequate samples of materials proposed to be used that require testing, along with proposed mix designs.
 2. Cooperate with laboratory personnel, and provide access to the Work and to manufacturers' facilities.
 3. Provide incidental labor and facilities:
 - a. To provide access to Work to be tested/inspected.
 - b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
 - c. To facilitate tests/inspections.
 - d. To provide storage and curing of test samples.
 4. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing/inspection services.
 5. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
- D. Re-testing required because of non-compliance with specified requirements shall be performed by the same agency on instructions by Architect.
- E. Re-testing required because of non-compliance with specified requirements shall be paid for by Contractor.
- 3.5 MANUFACTURERS' FIELD SERVICES
- A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust, and balance equipment as applicable, and to initiate instructions when necessary.
 - B. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.
- 3.6 DEFECT ASSESSMENT
- A. Replace Work or portions of the Work not complying with specified requirements.

END OF SECTION 01 40 00

SECTION 01 50 00 - TEMPORARY FACILITIES AND CONTROLS**PART 1 - GENERAL****1.1 SECTION INCLUDES**

- A. Temporary telecommunications services.
- B. Temporary telephone service.
- C. Temporary sanitary facilities.
- D. Temporary Controls: Barriers, enclosures and fencing.

1.2 TELECOMMUNICATIONS SERVICES

- A. Provide, maintain, and pay for telecommunications services to field office at time of project mobilization.
- B. Telecommunications services shall include:
 - 1. Windows-based personal computer dedicated to project telecommunications, with necessary software and laser printer.
 - 2. Telephone Land Lines: One line, minimum; one handset per line.
 - 3. Internet Connections: Minimum of one; 3G WiFi access point or faster.

1.3 TEMPORARY SANITARY FACILITIES

- A. Provide and maintain required facilities and enclosures. Provide at time of project mobilization.
- B. Maintain daily in clean and sanitary condition.

1.4 BARRIERS

- A. Provide barriers to prevent unauthorized entry to construction areas, to prevent access to areas that could be hazardous to workers or the public, to allow for owner's use of site and to protect existing facilities and adjacent properties from damage from construction operations and demolition.
- B. Provide barricades and covered walkways required by governing authorities for public rights-of-way and for public access to existing building.
- C. Provide protection for plants designated to remain. Replace damaged plants.
- D. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

1.5 FENCING

- A. Provide 6 foot high fence around construction site; equip with vehicular and pedestrian gates with locks.

1.6 EXTERIOR ENCLOSURES

- A. Provide temporary insulated weather tight closure of exterior openings to accommodate acceptable working conditions and protection for Products, to allow for temporary heating and maintenance of required ambient temperatures identified in individual specification sections, and to prevent entry of unauthorized persons. Provide access doors with self-closing hardware and locks.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION - NOT USED

END OF SECTION 01 50 00

SECTION 01 51 00 - TEMPORARY UTILITIES**PART 1 - GENERAL****1.1 SECTION INCLUDES**

- A. Temporary Utilities: Electricity, lighting, heat, ventilation and water.

1.2 RELATED REQUIREMENTS

- A. Section 01 50 00 - Temporary Facilities and Controls: Telephone service for administrative purposes.
- B. 29 CFR 1926 - U.S. Occupational Safety and Health Standards.

1.3 TEMPORARY ELECTRICITY

- A. Cost: By Contractor.
- B. Provide power service required from utility source.
- C. Provide power outlets for construction operations, with branch wiring and distribution boxes located at each floor. Provide flexible power cords as required.
- D. Provide main service disconnect and over-current protection at convenient location and meter.
- E. Permanent convenience receptacles may be utilized during construction.
- F. Provide adequate distribution equipment, wiring, and outlets to provide single phase branch circuits for power and lighting.

1.4 TEMPORARY LIGHTING FOR CONSTRUCTION PURPOSES

- A. Provide and maintain LED, compact fluorescent or high-intensity discharge lighting as suitable for the application for construction operations in accordance with requirements of 29 CFR 1926 and authorities having jurisdiction.
- B. Provide branch wiring from power source to distribution boxes with lighting conductors, pigtails, and lamps as required.
- C. Maintain lighting and provide routine repairs.

1.5 TEMPORARY HEATING

- A. Cost of Energy: By Contractor.
- B. Provide heating devices and heat as needed to maintain specified conditions for construction operations.
- C. Maintain minimum ambient temperature of 50 degrees F in areas where construction is in progress, unless indicated otherwise in specifications.
- D. Prior to operation of permanent equipment for temporary heating purposes, verify that installation is approved for operation, equipment is lubricated and filters are in place. Provide and pay for operation, maintenance, and regular replacement of filters and worn or consumed parts.

1.6 TEMPORARY COOLING

- A. Cost of Energy: By Contractor.
- B. Provide cooling devices and cooling as needed to maintain specified conditions for construction operations.

- C. Maintain maximum ambient temperature of 80 degrees F in areas where construction is in progress, unless indicated otherwise in specifications.
- D. Prior to operation of permanent equipment for temporary cooling purposes, verify that installation is approved for operation, equipment is lubricated and filters are in place. Provide and pay for operation, maintenance, and regular replacement of filters and worn or consumed parts.

1.7 TEMPORARY VENTILATION

- A. Existing ventilation equipment may not be used.

1.8 TEMPORARY WATER SERVICE

- A. Cost of Water Used: By Contractor.
- B. Provide and maintain suitable quality water service for construction operations at time of project mobilization.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION - NOT USED

END OF SECTION 01 51 00

SECTION 01 55 00 - VEHICULAR ACCESS AND PARKING**PART 1 - GENERAL****1.1 SECTION INCLUDES**

- A. Driveways, entrance and traffic routes.
- B. Parking.
- C. Existing pavements and parking areas.
- D. Permanent pavements and parking facilities.
- E. Construction parking controls.
- F. Haul routes.
- G. Traffic signs and signals.
- H. Maintenance.
- I. Removal, repair.
- J. Mud from site vehicles.

PART 2 - PRODUCTS**2.1 MATERIALS**

- A. Temporary Construction: Contractor's option.
- B. Materials for Permanent Construction: As specified in product specification sections, including earthwork, paving base and topping.

2.2 SIGNS, SIGNALS, AND DEVICES

- A. Post Mounted and Wall Mounted Traffic Control and Informational Signs: Specified in Section 01 58 13 - Temporary Project Signage.
- B. Traffic Cones and Drums, Flares and Lights: As approved by local jurisdictions.
- C. Flag Person Equipment: As required by local jurisdictions.

PART 3 - EXECUTION**3.1 DRIVEWAYS, ENTRANCE AND TRAFFIC ROUTES**

- A. Keep driveways and entrances serving premises and site surrounding Project clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials. Provide continuous monitoring of site.
 - 1. Schedule deliveries to minimize use of driveways and entrances.
 - 2. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
- B. Truck deliveries shall be scheduled so that the streets adjacent to the site do not back up with delivery trucks waiting to deliver materials. Trucks must be scheduled accordingly, or wait to unload inside the fence in the project site or off the Owner's property.

3.2 PARKING

- A. Use of existing parking facilities by construction personnel must be approved by Owner.
- B. Use of new parking facilities by construction personnel is not permitted.

- C. Do not allow heavy vehicles or construction equipment in parking areas.
- D. Arrange for temporary parking areas to accommodate construction personnel.
- E. When site space is not adequate, provide additional off-site parking.
- F. Locate as approved by Architect.

3.3 PERMANENT PAVEMENTS AND PARKING FACILITIES

- A. Prior to Substantial Completion the base for permanent roads and parking areas may be used for construction traffic.
- B. Avoid traffic loading beyond paving design capacity. Tracked vehicles not allowed.

3.4 CONSTRUCTION PARKING CONTROL

- A. Control vehicular parking to prevent interference with public traffic and parking, access by emergency vehicles, and Owner's operations.
- B. Monitor parking of construction personnel's vehicles in existing facilities. Maintain vehicular access to and through parking areas.
- C. Prevent parking on or adjacent to access roads or in non-designated areas.

3.5 HAUL ROUTES

- A. Consult with authority having jurisdiction, establish public thoroughfares to be used for haul routes and site access.
- B. Confine construction traffic to designated haul routes.
- C. Provide traffic control at critical areas of haul routes to regulate traffic, to minimize interference with public traffic.

3.6 TRAFFIC SIGNS AND SIGNALS

- A. At approaches to site and on site, install at crossroads, detours, parking areas, and elsewhere as needed to direct construction and affected public traffic.
- B. Install and operate traffic control signals to direct and maintain orderly flow of traffic in areas under Contractor's control, and areas affected by Contractor's operations.
- C. Relocate as work progresses, to maintain effective traffic control.

3.7 MAINTENANCE

- A. Maintain traffic and parking areas in a sound condition free of excavated material, construction equipment, products, mud, snow, and ice.
- B. Maintain existing paved areas used for construction; promptly repair breaks, potholes, low areas, standing water, and other deficiencies, to maintain paving and drainage in original, or specified, condition.

3.8 REMOVAL, REPAIR

- A. Repair existing and new permanent facilities damaged by use, to original condition.
- B. Remove equipment and devices when no longer required.
- C. Repair damage caused by installation.

3.9 MUD FROM SITE VEHICLES

- A. Provide means of removing mud from vehicle wheels before entering streets.

END OF SECTION 01 55 00

SECTION 01 60 00 - PRODUCT REQUIREMENTS**PART 1 - GENERAL****1.1 SECTION INCLUDES**

- A. General product requirements.
- B. Transportation, handling, storage and protection.
- C. Product option requirements.
- D. Substitution limitations.
- E. Maintenance materials, including extra materials, spare parts, tools, and software.

1.2 SUBMITTALS

- A. Proposed Products List: Submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.
 - 1. Submit prior to or with second full-month Application for Payment.
 - 2. For products specified only by reference standards, list applicable reference standards.
 - 3. Failure to comply with submission date will obligate Contractor to providing Basis-of-Design products where named in the specification, in order to allow associated trades to determine their coordination issues.
- B. Comparable Product Request Submittal: Submit request for consideration of each comparable product or system for evaluation by Architect in accordance with submittal procedures specified in this Section for Substitution Requests.
 - 1. Submit Comparable Product requests before scheduled submittal dates in Contractor's companion schedule to the construction schedule; refer to Section 01 32 16.
- C. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.
- D. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
- E. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
 - 1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

PART 2 - PRODUCTS**2.1 NEW PRODUCTS**

- A. Provide new products unless specifically required or permitted by Contract Documents.
- B. Where other criteria are met, Contractor shall give preference to products that:
 - 1. Are extracted, harvested, and/or manufactured closer to the location of the project.
 - 2. Have longer documented life span under normal use.
 - 3. Result in less construction waste. See Section 01 74 19
 - 4. Are made of vegetable materials that are rapidly renewable.
- C. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.

- D. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, that 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 not in conflict with requirements of the Contract Documents.
 4. Where products are accompanied by the term "as selected," Architect will make selection.
 5. Where products are accompanied by the term "match sample," sample to be matched is Architect's.
 6. Descriptive, performance, and reference standard requirements in the Specifications establish "salient characteristics" of products.

2.2 PRODUCT OPTIONS

- A. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.
- B. Products of Named Manufacturers: Contractor to provide products from named manufacturers; refer to other provisions regarding substitutions.
- C. Named Products: Products identified by manufacturer, make or model number or other designation shown or listed in manufacturer's published product literature.
- D. Basis-of-Design Product Specification: Where a specific manufacturer's product is named and accompanied by the words "basis of design," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of other named manufacturers.
1. Where other named manufacturers included acceptable product for performance, Contractor must coordinate modifications due to sizing or engineering differences with associated trade contractors.
- E. Comparable Product: Product that is demonstrated and approved through submittal process 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. Comparable Products include:
1. Product of manufacturer listed without identified product; either with or without Basis-of-Design product identified in the Section.
 2. Product of manufacturer other than manufacturer/product listed and followed with "or equal," "or approved equal," or similar phrase.
 3. Contractor is responsible for costs associated with the use of Comparable Products, including coordination and modification with other trade contractors related to selection of Comparable Product.
 4. Use of Comparable Product must not require changes to the building design or engineering; use must not require additional inspection or testing fees to be paid by the Owner.
- F. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.

2.3 MAINTENANCE MATERIALS

- A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.
- B. Deliver to Project site; obtain receipt prior to final payment.

PART 3 - EXECUTION**3.1 SUBSTITUTION LIMITATIONS**

- A. See Section 01 25 00 - Substitution Procedures.

3.2 TRANSPORTATION AND HANDLING

- A. Package products for shipment in manner to prevent damage; for equipment, package to avoid loss of factory calibration.
- B. If special precautions are required, attach instructions prominently and legibly on outside of packaging.
- C. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.
- D. Transport and handle products in accordance with manufacturer's instructions.
- E. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.
- F. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.
- G. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage, and to minimize handling.
- H. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

3.3 STORAGE AND PROTECTION

- A. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication. See Section 01 74 19.
- B. Store and protect products in accordance with manufacturers' instructions.
- C. Store with seals and labels intact and legible.
- D. Store sensitive products in weathertight, climate-controlled enclosures in an environment favorable to product.
- E. For exterior storage of fabricated products, place on sloped supports above ground.
- F. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.
- G. Comply with manufacturer's warranty conditions, if any.
- H. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.
- I. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.
- J. Prevent contact with material that may cause corrosion, discoloration, or staining.
- K. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.
- L. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

END OF SECTION 01 60 00

SECTION 01 70 00 - EXECUTION AND CLOSEOUT REQUIREMENTS**PART 1 - GENERAL****1.1 SECTION INCLUDES**

- A. Examination, preparation, and general installation procedures.
- B. Requirements for alterations work, including selective demolition, except removal, disposal, and/or remediation of hazardous materials and toxic substances.
- C. Pre-installation meetings.
- D. Cutting and patching.
- E. Surveying for laying out the work.
- F. Cleaning and protection.
- G. Starting of systems and equipment.

1.2 SUBMITTALS

- A. Survey work: Submit name, address, and telephone number of Surveyor before starting survey work.
 - 1. On request, submit documentation verifying accuracy of survey work.
 - 2. Submit a copy of site drawing signed by the Land Surveyor, that the elevations and locations of the work are in compliance with Contract Documents.
 - 3. Submit surveys and survey logs for the project record.
- B. Cutting and Patching: Submit written request in advance of cutting or alteration that affects:
 - 1. Structural integrity of any element of Project.
 - 2. Integrity of weather exposed or moisture resistant element.
 - 3. Efficiency, maintenance, or safety of any operational element.
 - 4. Visual qualities of sight exposed elements.
 - 5. Work of Owner or separate Contractor.
 - 6. Include in request:
 - a. Identification of Project.
 - b. Location and description of affected work.
 - c. Necessity for cutting or alteration.
 - d. Description of proposed work and products to be used.
 - e. Alternatives to cutting and patching.
 - f. Effect on work of Owner or separate Contractor.
 - g. Written permission of affected separate Contractor.
 - h. Date and time work will be executed.
- C. Project Record Documents: Accurately record actual locations of capped and active utilities.

1.3 QUALIFICATIONS

- A. For surveying work, employ a land surveyor registered in the State in which the Project is located and acceptable to Architect. Submit evidence of surveyor's Errors and Omissions insurance coverage in the form of an Insurance Certificate. Employ only individual(s) trained and experienced in collecting and recording accurate data relevant to ongoing construction activities.
- B. For field engineering, employ a professional engineer of the discipline required for specific service on Project, licensed in the State in which the Project is located. Employ only individual(s) trained and experienced in establishing and maintaining horizontal and vertical control points necessary for laying out construction work on project of similar size, scope and/or complexity.

1.4 PROJECT CONDITIONS

- A. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.
- B. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.
- C. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere and over adjacent property.
- D. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations.
- E. Pest and Rodent Control: Provide methods, means, and facilities to prevent pests and insects from damaging the work.
- F. Rodent Control: Provide methods, means, and facilities to prevent rodents from accessing or invading premises.
- G. Pollution Control: Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations. Comply with federal, state, and local regulations.

PART 2 - PRODUCTS

2.1 PATCHING MATERIALS

- A. New Materials: As specified in product sections; match existing products and work for patching and extending work.
- B. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 01 25 00 - Substitution Procedures.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.
- B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.
- C. Examine and verify specific conditions described in individual specification sections.
- D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.
- E. Verify that utility services are available, of the correct characteristics, and in the correct locations.
- F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

3.2 PREPARATION

- A. Clean substrate surfaces prior to applying next material or substance.
- B. Seal cracks or openings of substrate prior to applying next material or substance.
- C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

3.3 PREINSTALLATION MEETINGS

- A. When required in individual specification sections, convene a preinstallation meeting at the site prior to commencing work of the section.
- B. Require attendance of parties directly affecting, or affected by, work of the specific section.
- C. Notify Architect four days in advance of meeting date.
- D. Prepare agenda and preside at meeting:
 - 1. Review conditions of examination, preparation and installation procedures.
 - 2. Review coordination with related work.
 - 3. Review conflicts and compatibility issues.
 - 4. Review environmental limitations and protection.
 - 5. Examine substrates.
 - 6. Review requirements of the following:
 - a. Contract Documents.
 - b. Options.
 - c. Related Change Orders.
 - d. Submittals.
 - e. Mockups.
 - f. Testing and inspection.
- E. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

3.4 LAYING OUT THE WORK

- A. Verify locations of survey control points prior to starting work.
- B. Promptly notify Architect of any discrepancies discovered.
- C. Protect survey control points prior to starting site work; preserve permanent reference points during construction.
- D. Promptly report to Architect the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.
- E. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Architect.
- F. Utilize recognized engineering survey practices.
- G. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:
 - 1. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations.
 - 2. Grid or axis for structures.
 - 3. Building foundation, column locations, ground floor elevations.
- H. Periodically verify layouts by same means.
- I. Maintain a complete and accurate log of control and survey work as it progresses.

3.5 GENERAL INSTALLATION REQUIREMENTS

- A. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.
- B. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.
- C. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.
- D. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.

- E. Make neat transitions between different surfaces, maintaining texture and appearance.

3.6 CUTTING AND PATCHING

- A. Whenever possible, execute the work by methods that avoid cutting or patching.
- B. Perform whatever cutting and patching is necessary to:
 - 1. Complete the work.
 - 2. Fit products together to integrate with other work.
 - 3. Provide openings for penetration of mechanical, electrical, and other services.
 - 4. Match work that has been cut to adjacent work.
 - 5. Repair areas adjacent to cuts to required condition.
 - 6. Repair new work damaged by subsequent work.
 - 7. Remove samples of installed work for testing when requested.
 - 8. Remove and replace defective and non-complying work.
- C. Execute cutting and patching including excavation and fill to complete the work, to uncover work in order to install improperly sequenced work, to remove and replace defective or non-conforming work, to remove samples of installed work for testing when requested, to provide openings in the work for penetration of mechanical and electrical work, to execute patching to complement adjacent work, and to fit products together to integrate with other work.
- D. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.
- E. Employ original installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.
- F. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.
- G. Restore work with new products in accordance with requirements of Contract Documents.
- H. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- I. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 07 84 00, to full thickness of the penetrated element.
- J. Patching:
 - 1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
 - 2. Match color, texture, and appearance.
 - 3. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.
- K. Refinish surfaces to match adjacent finish. For continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
- L. Make neat transitions. Patch work to match adjacent work in texture and appearance. Where new work abuts or aligns with existing, perform a smooth and even transition.

3.7 PROGRESS CLEANING

- A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.
- B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.

- C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.
- D. Collect and remove waste materials, debris, and trash/rubbish from site periodically and dispose off-site; do not burn or bury.

3.8 PROTECTION OF INSTALLED WORK

- A. Protect installed work from damage by construction operations.
- B. Provide special protection where specified in individual specification sections.
- C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.
- D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.
- E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.
- F. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.
- G. Prohibit traffic from landscaped areas.
- H. Remove protective coverings when no longer needed; reuse or recycle coverings if possible.

3.9 SYSTEM STARTUP

- A. Coordinate schedule for start-up of various equipment and systems.
- B. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage.
- C. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.
- D. Verify that wiring and support components for equipment are complete and tested.
- E. Execute start-up under supervision of applicable Contractor personnel and manufacturer's representative in accordance with manufacturers' instructions.
- F. Submit a written report that equipment or system has been properly installed and is functioning correctly.

3.10 ADJUSTING

- A. Adjust operating products and equipment to ensure smooth and unhindered operation.

3.11 FINAL CLEANING

- A. 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.
- B. Use cleaning materials that are nonhazardous.
- C. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.
- D. Clean debris from roofs, overflow drains, area drains and drainage systems.
- E. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.
- F. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.

- G. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
- H. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
- I. Remove tools, construction equipment, machinery, and surplus material from Project site.
- J. Remove snow and ice to provide safe access to building.
- K. 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.
- L. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
- M. Sweep concrete floors broom clean in unoccupied spaces.
- N. Vacuum carpet and similar soft surfaces, removing debris and excess nap; shampoo if visible soil or stains remain.
- O. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
- P. Remove labels that are not permanent.
- Q. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.
 - 1. Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.
- R. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
- S. Replace parts subject to unusual operating conditions.
- T. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
- U. Clean exposed surfaces of diffusers, registers, and grills.
- V. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.
- W. Leave Project clean and ready for occupancy.

END OF SECTION 01 70 00

SECTION 01 71 23 - FIELD ENGINEERING**PART 1 - GENERAL****1.1 SECTION INCLUDES**

- A. Field engineering services by Contractor.
- B. Land surveying services by Contractor.

1.2 DESCRIPTION OF SERVICES

- A. Specific services listed in this section are in addition to, and do not supersede, general Execution and Closeout Requirements.
- B. Sole responsibility for establishing all locations, dimensions and levels of items of work.
- C. Sole responsibility for provision of all materials required to establish and maintain benchmarks and control points, including batter boards, grade stakes, structure elevation stakes, and other items.
- D. Keeping a transit, theodolite, or TST (total station theodolite with electronic distance measurement device); leveling instrument; and related implements such as survey rods and other measurement devices, at the project site at all times.
- E. Provision of facilities and assistance necessary for Architect to check lines and grade points placed by Contractor.
 - 1. Performance of excavation or embankment work until after all cross-sectioning necessary for determining payment quantities for Unit Price work have been completed and accepted by Architect.
- F. Preparation and maintenance of daily reports of activity on the work. Submission of reports containing key progress indicators and job conditions to Architect.
 - 1. Major equipment and materials installed as part of the work.
 - 2. Location of areas in which construction was performed.
 - 3. Work performed, including field quality control measures and testing.
 - 4. Weather conditions.
 - 5. Instructions received from Architect or Owner, if any.
- G. Preparation and maintenance of professional-quality, accurate, well organized, legible notes of all measurements and calculations made while surveying and laying out the work.
- H. Prior to backfilling operations, surveying - locating, and recording on a copy of Contract Documents - an accurate representation of buried work and Underground Facilities encountered.

1.3 REFERENCE STANDARDS

- A. FGDC-STD-007.1 - Geospatial Positioning Accuracy Standards - Part 1: Reporting Methodology.
- B. FGDC-STD-007.2 - Geospatial Positioning Accuracy Standards - Part 2: Standards for Geodetic Networks.
- C. FGDC-STD-007.4 - Geospatial Positioning Accuracy Standards - Part 4: Architecture, Engineering, Construction, and Facilities Measurement.
- D. State Plane Coordinate System for the State in which the Project is located.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

1.5 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Submit in addition to items required in Section 01 70 00 - Execution and Closeout Requirements.
- C. Informational Submittals: Submit the following:
 - 1. Field Engineering: Submit daily reports, with content as indicated in this section.
 - 2. Final property survey.

1.6 QUALITY ASSURANCE

- A. Field Engineer's Qualifications: As established in Section 01 70 00 - Execution and Closeout Requirements.
- B. Land Surveyor's Qualifications: As established in Section 01 70 00 - Execution and Closeout Requirements.
- C. Use adequate number of skilled and thoroughly-trained workers to perform the work of this section in a timely and comprehensive manner.
- D. Minimum accuracy for required work is as follows:
 - 1. Grade: Horizontal Tolerance: Plus or minus 0.5 feet, Vertical Tolerance: Plus or minus 0.05 feet.
 - 2. Culverts and ditches: Horizontal Tolerance: Plus or minus 0.5 feet, Vertical Tolerance: Plus or minus 0.05 feet.
 - 3. Structures: Horizontal Tolerance: Plus or minus 0.5 feet (location), Vertical Tolerance: Plus or minus 0.05 feet.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. Notify Owner's Representative and Architect of any discrepancies immediately in writing before proceeding to lay out the work. Locate and protect existing benchmarks and base line. Preserve permanent reference points during construction.
- B. Existing Utilities and Equipment: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify existing conditions.

3.2 FIELD ENGINEERING

- A. Maintain field office files, drawings, specifications, and record documents.
- B. Coordinate field engineering services with Contractor's subcontractors, installers, and suppliers as appropriate.
- C. Prepare layout and coordination drawings for construction operations.
- D. Check and coordinate the work for conflicts and interferences, and immediately advise Architect and Owner of all discrepancies of which Contractor is aware.
- E. Cooperate as required with Architect and Owner in observing the work and performing field inspections.
- F. Review and coordinate work on a regular basis with shop drawings and Contractor's other submittals.

- G. Check the location, line and grade of every major element as the work progresses. Notify the Architect when deviations from required lines or grades exceed allowable tolerances. Include in such notifications a thorough explanation of the problem, and a proposed plan and schedule for remedying the deviation. Do not proceed with remedial work without Owner's concurrence of the remediation plan.
- H. Check all formwork, reinforcing, inserts, structural steel, bolts, sleeves, piping, other materials and equipment for compliance with shop drawings and Contract Documents requirements.
- I. Check all bracing and shoring for structural integrity and compliance with designs prepared by the Contractor.

3.3 LAND SURVEYING

- A. General: Follow standards for geospatial positioning accuracy.
 - 1. FGDC-STD-007.1 as amended by Authority Having Jurisdiction.
 - 2. FGDC-STD-007.2 as amended by Authority Having Jurisdiction.
 - 3. FGDC-STD-007.4 as amended by Authority Having Jurisdiction.
- B. Coordinate survey data with the State Plane Coordinate System of the State in which the Project is located.
- C. Contractor is responsible for the restoration of all property corners and control monuments damaged or destroyed by construction-related activities. Any disturbed monuments must be replaced at Contractor's expense by a surveyor licensed in the State in which the Project is located, and approved by the Architect.
 - 1. Temporarily suspend work at such points and for such reasonable times as the Owner may require for resetting monuments. The Contractor will not be entitled to any additional compensation or extension of time.

3.4 CONSTRUCTION SURVEYING

- A. General: Perform surveying as applicable to specific items necessary for proper execution of work.
 - 1. Alignment Staking: Provide alignment stakes at 50 foot intervals on tangent, and at 25 foot intervals on curves.
 - 2. Slope Staking: Provide slope staking at 50 foot intervals on tangent, and at 25 foot intervals on curves. Re-stake at every ten-foot difference in elevation.
 - 3. Structure: Stake out structures, including elevations, and check prior to and during construction.
 - 4. Pipelines: Stake out pipelines including elevations, and check prior to and during construction.
 - 5. Site Utilities: Stake out utility lines including elevations, and check prior to and during construction.
 - 6. Cross-sections: Provide original, intermediate, and final staking as required, for site work and other locations as necessary for quantity surveys.
 - 7. Easement Staking: Provide easement staking at 50 foot intervals on tangent, and at 25 foot intervals on curves. If required by project conditions, provide wooden laths with flagging at 100 foot intervals.
 - 8. Record Staking: Provide permanent stake at each blind flange and each utility cap is provided for future connections. Use stakes for record staking of material(s) acceptable to Architect.
 - 9. Structural Frame: Upon completion, certify location and plumbness.
- B. Record Log: Maintain a log of layout control work. Record any 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.
- C. Accuracy:

1. Establish Contractor's temporary survey references points for Contractor's use to at least second-order accuracy (e.g., 1:10000). Set construction staking used as a guide for the work to at least third-order accuracy (e.g., 1:5000). Provide the absolute margin for error specified below on the basis established by such orders.
 - a. Horizontal accuracy of easement staking: Plus or minus 0.1 feet.
 - b. Accuracy of other staking shall be plus or minus 0.04 feet horizontally and plus or minus 0.02 feet vertically.
 - c. Include an error analysis sufficient to demonstrate required accuracy in survey calculations.
2. Owner reserves the right to check the Contractor's survey, measurements, and calculations. The requirement for accuracy will not be waived, whether this right is exercised or not.

3.5 SUPPORT AND BRACING

- A. General requirements: Design all support and bracing systems, if required. Provide for attachment to portions of the building structure capable of bearing the loads imposed. Design systems to not overstress the building structure.

3.6 REPORTS

- A. Submit two copies of Contractor's daily reports electronically by 9:00 AM the next working day after the day covered in the associated report. Daily report shall be signed by responsible member of Contractor's staff, such as project manager or superintendent, or foreman designated by Contractor as having authority to sign daily reports.

3.7 RECORDS

- A. Maintain at the Site a complete and accurate log of control and survey work as it progresses.
 1. Organize and record survey data in accordance with recognized professional surveying standards, Laws and Regulations, and prevailing standards of practice in the State in which the Project is located. Record Contractor's surveyor's original field notes, computations, and other surveying data in Contractor-furnished hard-bound field books. Contractor is solely responsible for completeness and accuracy of survey work, and completeness and accuracy of survey records, including field books. Survey records,(including field books) may be rejected by Owner due to failure to organize and maintain survey records in a manner that allows reasonable and independent verification of calculations, and/or allows identification of elevations, dimensions, and grades of the work.
 2. Illegible notes or data, and erasures on any page of field books, are unacceptable. Do not submit copied notes or data. Corrections by ruling or lining out errors will be unacceptable unless initialed by the surveyor. Violation of these requirements may require re-surveying the data questioned by Architect.
- B. Closeout Submittal: Submit three copies of final property survey to Owner. Include on the survey a certification, signed by the surveyor, that principal metes, bounds, lines, and levels of the Project are accurately positioned as shown on the survey. Include the following information:
 1. Structure locations from property lines, and distances to adjacent buildings.
 2. Dimensions and locations of drives, walks, walls, underground utilities, appurtenances and major site features.
 3. Location of easements.
 4. Final grading topographic survey.

3.8 CLOSEOUT ACTIVITIES

- A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.
- B. See Section 01 79 00 - Demonstration and Training, for additional requirements.

END OF SECTION 01 71 23

SECTION 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL**PART 1 - GENERAL****1.1 RELATED DOCUMENTS****1.2 SUMMARY**

- A. 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.

1.3 DEFINITIONS

- A. Construction Waste: Building, structure, and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.
- B. Demolition Waste: Building, structure, and site improvement materials resulting from demolition operations.
- C. 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.
- D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.
- E. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.
- F. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

1.4 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.

1.5 ACTION SUBMITTALS

- A. Waste Management Plan: Submit plan within 30 days of date established for commencement of the Work.

1.6 INFORMATIONAL SUBMITTALS

- A. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit report. Use Form CWM-7 for construction waste and Form CWM-8 for demolition waste. Include the following information:
1. Material category.
 2. Generation point of waste.
 3. Total quantity of waste in tons.
 4. Quantity of waste salvaged, both estimated and actual in tons.
 5. Quantity of waste recycled, both estimated and actual in tons.
 6. Total quantity of waste recovered (salvaged plus recycled) in tons.

7. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.
- B. 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.
- C. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.
- D. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.
- E. 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.
- F. 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.
- G. Qualification Data: For waste management coordinator and refrigerant recovery technician.
- H. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

1.7 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 not serve as Waste Management Coordinator.
- B. Refrigerant Recovery Technician Qualifications: Universal certified by EPA-approved certification program.
- C. Regulatory Requirements: Comply with transportation and disposal regulations of authorities having jurisdiction.
- D. Waste Management Conference(s): Conduct conference(s) at project site; 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.

1.8 WASTE MANAGEMENT PLAN

- A. General: Develop a waste management plan according to requirements in this Section. Plan shall consist of waste identification, waste reduction work plan, and cost/revenue analysis. Distinguish between demolition and construction waste. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.
- B. Waste Identification: Indicate anticipated types and quantities of demolition, site-clearing and construction waste generated by the Work. Use Form CWM-1 for construction waste and Form CWM-2 for demolition waste. Include estimated quantities and assumptions for estimates.

- C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Use Form CWM-3 for construction waste and Form CWM-4 for demolition waste. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.
1. Salvaged Materials for Sale: For materials that will be sold to individuals and organizations, include list of their names, addresses, and telephone numbers.
 2. Salvaged Materials for Donation: For materials that will be donated to individuals and organizations, include list of their names, addresses, and telephone numbers.
 3. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
 4. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
 5. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location where materials separation will be performed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General: Achieve end-of-Project rates for salvage/recycling of 75 percent by weight of total nonhazardous solid waste generated by the Work. Practice efficient waste management in the use of materials in the course of the Work. Use all reasonable means to divert construction and demolition waste from landfills and incinerators. Facilitate recycling and salvage of materials.

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 the entire duration of the Contract.
- B. Waste Management Coordinator: Designate a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan.
- C. 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.
- D. 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.

3.2 SALVAGING DEMOLITION WASTE

- A. Salvaged Items for Sale and Donation: Not permitted on project site.

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 shall accrue to Contractor.

- C. Preparation of Waste: Prepare and maintain recyclable waste materials according to 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 the maximum extent practical according to 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 RECYCLING DEMOLITION WASTE

- A. Asphalt Paving: Break up and transport paving to asphalt-recycling facility.
- B. Concrete: Remove reinforcement and other metals from concrete and sort with other metals.
- C. Masonry: Remove metal reinforcement, anchors, and ties from masonry and sort with other metals.
- D. Wood Materials: Sort and stack members according to size, type, and length. Separate lumber, engineered wood products, panel products, and treated wood materials.
- E. Metals: Separate metals by type.
 - 1. Structural Steel: Stack members according to size, type of member, and length.
 - 2. Remove and dispose of bolts, nuts, washers, and other rough hardware.
- F. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location. Remove edge trim and sort with other metals. Remove and dispose of fasteners.
- G. Acoustical Ceiling Panels and Tile: Stack large clean pieces on wood pallets and store in a dry location.
- H. Metal Suspension System: Separate metal members, including trim and other metals from acoustical panels and tile, and sort with other metals.
- I. Carpet: Roll large pieces tightly after removing debris, trash, adhesive, and tack strips.
 - 1. Store clean, dry carpet in a closed container or trailer provided by carpet reclamation agency or carpet recycler.
- J. Carpet Tile: Remove debris, trash, and adhesive.
 - 1. Stack tile on pallet and store clean, dry carpet in a closed container or trailer provided by carpet reclamation agency or carpet recycler.
- K. Piping: Reduce piping to straight lengths and store by material and size. Separate supports, hangers, valves, sprinklers, and other components by material and size.
- L. Conduit: Reduce conduit to straight lengths and store by material and size.
- M. Lamps: Separate lamps by type and store according to requirements in 40 CFR 273.

3.5 RECYCLING CONSTRUCTION WASTE

A. Packaging:

1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
2. Polystyrene Packaging: Separate and bag materials.
3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.

B. Wood Materials:

1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.

C. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location.

D. Paint: Seal containers and store by type.

3.6 DISPOSAL OF WASTE

A. General: 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. Except as 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. Burning: Do not burn waste materials.

3.7 ATTACHMENTS

- A. Form CWM-1 for construction waste identification.
- B. Form CWM-2 for demolition waste identification.
- C. Form CWM-3 for construction waste reduction work plan.
- D. Form CWM-4 for demolition waste reduction work plan.
- E. Form CWM-7 for construction waste reduction progress report.
- F. Form CWM-8 for demolition waste reduction progress report.

END OF SECTION 01 74 19

FORM CWM-1: CONSTRUCTION WASTE IDENTIFICATION							
MATERIAL CATEGORY	GENERATION POINT	EST. QUANTITY OF MATERIALS RECEIVED* (A)	EST. WASTE - % (B)	TOTAL EST. QUANTITY OF WASTE* (C = A x B)	EST. VOLUME CY (CM)	EST. WEIGHT TONS (TONNES)	REMARKS AND ASSUMPTIONS
Packaging: Cardboard							
Packaging: Boxes							
Packaging: Plastic Sheet or Film							
Packaging: Polystyrene							
Packaging: Pallets or Skids							
Packaging: Crates							
Packaging: Paint Cans							
Packaging: Plastic Pails							
Site-Clearing Waste							
Masonry or CMU							
Lumber: Cut-Offs							
Lumber: Warped Pieces							
Plywood or OSB (scraps)							
Wood Forms							
Wood Waste Chutes							
Wood Trim (cut-offs)							
Metals							
Insulation							
Roofing							
Joint Sealant Tubes							
Gypsum Board (scraps)							
Carpet and Pad (scraps)							
Piping							
Electrical Conduit							
Other:							

* Insert units of measure.

FORM CWM-2: DEMOLITION WASTE IDENTIFICATION				
MATERIAL DESCRIPTION	EST. QUANTITY	EST. VOLUME CY (CM)	EST. WEIGHT TONS (TONNES)	REMARKS AND ASSUMPTIONS
Asphaltic Concrete Paving				
Concrete				
Brick				
CMU				
Lumber				
Plywood and OSB				
Wood Paneling				
Wood Trim				
Miscellaneous Metals				
Structural Steel				
Rough Hardware				
Insulation				
Roofing				
Doors and Frames				
Door Hardware				
Windows				
Glazing				
Acoustical Tile				
Carpet				
Carpet Pad				
Demountable Partitions				
Equipment				
Cabinets				
Plumbing Fixtures				
Piping				
Piping Supports and Hangers				
Valves				
Sprinklers				
Mechanical Equipment				
Electrical Conduit				
Copper Wiring				
Light Fixtures				
Lamps				
Lighting Ballasts				
Electrical Devices				
Switchgear and Panelboards				
Transformers				
Other:				

FORM CWM-3: CONSTRUCTION WASTE REDUCTION WORK PLAN						
MATERIAL CATEGORY	GENERATION POINT	TOTAL EST. QUANTITY OF WASTE TONS (TONNES)	DISPOSAL METHOD AND QUANTITY			HANDLING AND TRANSPORTION PROCEDURES
			EST. AMOUNT SALVAGED TONS (TONNES)	EST. AMOUNT RECYCLED TONS (TONNES)	EST. AMOUNT DISPOSED TO LANDFILL TONS (TONNES)	
Packaging: Cardboard						
Packaging: Boxes						
Packaging: Plastic Sheet or Film						
Packaging: Polystyrene						
Packaging: Pallets or Skids						
Packaging: Crates						
Packaging: Paint Cans						
Packaging: Plastic Pails						
Site-Clearing Waste						
Masonry or CMU						
Lumber: Cut-Offs						
Lumber: Warped Pieces						
Plywood or OSB (scraps)						
Wood Forms						
Wood Waste Chutes						
Wood Trim (cut-offs)						
Metals						
Insulation						
Roofing						
Joint Sealant Tubes						
Gypsum Board (scraps)						
Carpet and Pad (scraps)						
Piping						
Electrical Conduit						
Other:						

FORM CWM-4: DEMOLITION WASTE REDUCTION WORK PLAN						
MATERIAL CATEGORY	GENERATION POINT	TOTAL EST. QUANTITY OF WASTE TONS (TONNES)	DISPOSAL METHOD AND QUANTITY			HANDLING AND TRANSPORTION PROCEDURES
			EST. AMOUNT SALVAGED TONS (TONNES)	EST. AMOUNT RECYCLED TONS (TONNES)	EST. AMOUNT DISPOSED TO LANDFILL TONS (TONNES)	
Asphaltic Concrete Paving						
Concrete						
Brick						
CMU						
Lumber						
Plywood and OSB						
Wood Paneling						
Wood Trim						
Miscellaneous Metals						
Structural Steel						
Rough Hardware						
Insulation						
Roofing						
Doors and Frames						
Door Hardware						
Windows						
Glazing						
Acoustical Tile						
Carpet						
Carpet Pad						
Demountable Partitions						
Equipment						
Cabinets						
Plumbing Fixtures						
Piping						
Supports and Hangers						
Valves						
Sprinklers						
Mechanical Equipment						
Electrical Conduit						
Copper Wiring						
Light Fixtures						
Lamps						
Lighting Ballasts						
Electrical Devices						
Switchgear and Panelboards						
Transformers						
Other:						

FORM CWM-7: CONSTRUCTION WASTE REDUCTION PROGRESS REPORT								
MATERIAL CATEGORY	GENERATION POINT	TOTAL QUANTITY OF WASTE TONS (TONNES) (A)	QUANTITY OF WASTE SALVAGED		QUANTITY OF WASTE RECYCLED		TOTAL QUANTITY OF WASTE RECOVERED TONS (TONNES) (D = B + C)	TOTAL QUANTITY OF WASTE RECOVERED % (D / A x 100)
			ESTIMATED TONS (TONNES)	ACTUAL TONS (TONNES) (B)	ESTIMATED TONS (TONNES)	ACTUAL TONS (TONNES) (C)		
Packaging: Cardboard								
Packaging: Boxes								
Packaging: Plastic Sheet or Film								
Packaging: Polystyrene								
Packaging: Pallets or Skids								
Packaging: Crates								
Packaging: Paint Cans								
Packaging: Plastic Pails								
Site-Clearing Waste								
Masonry or CMU								
Lumber: Cut-Offs								
Lumber: Warped Pieces								
Plywood or OSB (scraps)								
Wood Forms								
Wood Waste Chutes								
Wood Trim (cut-offs)								
Metals								
Insulation								
Roofing								
Joint Sealant Tubes								
Gypsum Board (scraps)								
Carpet and Pad (scraps)								
Piping								
Electrical Conduit								
Other:								

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FORM CWM-8: DEMOLITION WASTE REDUCTION PROGRESS REPORT								
MATERIAL CATEGORY	GENERATION POINT	TOTAL QUANTITY OF WASTE TONS (TONNES) (A)	QUANTITY OF WASTE SALVAGED		QUANTITY OF WASTE RECYCLED		TOTAL QUANTITY OF WASTE RECOVERED TONS (TONNES) (D = B + C)	TOTAL QUANTITY OF WASTE RECOVERED % (D / A x 100)
			ESTIMATED TONS (TONNES)	ACTUAL TONS (TONNES) (B)	ESTIMATED TONS (TONNES)	ACTUAL TONS (TONNES) (C)		
Asphaltic Concrete Paving								
Concrete								
Brick								
CMU								
Lumber								
Plywood and OSB								
Wood Paneling								
Wood Trim								
Miscellaneous Metals								
Structural Steel								
Rough Hardware								
Insulation								
Roofing								
Doors and Frames								
Door Hardware								
Windows								
Glazing								
Acoustical Tile								
Carpet								
Demountable Partitions								
Equipment								
Cabinets								
Plumbing Fixtures								
Piping								
Supports and Hangers								
Valves								
Sprinklers								
Mechanical Equipment								
Electrical Conduit								
Copper Wiring								
Light Fixtures								
Lamps								
Lighting Ballasts								
Electrical Devices								
Switchgear and Panelboards								
Transformers								
Other:								

SECTION 01 77 00 - CLOSEOUT PROCEDURES**PART 1 - GENERAL****1.1 SECTION INCLUDES**

- A. Administrative and procedural requirements for contract closeout, including, but not limited to, the following:
 - 1. Inspection procedures.

1.2 SUBSTANTIAL COMPLETION

- A. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete in request.
 - 1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
 - 2. Advise Owner of pending insurance changeover requirements.
 - 3. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
 - 4. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
 - 5. Prepare and submit Project Record Documents, operation and maintenance manuals, damage or settlement surveys, property surveys, and similar final record information.
 - 6. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.
 - 7. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
 - 8. Complete startup testing of systems.
 - 9. Submit test/adjust/balance records.
 - 10. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
 - 11. Advise Owner of changeover in heat and other utilities.
 - 12. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
 - 13. Complete final cleaning requirements, including touchup painting.
 - 14. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
- B. Inspection: Submit a written request for inspection for Substantial Completion. 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. Reinspection: 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.

1.3 FINAL COMPLETION

- A. Preliminary Procedures: Before requesting final inspection for determining date of Final Completion, complete the following:
 - 1. Submit a final Application for Payment according to the Contract.
 - 2. Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. The certified copy

- of the list shall state that each item has been completed or otherwise resolved for acceptance.
3. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
 4. Submit pest-control final inspection report and warranty.
 5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.
- B. Inspection: Submit a written request for final inspection for acceptance. 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. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
- 1.4 LIST OF INCOMPLETE ITEMS (PUNCH LIST)
- A. Preparation: Submit three copies 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. Use form reviewed and accepted by Owner and Architect.
1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.
 2. Organize items applying to each space by major element, including categories for ceiling, 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.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION - NOT USED

END OF SECTION 01 77 00

SECTION 01 78 00 - CLOSEOUT SUBMITTALS**PART 1 - GENERAL****1.1 SECTION INCLUDES**

- A. Project Record Documents.
- B. Operation and Maintenance Data.
- C. Warranties and bonds.

1.2 SUBMITTALS

- A. Project Record Documents: Submit documents to Architect with claim for final Application for Payment.
- B. 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 and one set of plots.
 - b. Final Submittal:
 - 1) Submit record digital data files and three set(s) of record digital data file plots.
- C. Record Specifications: Submit searchable, annotated PDF electronic files of Project's Specifications, including addenda and contract modifications.
- D. Record Product Data: Submit searchable, annotated PDF electronic files of each Product Data submittal.
 - 1. Where Record Product Data is required as part of operation and maintenance manuals, submit marked-up Product Data as an insert in manual instead of submittal as Record Product Data.
- E. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit searchable, annotated PDF electronic files and directories of each submittal.
- F. Certification: With each application for payment, provide written certification that Project Record Documents are current at time application is submitted.
- G. Reports: Submit written report weekly indicating items incorporated into project record documents concurrent with progress of the Work, including revisions, concealed conditions, field changes, product selections, and other notations incorporated.
- H. Operation and Maintenance Data:
 - 1. Manual Content Submittal: Operations and maintenance manual content is specified in individual Specification Sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
 - a. Architect will comment on whether content of operations and maintenance submittals are acceptable.
 - b. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.
 - 2. Manual Format: Submit operations and maintenance manuals in the following format:
 - a. PDF electronic file. Assemble each manual into a composite electronically indexed file.

- 1) Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.
 - a) 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.
 - b) File Names and Bookmarks: Enable bookmarking of 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.
- 2) Enable inserted reviewer comments on draft submittals.
- b. Three paper copies. Include a complete operation and maintenance directory. Enclose title pages and directories in clear plastic sleeves. Architect will return two copies.
3. Initial Manual Submittal: Submit draft copy of each manual at least 90 days calendar days before commencing demonstration and training. Architect or Owner will comment on whether general scope and content of manual are acceptable within 60 calendar days before commencing demonstration and training.
4. Final Draft Manual Submittal: Submit revised draft copy of each manual that was found unacceptable by Architect or Owner at least 30 calendar days before commencing demonstration and training. Architect or Owner will comment or approve within 15 calendar days before commencing demonstration and training.
- I. Warranties and Bonds:
 1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 10 days after acceptance.
 2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.
 3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 PROJECT RECORD DOCUMENTS

- A. Maintain on site one set of the following record documents; record actual revisions to the Work:
 1. Drawings.
 2. Specifications.
 3. Addenda.
 4. Change Orders and other modifications to the Contract.
 5. Reviewed shop drawings, product data, and samples.
- B. Ensure entries are complete and accurate, enabling future reference by Owner.
- C. Store record documents separate from documents used for construction.
- D. Record information concurrent with construction progress.
- E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:

1. Manufacturer's name and product model and number.
 2. Product substitutions or alternates utilized.
 3. Changes made by Addenda and modifications.
 4. Format: Submit record Specifications as searchable, annotated PDF electronic file.
- F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction.
1. Record Prints:
 - a. 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.
 - 1) Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
 - 2) Accurately record information in an understandable drawing technique.
 - 3) Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.
 - 4) Cross-reference record prints to corresponding archive photographic documentation.
 - b. Content: Types of items requiring marking include, but are not limited to, the following:
 - 1) Dimensional changes to Drawings.
 - 2) Revisions to details shown on Drawings.
 - 3) Depths of foundations below first floor.
 - 4) Locations and depths of underground utilities referenced to permanent surface improvements.
 - 5) Revisions to routing of piping and conduits.
 - 6) Revisions to electrical circuitry.
 - 7) Actual equipment locations.
 - 8) Duct size and routing.
 - 9) Locations of concealed internal utilities referenced to visible and accessible features of the structure.
 - 10) Changes made by addendum.
 - 11) Changes made by Change Order or Construction Change Directive.
 - 12) Changes made following Architect's written orders.
 - 13) Details not on the original Contract Drawings.
 - 14) Field records for variable and concealed conditions.
 - 15) Record information on the Work that is shown only schematically.
 - c. Mark the Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. If Shop Drawings are marked, show cross-reference on the Contract Drawings. Use personnel proficient at recording graphic information in production of marked-up record prints.
 - d. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
 - e. Mark important additional information that was either shown schematically or omitted from original Drawings.
 - f. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.
 2. Record Digital File: Immediately before inspection for Certificate of Substantial Completion, review marked-up Record Prints with Architect. When authorized, prepare a full set of digital data files of the Contract Drawings, as follows:
 - a. Format: Same digital data software program, version, and operating system as the original Contract Drawings.
 - b. Format: Annotated PDF electronic file annotated text, optical character recognition (OCR) searchable, PDF electronic files with comment function enabled.

- c. Incorporate changes and additional information previously marked on Record Prints. Delete, redraw, and add details and notations where applicable.
 - d. Refer instances of uncertainty to Architect for resolution.
- 3. Newly Prepared Record Drawings: Prepare new Drawings instead of preparing record Drawings where Architect determines that neither the original Contract Drawings nor Shop Drawings are suitable to show actual installation.
 - a. New Drawings may be required when a Change Order is issued as a result of accepting an alternate, substitution, or other modification.
 - b. Consult Architect for proper scale and scope of detailing and notations required to record the actual physical installation and its relation to other construction. Integrate newly prepared record Drawings into record Drawing sets; comply with procedures for formatting, organizing, copying, binding, and submitting.
- 4. Format: Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
 - a. Record Prints: Organize Record Prints and newly prepared record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
 - b. 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.
 - c. Identification: As follows:
 - 1) Project name.
 - 2) Date.
 - 3) Designation "PROJECT RECORD DRAWINGS."
 - 4) Name of Architect.
 - 5) Name of Contractor.
- G. Product Record Data: 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. If possible, a Change Order proposal should include resubmitting updated Product Data. This eliminates the need to mark up the previous submittal.
 - 4. Note related Change Orders, Record Specifications, and Record Drawings where applicable.
 - 5. Format: Submit record Product Data as searchable, annotated PDF electronic file.
 - a. Include record Product Data directory organized by Specification Section number and title, electronically linked to each item of record Product Data.
- H. Miscellaneous Record Submittals:
 - 1. 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.
 - 2. Format: Submit miscellaneous record submittals as PDF electronic file.
 - a. Include miscellaneous record submittals directory organized by Specification Section number and title, electronically linked to each item of miscellaneous record submittals.

3.2 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

- A. Directory: Prepare a single, comprehensive directory of emergency, operation, and maintenance data and materials, listing items and their location to facilitate ready access to desired information. Include a section in the directory for each of the following:
 - 1. List of documents.
 - 2. List of systems.
 - 3. List of equipment.
 - 4. Table of contents.
- B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.
- C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.
- D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.
- 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 according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

3.3 OPERATION AND MAINTENANCE DATA

- A. Source Data: For each product or system, list names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.
- B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.
- C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.
- D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

3.4 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES

- A. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.
- B. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

3.5 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

- A. For Each Item of Equipment and Each System:
 - 1. Description of unit or system, and component parts.
 - 2. Identify function, normal operating characteristics, and limiting conditions.
 - 3. Include performance curves, with engineering data and tests.
 - 4. Complete nomenclature and model number of replaceable parts.
- B. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.
- C. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.

- D. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- E. Provide servicing and lubrication schedule, and list of lubricants required.
- F. Include manufacturer's printed operation and maintenance instructions.
- G. Include sequence of operation by controls manufacturer.
- H. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- I. Provide control diagrams by controls manufacturer as installed.
- J. Provide Contractor's coordination drawings, with color coded piping diagrams as installed.
- K. Additional Requirements: As specified in individual product specification sections.

3.6 ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS

- A. Assemble operation and maintenance data into durable manuals for Owner's personnel use, with data arranged in the same sequence as, and identified by, the specification sections.
- B. Where systems involve more than one specification section, provide separate tabbed divider for each system.
- C. Prepare instructions and data by personnel experienced in maintenance and operation of described products.
- D. Prepare data in the form of an instructional manual.
- E. Binders: Commercial quality, 8-1/2 by 11 inch three D side ring binders with durable plastic covers; 2 inch maximum ring size. When multiple binders are used, correlate data into related consistent groupings.
- F. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.
- G. Project Directory: Title and address of Project; names, addresses, and telephone numbers of Architect, Consultants, Contractor and subcontractors, with names of responsible parties.
- H. Text: Manufacturer's printed data, or typewritten data on 24 pound paper.
- I. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
- J. Arrangement of Contents: Organize each volume in parts as follows:
 - 1. Project Directory.
 - 2. Table of Contents, of all volumes, and of this volume.
 - 3. Operation and Maintenance Data: Arranged by system, then by product category.
 - a. Source data.
 - b. Product data, shop drawings, and other submittals.
 - c. Operation and maintenance data.
 - d. Field quality control data.
 - e. Photocopies of warranties and bonds.
- K. Arrange content by systems under section numbers and sequence of Table of Contents of this Project Manual.
- L. Table of Contents: Provide title of Project; names, addresses, and telephone numbers of Architect, Consultants, and Contractor with name of responsible parties; schedule of products and systems, indexed to content of the volume. Prepare a Table of Contents for each volume, with each product or system description identified, in three parts as follows:
 - 1. Part 1: Directory, listing names, addresses, and telephone numbers of Architect, Contractor, Subcontractors, and major equipment suppliers.

2. Part 2: Operation and maintenance instructions, arranged by system and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:
 - a. Significant design criteria.
 - b. List of equipment.
 - c. Parts list for each component.
 - d. Operating instructions.
 - e. Maintenance instructions for equipment and systems.
 - f. Maintenance instructions for special finishes, including recommended cleaning methods and materials, and special precautions identifying detrimental agents.
 3. Part 3: Project documents and certificates, including the following:
 - a. Shop drawings and product data.
- M. Provide a listing in Table of Contents for design data, with tabbed dividers and space for insertion of data.
- N. Dividers: Provide tabbed dividers for each separate product and system; identify the contents on the divider tab; immediately following the divider tab include a description of product and major component parts of equipment.
- O. 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.
 2. Performance and design criteria if Contractor is 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.
- P. 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.
- Q. 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.
- R. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

- S. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

3.7 PRODUCT MAINTENANCE MANUAL

- A. Content: Organize manual into a separate section for each product, material, and finish. Section format to follow that of the Project Manual(s). Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.
- B. 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.
- C. 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.
- D. 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.
- E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
- F. 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.

3.8 SYSTEMS AND EQUIPMENT MAINTENANCE MANUAL

- A. 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 warranty and bond information, as described below.
- B. 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.
- C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:
1. Standard printed maintenance instructions and bulletins.
 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.
- D. 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.
- E. 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.
- F. 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.
- G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.
- H. 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.

3.9 WARRANTIES AND BONDS

- A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Substantial completion is determined.
- B. General:
1. Execute and provide notarized Project Warranty on form furnished by Owner.
 2. Provide special written warranties or guarantees or both for products, equipment, systems, and installations required by other sections of Contract Documents for duration indicated.
 3. Provide manufacturer's warranties or guarantees or both for products, equipment, systems, and installations required by other sections of Contract Documents for duration indicated.
 4. Where manufacturer's warranties or guarantees, or both expire before duration required by other sections of Contract Documents, obtain and pay for extensions as a part of Contract Price.
 5. Provide all warranties or guarantees or both prior to Final Payment.
 6. Warranties or guarantees or both required by Contract Documents shall commence on date of Substantial Completion of work, or designated portion thereof, unless otherwise indicated in Certificate of Substantial Completion.
- C. Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
- D. Include procedures to follow to ensure Warranties are not voided due to maintenance and operational activities,
- E. Include procedures required to initiate warranty claims.
- F. Provide special written warranties, manufacturer's warranties, and/or guarantees for products, equipment, systems, and installation which are required by other sections of Contract Documents for the duration indicated.

- G. Warranties and guarantees shall commence on the date of Substantial Completion of work, or designated portion of work thereof, unless otherwise indicated in Certificate of Substantial Completion.
- H. If Contractor cannot warrant and/or guarantee any portion of work using products or construction methods indicated in the Contract Documents, notify Architect and Owner in writing during bid period and before contracts are awarded.
 - 1. Indicate product or work name(s) and the reasoning to support claim.
 - 2. Provide names of products, method, and/or data on which substitutions can be warranted and/or guaranteed.
 - 3. Should Contractor fail to notify Architect, Contractor will be considered as having agreed to warrant and/or guarantee the work indicated.
- I. Provide a fully executed and notarized Project Warranty. Owner Standard Document shall be provided.

END OF SECTION 01 78 00

SECTION 01 79 00 - DEMONSTRATION AND TRAINING**PART 1 - GENERAL****1.1 SUMMARY**

- A. Demonstration of products and systems to be commissioned and where indicated in specific specification sections.
- B. Training of Owner personnel in operation and maintenance is required for:
 - 1. All software-operated systems.
 - 2. HVAC systems and equipment.
 - 3. Plumbing equipment.
 - 4. Electrical systems and equipment.
 - 5. Security and audio visual systems.
 - 6. Conveying systems.
 - 7. Items specified in individual product Sections.
- C. Training of Owner personnel in care, cleaning, maintenance, and repair is required for:
 - 1. Roofing, waterproofing, and other weather-exposed or moisture protection products.
 - 2. Finishes, including flooring, wall finishes, ceiling finishes.
 - 3. Fixtures and fittings.
 - 4. Items specified in individual product Sections.

1.2 SUBMITTALS

- A. Video Recordings: Submit digital video recording of each demonstration and training session for Owner's subsequent use.
 - 1. Format: Flash Drive.
 - 2. Label with session identification and date, with durable tag.

1.3 QUALITY ASSURANCE

- A. Instructor Qualifications: Familiar with design, operation, maintenance and troubleshooting of the relevant products and systems.
 - 1. Provide as instructors the most qualified trainer of those contractors and/or installers who actually supplied and installed the systems and equipment.
 - 2. Where a single person is not familiar with all aspects, provide specialists with necessary qualifications.

PART 2 - PRODUCTS - NOT USED**PART 3 - EXECUTION****3.1 DEMONSTRATION - GENERAL**

- A. Demonstrations conducted during system start-up do not qualify as demonstrations for the purposes of this section, unless approved in advance by Owner.
- B. Demonstrations conducted during Functional Testing need not be repeated unless Owner personnel training is specified.
- C. Demonstration may be combined with Owner personnel training if applicable.
- D. Operating Equipment and Systems: Demonstrate operation in all modes, including start-up, shut-down, seasonal changeover, emergency conditions, and troubleshooting, and maintenance procedures, including scheduled and preventive maintenance.
 - 1. Perform demonstrations not less than two weeks prior to Substantial Completion.

- 2. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.
- E. Non-Operating Products: Demonstrate cleaning, scheduled and preventive maintenance, and repair procedures.
 - 1. Perform demonstrations not less than two weeks prior to Substantial Completion.
- F. Coordinate demonstration and training requirements with commissioning requirements.

END OF SECTION 01 79 00

SECTION 02 30 00 - SUBSURFACE DRILLING AND SAMPLING INFORMATION**PART 1 - GENERAL****1.1 AVAILABLE INFORMATION**

- A. The following information is included in the Project Manual for bidders' use in preparing bids, but is not part of the Contract Documents, and does not relieve the bidders from doing their own investigation to determine the accuracy of the information.
 - 1. Geotechnical Engineering Report; dated April 8, 2024.

1.2 STATEMENT CONCERNING THE BORING DATA

- A. The test borings and samples of the soils encountered were obtained by the Architect to assist the Architect and his consultants in determining the type and design of the foundation systems.
- B. The test borings were made by Geotech Engineers, Inc., in accordance with their system of soils classification and they, Geotech Engineers, Inc., neither the Owner, the Architect, or his consultants guarantee the accuracy or consistency of the information contained within the Geotechnical Report with the actual site conditions.
- C. Any radical deviation from the anticipated material, as indicated by the borings, during the excavation for the building should be reported to the Architect immediately and confirmed in writing.

1.3 CONFIRMATION OF BORING DATA

- A. Bidders, Contractors, and any others who are concerned with, or are affected by the test borings should make their own borings and tests at the site.
- B. No additional compensations will be allowed the Contractor for failure to fully investigate the site or for the neglect of the information contained in the Boring Logs.

1.4 ATTACHMENTS

- A. Geotechnical Engineering Report; dated April 8, 2024.

PART 2 - PRODUCTS (NOT USED)**PART 3 - EXECUTION (NOT USED)****END OF SECTION 02 30 00**

GEOTECHNICAL ENGINEERING REPORT

**FULLERTON MAINTENANCE BUILDING
4421 BUCKS SCHOOLHOUSE ROAD
BALTIMORE, MD
(PROJECT NO. 432827E)**



April 8, 2024

Prepared by:

**GEOTECH ENGINEERS, INC.
11890 Old Baltimore Pike, Suite U
Beltsville, MD 20705**

Prepared for:

**GRIMM & PARKER ARCHITECTS
11720 BELTSVILLE DRIVE, SUITE 600
CALVERTON, MD 20705**

April 8, 2024

Grimm and Parker Architects
11720 Beltsville Drive, Suite 600
Calverton, MD 20705

Attn: Ms. Sue Hains, AIA

Project: Geotechnical Engineering Report (Revised)
Fullerton Maintenance Building
4421 Bucks Schoolhouse Road
Baltimore, MD
(Project No. 432827E)

Dear Ms. Hains:

Submitted herewith is our revised geotechnical engineering report for the above project. Our original report has been revised based on the additional information provided to us by the structural engineer.

Services performed under this agreement included the drilling of five soil borings, soil laboratory tests, in-situ infiltration tests, and preparation of a geotechnical engineering report. Our report includes the following:

- a. General subsurface conditions within the site.
- b. Site grading and earthwork recommendations.
- c. Foundation recommendations for the proposed building and floor slab.
- d. Seismic soil classification.
- e. Infiltration tests results and comments on SWM design.
- f. Comments on the existing pavement.
- g. Geotechnical engineering considerations during construction.

Services for environmental study, wetland and asbestos study, erosion control, cost or quantity estimates, construction inspection and other professional services not mentioned above are not included in the scope of this study.

Soil samples will be held until May 2, 2024 and then discarded unless other disposition is requested.

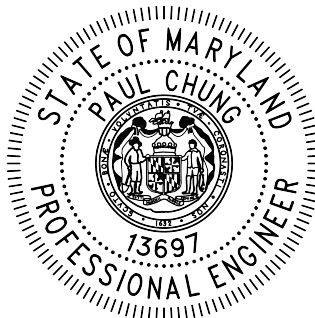
We appreciate the opportunity to be of service for this project. Please call the undersigned if you have any questions regarding the enclosed report.

Sincerely,

GEOTECH ENGINEERS, INC.

Vince Zeng

Vince Zeng, P.E.
Senior Geotechnical Engineer



A handwritten signature in blue ink, appearing to read "Paul Chung".

Paul Chung, P.E.
State of Maryland

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Appendix

**GEOTECHNICAL ENGINEERING REPORT
PROPOSED MAINTENANCE BUILDING
4421 BUCKS SCHOOLHOUSE ROAD
BALTIMORE, MD**

1.0 SUMMARY OF RECOMMENDATIONS

The following is a summary of our findings and recommendations for this project:

- a. Test borings indicate that the site is generally underlain by loose existing fill (Stratum A) extending to depths of 13.5 to 14.5 ft below grade. Dense sand and silt with gravel was encountered below the existing fill. The groundwater table was not encountered within the depths of the borings.
- b. We recommend that the building structure be supported by grade beam type footing. The footings founded on the existing fill may be designed for a soil bearing pressure of 1500 psf. The maximum allowable uplift capacity should be taken as a sum of the effective weight of soil plus the dead weight of the foundation.
- c. An earth-supported floor slab along with a 4-inch gravel base is considered suitable. A modulus of subgrade reaction (Ks) of 100 pci is recommended for the floor slab design.
- d. Soil site class D is recommended for the seismic design.
- e. Controlled fill is expected to be required for the proposed construction. Materials classified as SC, SM, SP, SW, GM, GC, GP, GW or more granular soils per ASTM D-2487 are considered suitable for new controlled fill. Controlled fill should be compacted to at least 95 percent of the maximum dry density as determined by ASTM D-1557. Excavated sand from Strata A and B, free of organic and construction debris, is generally considered suitable for reuse as controlled fill.
- f. An infiltration rate of 0.18 inches per hr was recorded in SWM-1. The groundwater was not encountered up to a depth of 13 ft below grade. Based on the infiltration tests and subsurface investigation data, infiltration practice is not feasible at this location.

2.0 DESCRIPTION OF SITE AND PROPOSED CONSTRUCTION

2.1. Existing Site Conditions

The site is located in the northwest corner of the existing maintenance yard in the south of Bucks Schoolhouse Road in Baltimore, MD. The area within the proposed building is a paved parking lot, and the

existing grade is relatively flat at EL 221. There is an uphill beyond the north of the proposed building. Standing water was observed at the bottom of the hill at the time of our investigation.

2.3. Proposed Construction,

The proposed construction will consist of a one-story slab-on-grade prefabricated building, stormwater management facility, and a parking lot. The controlling loads for the footings were mainly a combination of uplift and shear loads. The highest downward vertical load is 30 kips according to the information provided to us by CEI. We assumed the floor slab at EL 221 for our study. We understand that the use of the existing pavement has not been decided yet.

3.0 SUBSURFACE CONDITIONS

Five test soil borings, three borings for the building, one for the storm water management (swm) and one for the pavement, were performed to explore the subsurface conditions of the site. The boring logs and locations are included in Appendix G.

Test borings and Standard Penetration Tests (SPT's) were conducted in accordance with ASTM D-1586. The number of hammer blows required to drive a split spoon 12 inches is defined as "N" value. Soil samples were classified in accordance with ASTM D-2487 as included in Appendix B.

3.1. Soil Stratification

Various soil types were grouped into the major zones noted in the boring logs. A brief explanation of the terms and notes used in the logs is included in 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 description and depth of various soil strata are given in boring logs, together with SPT blow counts with depth.

Test borings indicate the generalized soil strata underlying the site as follows:

Ground Cover: Asphalt pavement is present in the entire building footprint. A 3 to 4 inch thick asphalt pavement and 8-inch stone base was encountered.

Stratum A: Existing Fill. Consisted of brown silty sand and sandy silt trace gravel. Encountered below the pavement and extended to depths of 13.5 to 14.5 ft below grade. N values were in the range of 10 to 21 (medium dense) for the upper 5 ft and 2 to 6 below 5 ft (very loose to loose).

Stratum B: Brown and gray sandy SILT (ML), silty SAND (SM), poorly graded SAND (SP). Encountered below Stratum B and extended up to 30 ft, the maximum depth of boring. N values ranged from 6 to 77, indicating medium dense to very dense density.

3.2. Geology

The upper part of Stratum A was probably placed or recompacted during the construction of the current development. The lower part of Stratum A, generally below 5 ft from the surface, is believed to be a dumped backfill placed over the old gravel mine according to the historical map included in Appendix A. The map shows that the project site is located at the edge of the old gravel mining pit. The sand and silt with gravel of Stratum B belong to the Patuxent Formation of Potomac Group of Cretaceous Age.

3.3 Groundwater

Groundwater observations were made in the boreholes during drilling and 24-hour after completion of drilling operations. The groundwater was not encountered during drilling and after 24 hrs upon completion.

Fluctuations in the level and quantity of ground water will occur due to variations in rainfall, temperature, soil permeability and other factors not evident at the time of the water level measurements recorded in boring logs.

3.4. Test Pit

A vacuum test pit No. TP-1 was performed near the existing water manhole located at the southwest corner of the proposed building. The location of the test pit is shown on the boring location plan in Appendix F. The test pit revealed that an 8-inch steel pipe was observed at a depth of about 4 ft below existing grade. Water was observed in the test hole. The water might be perched water or pipe leaking water.

4.0 LABORATORY TESTS

Laboratory tests were performed in our soil laboratory on the selected samples. The samples were classified according to ASTM D-2487 included in Appendix B. A summary of soil laboratory tests along with gradation test report are included in Appendix C. The test results are summarized as follows:

- Stratum A: One sample consisted of 25.1 percent gravel, 47.7 percent sand and 27.2 percent fines. The Atterberg limit tests showed the fines were non-plastic. The sample was classified as silty SAND with gravel (SM).
- Stratum B: One sample collected from this stratum was tested. The sample consisted of 0.5 percent gravel, 30.5 percent sand and 69.0 percent fines. Fines were non-plastic. The sample was classified as sandy SILT (ML).

Pavement Subgrade: One sample collected from the existing pavement subgrade was tested. The sample consisted of 30.6 percent gravel, 36.0 percent sand and 33.4 percent fines. Fines appeared to be non-plastic. The sample was classified as silty SAND with gravel (SM).

Moisture content tests were performed for the samples from SWM-1 and the results are included in Appendix C.

5.0 FOUNDATION RECOMMENDATIONS

5.1. Foundation Recommendations

Test borings indicate that the site is generally underlain by highly compressible existing fill extending to 14.5 ft below grade and then by dense Potomac sand. Based on the provided foundation plan showing that all the column footings are located along the walls and our discussions with structural engineers, grade beam type footings were considered feasible for the building support as detailed below:

5.1.1 Soil Bearing and Footing Depth

We recommend that grade beam footings be used to support the proposed structure. The grade beam footings may be designed for a bearing pressure of 1,500 psf when founded on the relatively dense upper existing fill. Footings should be at least 24 inches wide for consideration of shear. Settlement of the footings is not expected to exceed 1 inch.

Perimeter footings should be founded at 2.5 ft below the final exterior grade for frost protection.

A modulus of subgrade reaction of 100 pci may be considered for the design of the grade beam.

If unsuitable soils are present at the footing subgrade, unsuitable soils should be undercut as directed by the geotechnical engineer and the undercutting be backfilled with crushed stone.

Footings may be lowered as necessary. However, a maximum angle of 1.5H to 1V should be maintained between the adjacent footings.

5.1.2 Lateral and Uplift Resistance

Lateral loads transmitted to the footings may be resisted by a combination of soil concrete friction on the footing base and passive pressure on the side of the footing. An equivalent fluid pressure of 360 pcf is recommended for the lateral resistance. To resist lateral forces, a net allowable passive resistance may be utilized for portions of footings extending below the surface. If the footing is formed during construction, the open space between the footing/grade beams and the in-situ soils should be backfilled with compacted soils. An illustrated figure of lateral earth resistance is shown in Appendix D.

Uplift resistance of spread footings can be developed from the effective weight of the footing and the overlying soils. As illustrated on the figure shown in Appendix D, the effective weight of the soil is defined by diagonal planes extending up from the foundation to the ground surface at an angle of 20 degrees from the vertical can be included in the uplift resistance. The maximum allowable uplift capacity should be taken as a sum of the effective weight of soil plus the dead weight of the foundation. A soil unit weight and concrete unit weight of 120 pcf and 150 pcf may be used for the uplift design, respectively.

As discussed above, the following soil parameters may be used for the foundation and uplift design:

-Internal friction angle:	30 degrees
-Unit weight (moist):	120 pcf
-Cohesion:	None
-Coefficient of active pressure, K_a :	0.33
-Coefficient of passive pressure, K_p :	3.03
-Coefficient of at rest pressure, K_o :	0.50
-Friction factor between soil and concrete:	0.35
-A passive equivalent fluid pressure:	360 pcf

Care should be taken to avoid disturbance of the footing bearing area since loose material could increase settlement and decrease resistance to lateral loading. Loose materials at the bottom of the footings, if present, should be tamped prior to concreting.

5.2. Floor Slab

Based on the provided plan, we understand that structural turndown slab is planned. Earth supported slab may be considered feasible. The exposed subgrade after the undercutting should be proofrolled as detailed in the "Earthwork Recommendations" section. In addition, the exposed slab subgrade should be compacted prior to placing the gravel base to provide uniform support. We recommended the structural turndown slab may be structurally separated from the grade beam footing.

An earth supported floor slab is considered suitable and recommended. A 4-inch gravel base along with a 10-mil plastic is recommended as a moisture barrier. A modulus of subgrade reaction (K_s) of 100 pci is recommended for the floor slab design.

Saw-cut control joints should be placed in the slab to help control the location and extent of cracking. Joints or any cracks that developed should be sealed with a waterproof, non-extruding compressible compound specifically recommended for heavy duty concrete pavement and wet environments. It is recommended and assumed that a structural engineer will specify the floor slab thickness, reinforcing, joint details and other parameters.

5.3. Seismic

We are providing Seismic Site Class Definition per International Building Code (IBC). Soil borings show that the site is underlain by Cretaceous soils. The local geology map shows that Cretaceous soils extend to the bedrock. Based on our soil borings and the local geology map, we recommend that Soil “Site Class D” be used for seismic design.

Recommended design spectral acceleration parameters at short period and 1 second are as follows.

Table 1: Seismic Design Values

Type	Value	Description
S_S	0.137g	Maximum considered earthquake (MCE_R) ground motion for 0.2 second period
S_I	0.052g	Maximum considered earthquake (MCE_R) ground motion for 1.0 second period
S_{MS}	0.218g	Site-modified spectral acceleration value for 0.2 second period
S_{MI}	0.126g	Site-modified spectral acceleration value for 1.0 second period
S_{DS}	0.146g	Five percent damped design spectral acceleration value at 0.2 second period
S_{DI}	0.084g	Five percent damped design spectral acceleration value at 1.0 second period

6.0 INFILTRATION

6.1. Subsurface Conditions

One boring (SWM-1) was drilled in the area of the proposed stormwater management facility. Samples were classified according to both ASTM and USDA. The following is a summary of subsurface condition at the proposed stormwater management structure:

Depth (ft)	Soil Description
0-10	Brown silty sand (SM/FILL) Sandy Loam per USDA
10-15	Brown silty sand with gravel (SM/FILL) Loamy Sand per USDA

The boring log for the above SWM boring is included in Appendix G.

6.2. Infiltration Tests

Infiltration tests were performed in the offset holes drilled adjacent to the test boring. The tests were generally conducted as follows:

- a. A 7-inch diameter borehole was prepared to a designated depth.
- b. A 4-inch diameter solid PVC casing was inserted, and the borehole was presoaked overnight.
- c. On the next day, the hole was refilled with water.
- d. Water levels in the pipe were monitored.

The results of the in-situ infiltration test are included in Appendix E and are summarized as follows:

Boring No.	Test Depth (ft)	Infiltration Rate (in/hr)	Groundwater		Soil Description at Test Depth (USDA)	Remark
			Depth Below Surface	Elevation		
SWM-1	8.0	0.18	Greater than 13 ft	Lower than El 207	Sandy Loam	Existing Fill

6.3. Recommendations

The infiltration rates and the groundwater table included in the above table are believed to be reasonable. However, since the existing fill extends to 15 ft below grade, infiltration practice is not considered feasible due to significant variations in the existing fill. We recommend that the drain pipes be installed in this swm facility.

The infiltration design criteria established by the Maryland Department of the Environment (MDE) Water Management Administration advises that infiltration practices are not 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 an 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. The minimum infiltration rate required by the county is 0.52 in/hr.

7.0 EARTHWORK RECOMMENDATIONS

Based on our understanding of the project as currently proposed and our field observations, only a minor controlled fill is expected to be placed for the proposed building. The controlled fill should be placed and compacted as follows:

7.1. Subgrade Preparation

Pavement, topsoil, existing structures and other deleterious material present within the area of the proposed construction should be removed first. We anticipate that the actual depth of stripping will vary across the site. Man-made debris, organic soil, and excessive tree roots should be removed and replaced with controlled fill.

We recommend that the exposed subgrade be proofrolled by a 20-ton loaded dump truck or other similar construction equipment before introducing any new controlled fill materials. Proofrolling should be performed in a grid pattern to check the subgrade conditions in all directions. Proofrolling should be performed under the supervision of the geotechnical engineer and any significant pumping or rutting, if encountered, should be removed and replaced with controlled fill.

Upon completion of proofrolling, we recommend that the exposed subgrade be compacted to 95 percent per ASTM D-698 prior to placement of any new fill. Over-excavated areas such as old utilities and structures, should be backfilled according to the recommendations as detailed herein.

7.2. Controlled Fill

Soils classified as SM, SC, SP, SW, GM, GC, GP, GW or more granular soils in accordance with ASTM D-2487 are considered suitable for controlled fill. For SC and GC soils, a plasticity index should not exceed 12 and a liquid limit 35. The proposed fill soil should have a maximum dry density of no less than 110 pcf. Recycled concrete should not be used under the building and SWM facilities but may be used for the parking lot.

All materials proposed for controlled fill should be tested and approved by the geotechnical engineer prior to use. The on-site sand in the upper 5 ft of Stratum A, if excavated, is generally considered suitable for reuse as controlled fill. However, construction debris and organic matter should be removed and should not be used for controlled fill. Moisture contents of the excavated soils should be checked prior to use. Scarifying and aeration may be necessary depending on the actual moisture contents.

Controlled fill for the structure support should be placed in loose lifts not exceeding 8 inches in thickness and be compacted to at least 95 percent of the maximum dry density as determined by ASTM D-1557. Controlled fill for support of the sidewalk, steps, pavement, retaining walls should also be compacted to at least 90 percent. Grading fill in the grass area may be compacted to 85 percent. Vibratory smooth drum rollers are generally considered feasible for this purpose.

We further recommend that a surface swale be installed behind the proposed building to intercept the runoff from the existing slope.

7.3. Pavement

The borings showed that the existing pavement consisted of 3- to 4-inch asphalt pavement and 8-inch aggregate stone base. Cracks and potholes were observed in many areas of the existing pavement parking lot.

Considering the maintenance truck traffics in the parking lot, we recommend that following procedures to support the relatively heavy maintenance trucks:

- a. Remove cracked pavement from the new parking areas. Especially “allegator” cracks should be removed.
- b. Proofroll the existing pavement with a full-load dump truck to define the unsuitable areas as detailed in Section 8.1. Undercut “pumping” soils, as necessary.
- c. Place a pavement specific fabric over the remaining pavement area.
- d. Install 2-inch asphalt overlay.

It should be noted that the actual extent of the undercutting should be determined by the geotechnical engineer during the construction.

8.0 CONSTRUCTION CONSIDERATIONS

8.1. Spread Footing

Footing subgrade should be observed and tested by the geotechnical engineer to ascertain that footings are placed on a suitable subgrade as recommended herein. Care should be taken during excavation to minimize the disturbance of the bearing soils.

We recommend that footings be excavated and poured the same day in order to preclude ponding of any surface water in the footing excavation. Disturbed, frozen or softened soils should be removed prior to placement of concrete.

8.2 Floor Slab Subgrade

The floor subgrade should be observed by the geotechnical engineer prior to placement of the gravel base. Where the subgrade has been disturbed due to construction activity or other causes, the disturbed material should be replaced with crushed stone or controlled fill. Any trenches excavated for utility construction should be backfilled with controlled fill or crushed stone.

8.3. Earthwork

No significant problems are anticipated during the construction of site preparation, excavation and new controlled fill. We recommend that earthwork be performed between May and November to minimize problems with weather and wet on-site soils. The contractor should be prepared for proper surface runoff during construction.

8.4. Observation During Construction

The analysis and recommendations submitted in this report are based on the data obtained from the test borings performed at the locations indicated on the boring location plan. This report does not reflect any variations which may be present in the area between the borings. The nature and extent of variations between the borings may become evident only at the time of construction.

Careful monitoring during earthwork is essential for successful foundation work. It is recommended that **Geotech Engineers, Inc.** be retained as a quality control agency to perform professional observations for footing and floor subgrade, proofrolling and performing field density tests during placement of controlled fill.

9.0 GENERAL AND LIMITATIONS

It is recommended that we be provided the opportunity to review the final foundation plans and specifications to determine whether our recommendations have been properly applied.

Some variations in the soil conditions between the borings should be anticipated. An allowance should be established to account for additional costs that may be required during construction.

We have prepared this report for the use of the design professional for design purposes in accordance with generally accepted geotechnical engineering practices. No warranty, expressed or implied, is made as to the professional advice included in this report.

APPENDIX

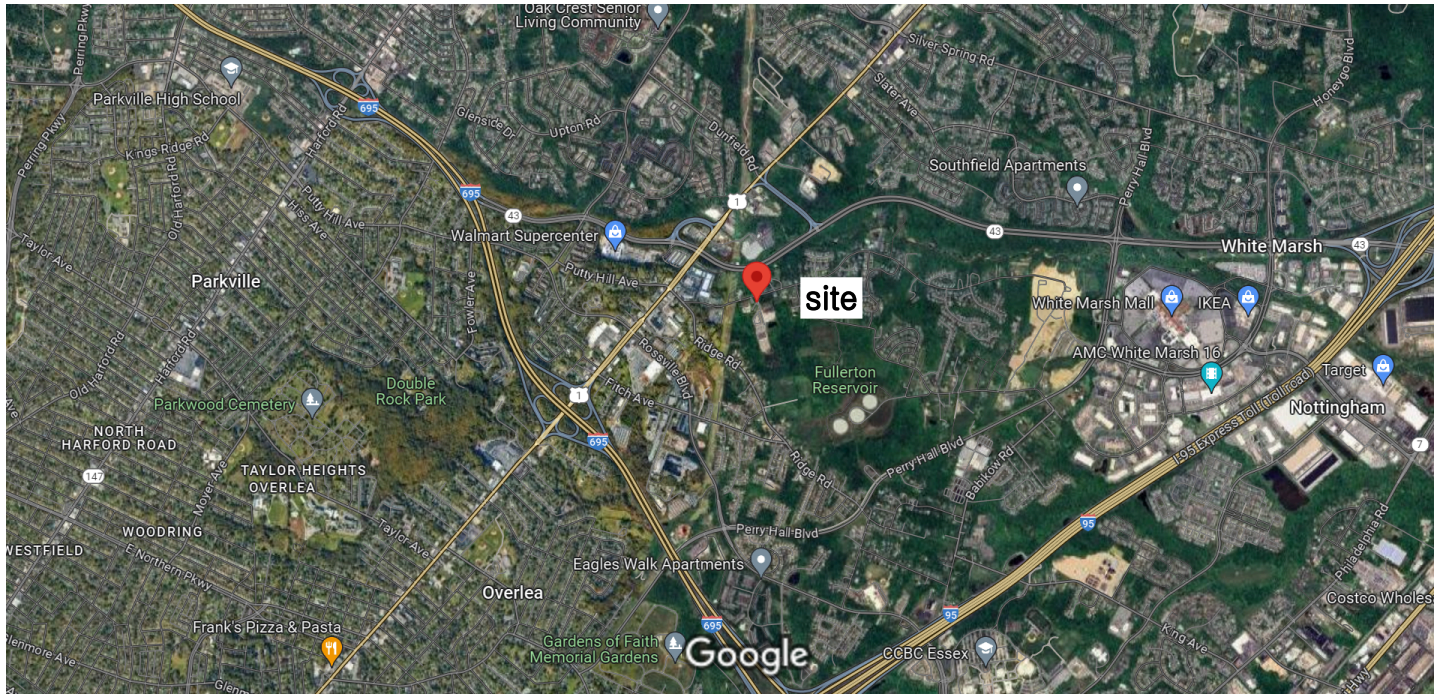
APPENDIX A	Vicinity Map and Historic Map
APPENDIX B	Soil Classification Charts ASTM D-2487 USDA Textural Classification
APPENDIX C	Summary of Soil Laboratory Tests Gradation Test Reports (3) Water Content Tests (1)
APPENDIX D	Schematic Footing Recommendations
APPENDIX E	Infiltration Test Report SWM-1
APPENDIX F	Test Pit Report
APPENDIX G	Test Boring Report Test Boring Summary Boring Logs Boring Location Plan

APPENDIX A

Vicinity Map

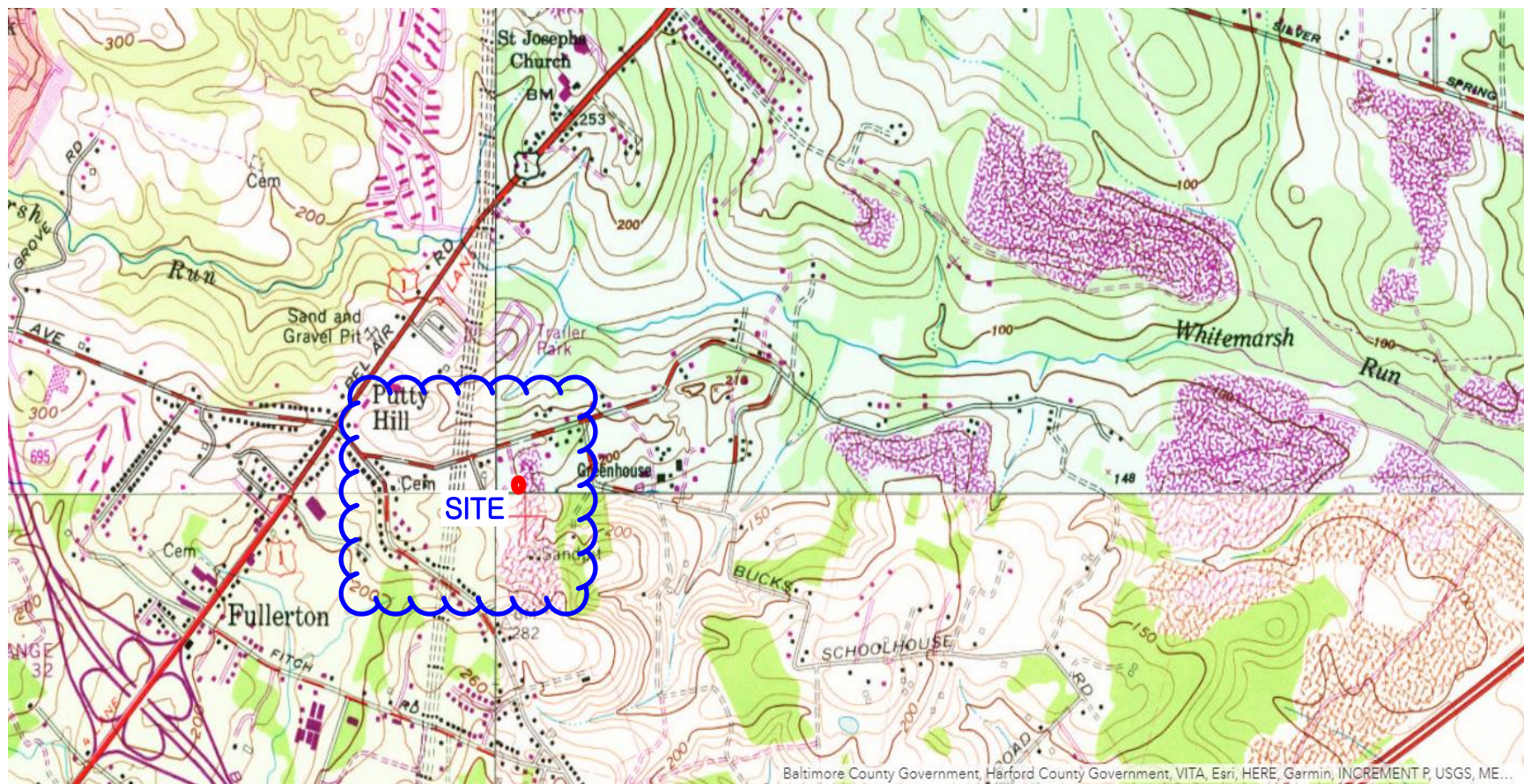
1. Vicinity Map
2. Historic Map

Google Maps 4421 Bucks School House Rd



Imagery ©2024 Airbus, Landsat / Copernicus, Maxar Technologies, Sanborn, U.S. Geological Survey, USDA/FPAC/GEO, Map data
©2024 Google

2000 ft



APPENDIX B
Soil Classification Charts

1. Soil Classification Chart of USGS (ASTM-2487)
2. Soil Classification Chart of USDA Soil Textural Classification

SOIL CLASSIFICATION CHART (ASTM D-2487)

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests ^A				Soil Classification	
				Group Symbol	Group Name ^B
Coarse-Grained Soils More than 50% retained on No. 200 sieve	Gravels	Clean Gravels	$Cu \geq 4$ and $1 \leq Cc \leq 3^E$	GW	well-graded GRAVEL ^F
	More than 50% of coarse fraction retained on No. 4 sieve	Less than 5% fines ^C	$Cu < 4$ and/or $1 > Cc > 3^E$	GP	poorly graded GRAVEL ^F
		Gravels with Fines	Fines classify as ML or MH	GM	silty GRAVEL ^{F,G,H}
	Sands 50 % or more of coarse fraction passes No. 4 sieve	More than 12 % fines ^C	Fines classify as CL or CH	GC	clayey GRAVEL ^{F,G,H}
		Clean Sands	$Cu \geq 6$ and $1 \leq Cc \leq 3^E$	SW	well-graded SAND ^I
		Less than 5 % fines ^D	$Cu < 6$ and/or $1 > Cc > 3^E$	SP	poorly graded SAND ^I
		Sands with Fines	Fines classify as ML or MH	SM	silty SAND ^{G,H,I}
	More than 12 % fines ^D	Fines classify as CL or CH	SC	clayey SAND ^{G,H,I}	
Fine-Grained Soils 50 % or more passes the No. 200 sieve	Silts and Clays Liquid limit less than 50	inorganic	$PI > 7$ and plots on or above "A" line ^J	CL	lean CLAY ^{K,L,M}
			$PI < 4$ or plots below "A" line ^J	ML	SILT ^{K,L,M}
	Silts and Clays Liquid limit 50 or more	organic	$\frac{\text{Liquid limit - oven dried}}{\text{Liquid limit - not dried}} < 0.75$	OL	organic CLAY ^{K,L,M,N} organic SILT ^{K,L,M,O}
		inorganic	PI plots on or above "A" line	CH	fat CLAY ^{K,L,M}
			PI plots below "A" line	MH	elastic SILT ^{K,L,M}
		organic	$\frac{\text{Liquid limit - oven dried}}{\text{Liquid limit - not dried}} < 0.75$	OH	organic CLAY ^{K,L,M,P} organic SILT ^{K,L,M,Q}
		Highly Organic Soils	Primarily organic matter, dark in color, and organic odor		

^A Based on the material passing the 3-in. (75mm) sieve.

^B If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

^C Gravels with 5 to 12 % fines require dual symbols:
 GW-GM well-graded GRAVEL with silt
 GW-GC well-graded GRAVEL with clay
 GP-GM poorly graded GRAVEL with silt
 GP-GC poorly graded GRAVEL with clay

^D Sand with 5 to 12 % fines require dual symbols:
 SW-SM well-graded SAND with silt
 SW-SC well-graded SAND with clay
 SP-SM poorly graded SAND with silt
 SP-SC poorly graded SAND with clay

^E $Cu = D_{60} / D_{10}$ $Cc = (D_{30})^2 / (D_{10} \times D_{60})$

^F If soil contains ≥ 15 % sand, add "with sand" to group name.

^G If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

^H If fines are organic, add "with organic fines" to group name.

^I If soil contains ≥ 15 % gravel, add "with gravel" to group name.

^J If Atterberg limits plot in hatched area, soil is a CL-ML, silty CLAY.

^K If soil contains 15 to 29 % plus No. 200, add "with sand" or "with gravel," whichever is predominant.

^L If soil contains ≥ 30 % plus No. 200, predominantly sand, add "sandy" to group name.

^M If soil contains ≥ 30 % plus No. 200, predominantly gravel, add "gravelly" to group name.

^N $PI \geq 4$ and plots on or above "A" line.

^O $PI < 4$ or plots below "A" line.

^P PI plots on or above "A" line.

^Q PI plots below "A" line.

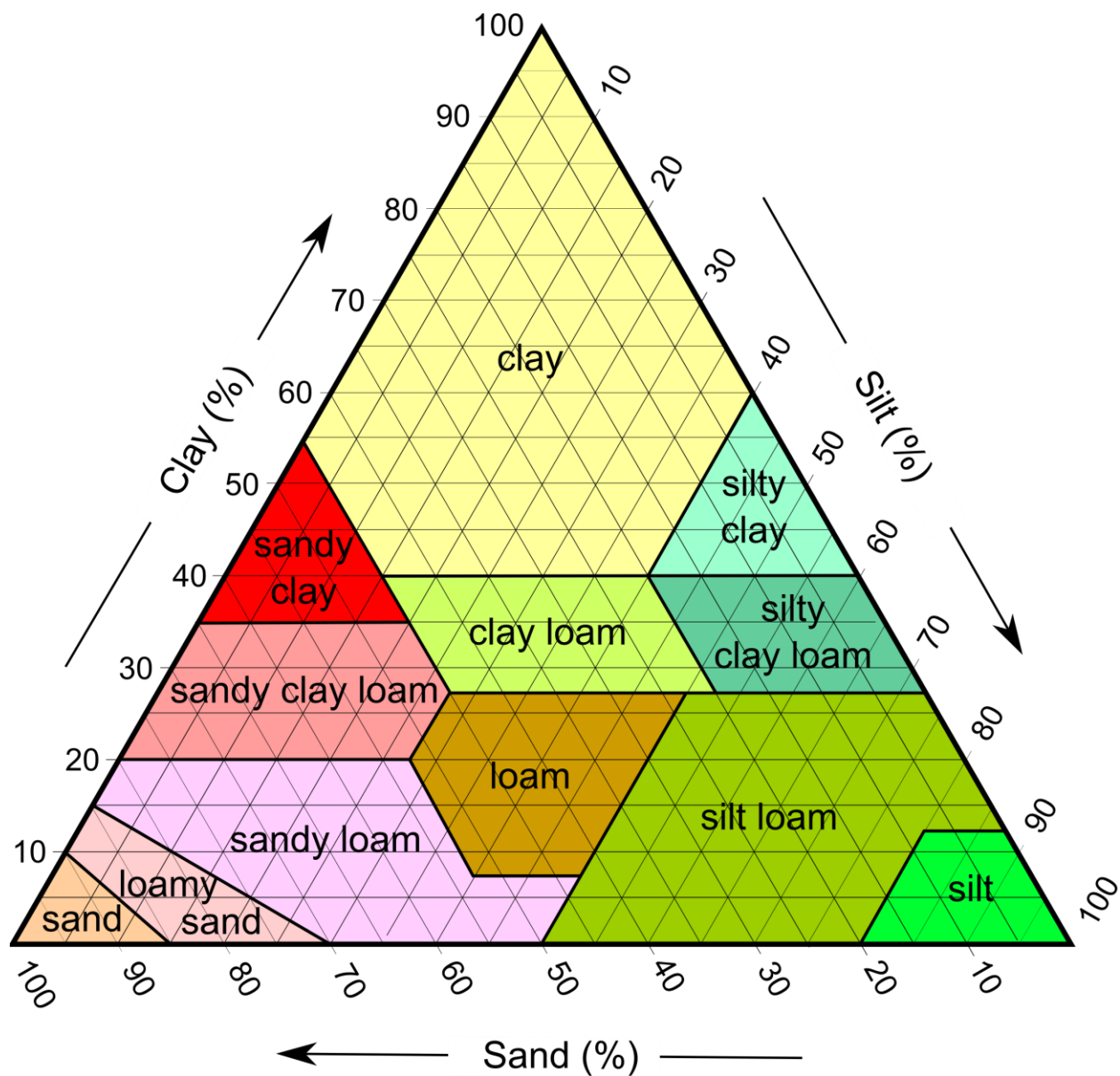
"Some" indicates presence of negligible amount of material.

RELATIVE DENSITY AND CONSISTENCY TABLE

The Standard Penetration Resistance values (N-values) and DCP values are used to describe the relative density of coarse-grained soils and the consistency of fine-grained soils as follows:

Cohesionless Soil			Cohesive Soil		
N-value	DCP	Term	N-value	DCP	Term
0 - 3	0 - 2	Very Loose	0 - 2	0 - 2	Very Soft
4 - 5	3 - 5	Loose	3 - 5	3 - 5	Soft
6 - 20	6 - 20	Medium Dense	6 - 9	6 - 9	Medium Stiff
21 - 30	21+	Dense	10 - 15	10 - 20	Stiff
31+		Very Dense	16 - 30	21+	Very Stiff
			31+		Hard

GEOTECH ENGINEERS, INC.



APPENDIX C
Laboratory Tests

1. Gradation Test Reports
2. Summary of Water Content Tests

Summary of Soil Laboratory Tests

Gradation Test Reports (3)
Moisture Content Test Report

Sample I.D	Sample Depth (feet)	MC (%)	Soil Description	Atterberg Limits			Percent Passing No. 200 Sieve	Moisture - Density		CBR Value	Remarks
				LL	PL	PI		Maximum Dry Density (pcf)	Optimum Moisture (%)		
B-1	5.0'	10.3	Brown silty SAND with gravel (SM)		NP		27.2				Stratum A
B-2	18.5	13.8	Gray sandy SILT (ML)	32.7	NP		69				Stratum B
P-1	0-1.5	6.8	Brown silty SAND with gravel (SM)		NP		33.4				

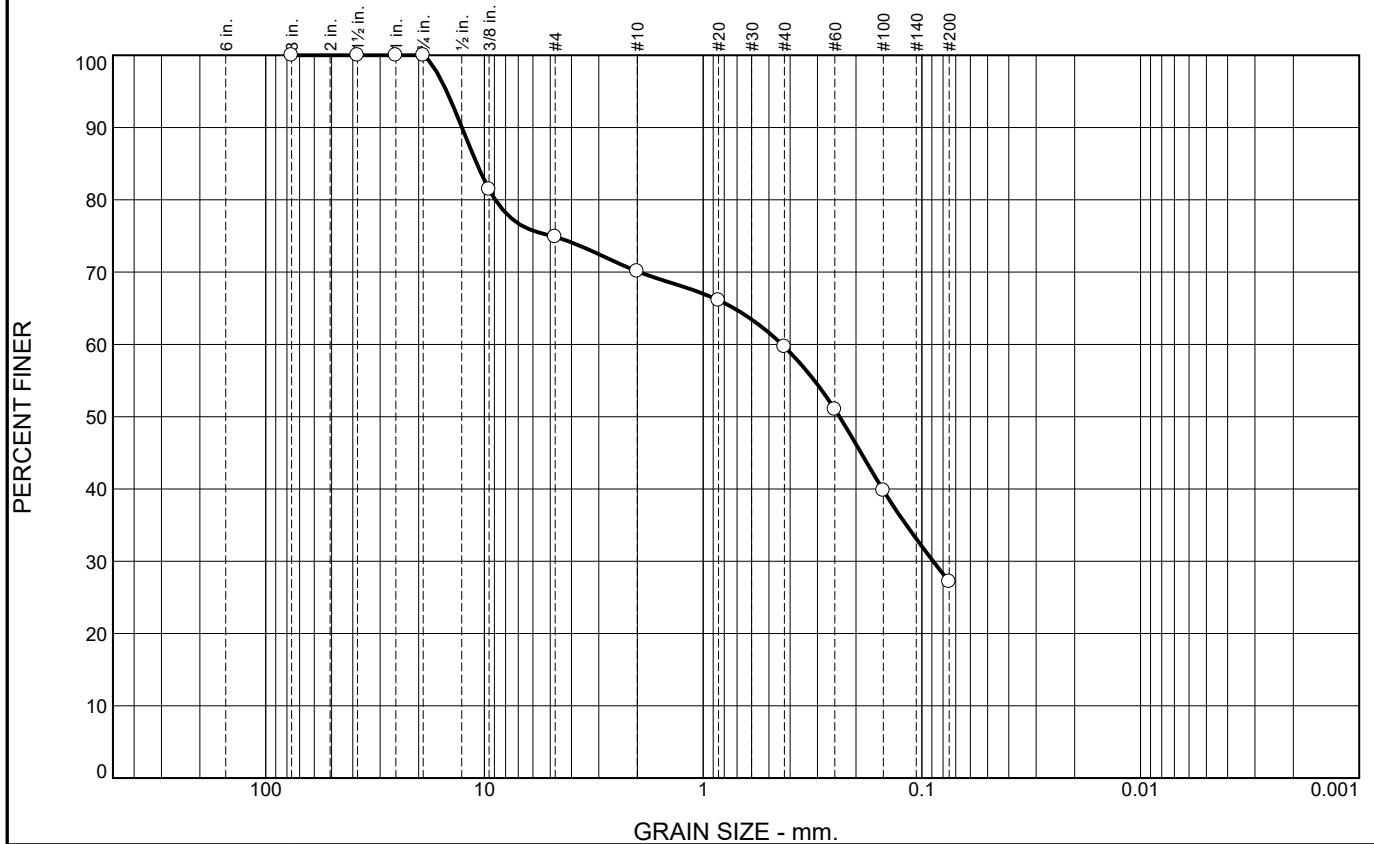
Notes: MC: Moisture Content, LL: Liquid Limit, PL: Plastic Limit, PI: Plasticity Index, CBR: California Bearing Ratio
NP: Visually classified as non-plastic.



Geotech Engineers, Inc.
11890-U Old Baltimore Pike
Beltsville, MD 20705
Phone: (301) - 937- 9227

Project No. 442827
Project Name: Fullerton Maintenance Building

Particle Size Distribution Report



% +3"	% Gravel	% Sand	% Silt	% Clay
0.0	25.1	47.7	27.2	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3	100.0		
1.5	100.0		
1	100.0		
.75	100.0		
.375	81.4		
#4	74.9		
#10	70.1		
#20	66.1		
#40	59.7		
#60	51.0		
#100	39.8		
#200	27.2		

* (no specification provided)

<u>Material Description</u>		
Brown silty SAND with gravel		
<u>Atterberg Limits</u>		
PL= NP	LL=	PI=
<u>Coefficients</u>		
D ₉₀ = 12.6662	D ₈₅ = 10.8371	D ₆₀ = 0.4361
D ₅₀ = 0.2379	D ₃₀ = 0.0887	D ₁₅ =
D ₁₀ =	C _u =	C _c =
<u>Classification</u>		
USCS= SM	AASHTO= A-2-4	
<u>Remarks</u>		
Moisture Content: 10.3%		

Location: B-1
Depth: -5.0' to 6.5'

Date: 03/21/2024

GEOTECH ENGINEERS, INC.

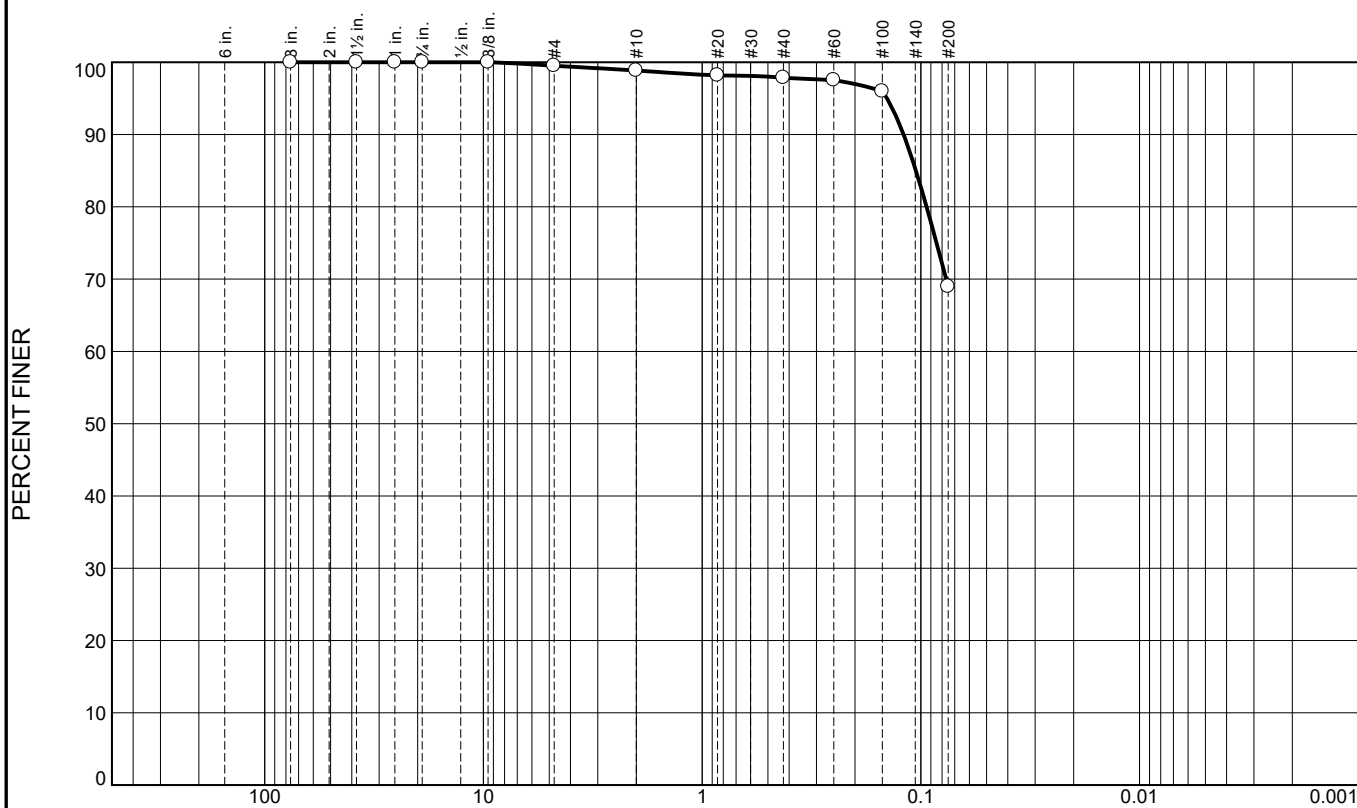
Beltsville, Maryland

Client: Grimm + Parker
Project: Fullerton Maintenance Building
Baltimore, MD

Project No: 442827E

Figure

Particle Size Distribution Report



% +3"	% Gravel	% Sand	% Silt	% Clay
0.0	0.5	30.5	69.0	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3	100.0		
1.5	100.0		
1	100.0		
.75	100.0		
.375	100.0		
#4	99.5		
#10	98.9		
#20	98.2		
#40	97.9		
#60	97.5		
#100	96.0		
#200	69.0		

* (no specification provided)

Material Description		
Grey sandy SILT		
Atterberg Limits		
PL= NP	LL= 32.7	PI=
Coefficients		
D ₉₀ = 0.1199	D ₈₅ = 0.1053	D ₆₀ =
D ₅₀ =	D ₃₀ =	D ₁₅ =
D ₁₀ =	C _u =	C _c =
Classification		
USCS= ML	AASHTO= A-4	
Remarks		
Moisture Content: 13.8%		

Location: B-2
Depth: -18.5 to 20.0'

Date: 03/21/2024

GEOTECH ENGINEERS, INC.

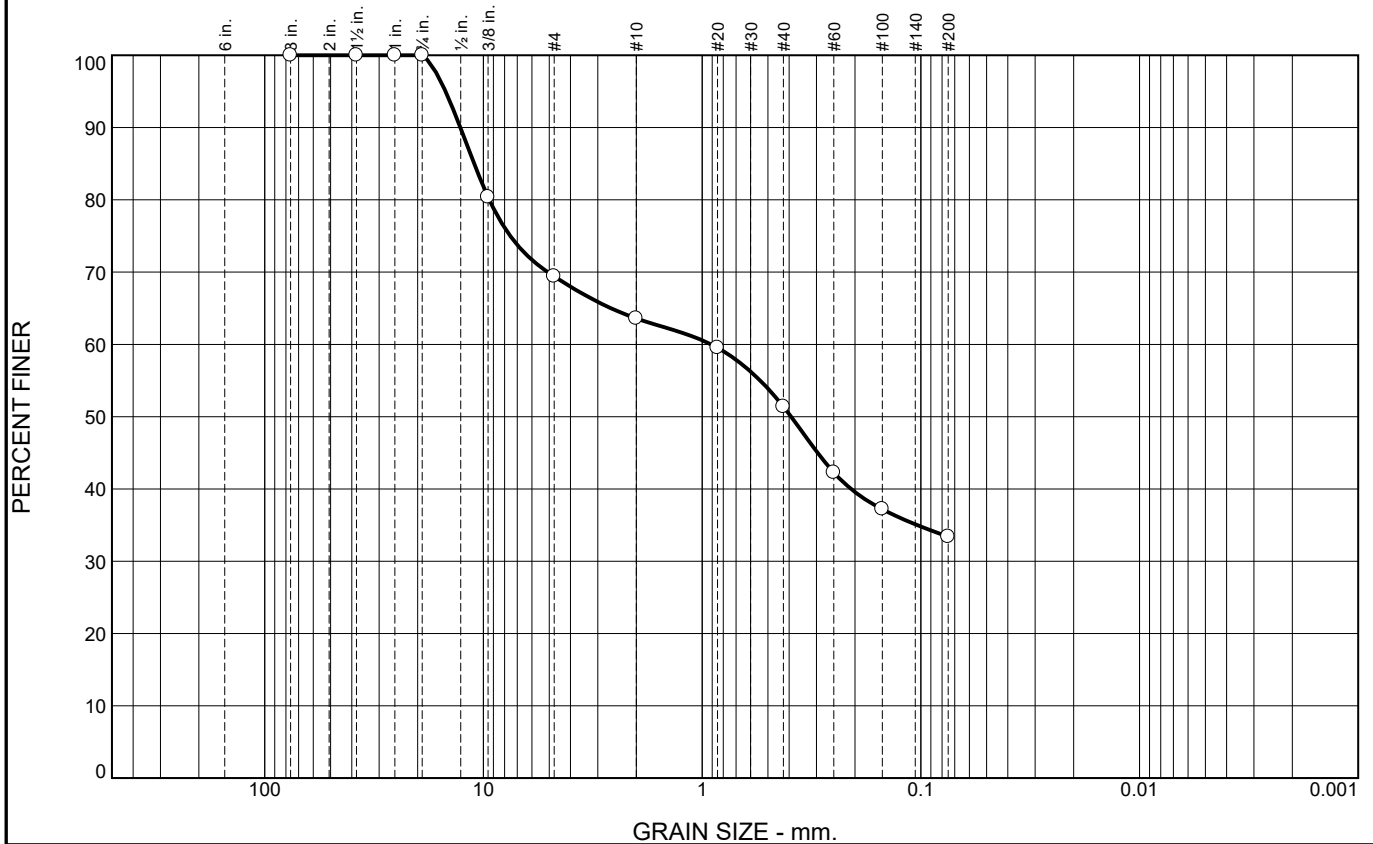
Beltsville, Maryland

Client: Grimm + Parker
Project: Fullerton Maintenance Building
Baltimore, MD

Project No: 442827E

Figure

Particle Size Distribution Report



% +3"	% Gravel	% Sand	% Silt	% Clay
0.0	30.6	36.0	33.4	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3	100.0		
1.5	100.0		
1	100.0		
.75	100.0		
.375	80.4		
#4	69.4		
#10	63.6		
#20	59.5		
#40	51.4		
#60	42.3		
#100	37.2		
#200	33.4		

* (no specification provided)

<u>Material Description</u>		
Brown silty SAND with gravel		
<u>Atterberg Limits</u>		
PL= NP	LL=	PI=
<u>Coefficients</u>		
D ₉₀ = 12.7470	D ₈₅ = 11.0243	D ₆₀ = 0.9103
D ₅₀ = 0.3919	D ₃₀ =	D ₁₅ =
D ₁₀ =	C _u =	C _c =
<u>Classification</u>		
USCS= SM	AASHTO= A-2-4	
<u>Remarks</u>		
Moisture Content: 6.8%		

Location: P-1
Depth: -0.0' to 1.5'

Date: 03/21/2024

GEOTECH ENGINEERS, INC.

Beltsville, Maryland

Client: Grimm + Parker
Project: Fullerton Maintenance Building
Baltimore, MD

Project No: 442827E

Figure

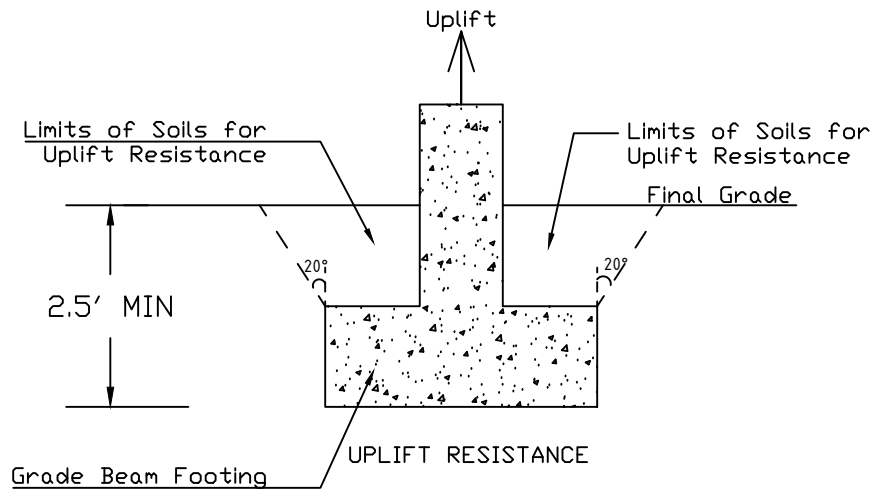
Moisture Content Test Report

PROJECT NAME:	Fullerton Maintenance Building
LOCATION:	Baltimore, MD
PROJECT NO:	442827E
TEST DATE:	3/21/2024

SWM-1	
Depth (ft)	Moist Content (%)
0-1.5	10.1
2.5-4	12.4
5-6.5	8.5
7.5-9.0	9.7
10-11.5	10.5
13.5-15	9.9

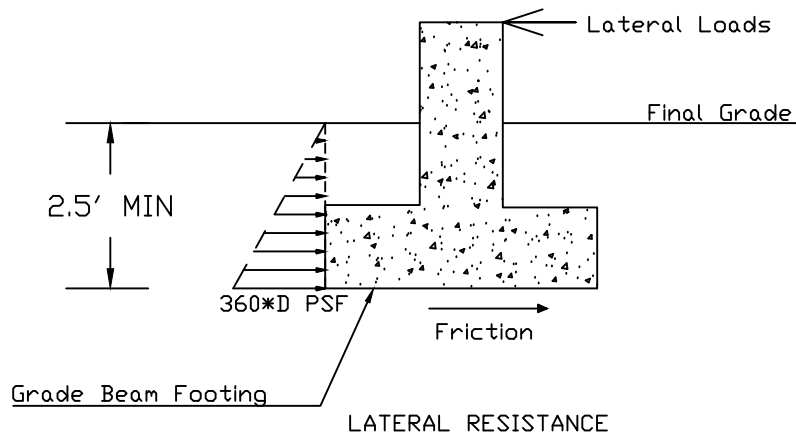
APPENDIX D
Footing Recommendations

1. Schematic Footing Recommendations



Note:

1. For Information Purpose Only, Not For Construction.
2. Uplift Resistance = Weight of Footings + Effective Weight of Overlaying Soils.



SCHEMATIC FOOTING RECOMMENDATIONS

HORIZONTAL SCALE: N. T. S.	DRAWN BY/APPROVED BY V. Z.	DATE DRAWN
VERTICAL SCALE: N. T. S.		4/8/2023
PROPOSED FULLERTON MAINTENANCE BUILDING		
PROJECT NO. 442827E		FIGURE NUMBER

APPENDIX E
Infiltration Tests

1. Infiltration Test Report: SWM-1

INFILTRATION TEST REPORT

GEOTECH ENGINEERS, INC.

PROJECT NAME:	Fullerton Maintenance Building	PROJECT NO:	442827E
LOCATION:	Baltimore, MD	HOLE NO:	SWM-1
PIPE DIAMETER:	4"	TEST DEPTH:	8.0'
PRE-SOAKING DATE:	2/27/2024	TEST DATE:	2/28/2024

TIME	TIME ELAPSED	WATER DEPTH (BELOW REF.)	DROP IN LEVEL	INFILTRATION RATE	REMARKS
	min.	ft	in	in/hr	
10:47	0	2.54			
11:17	30	2.62	0.96	1.92	
11:47	60	2.65	0.36	0.72	
12:17	90	2.69	0.48	0.96	
12:47	120	2.71	0.24	0.48	
13:17	150	2.72	0.12	0.24	
13:47	180	2.72	0.00	0.00	
14:17	210	2.72	0.00	0.00	
14:47	240	2.74	0.24	0.48	

Remarks: Water was present in the pipe at testing.

Performed by: JR

Infiltraton Rate : **0.18** in/hr

APPENDIX F
Test Pit Report

1. Test pit was conducted by Kim Engineering.
2. Vacuum method was used to avoid damage to the existing pipe.
3. The existing pipe was located and identified.

TEST PIT SUMMARY

TEST PIT SUMMARY

4421 BUCK SCHOOL HOUSE RD TEST PITS

LOCATION: ROSEDALE, MD

Test Hole	DATE	UTILITY	MATERIAL	SIZE (inch)	DEPTH (inch)		REMARK
					TOP	Bottom	
TP-1	3/14/2024	Water	Steel	8	49	57	

NOTE: The test holes were restored using excavated soil and compacted with pneumatic tamper.

TEST HOLE DATA

PROJECT NAME: 4421 Buck School House Rd

KIM PROJECT NUMBER: D24025

CLIENT: RK&K

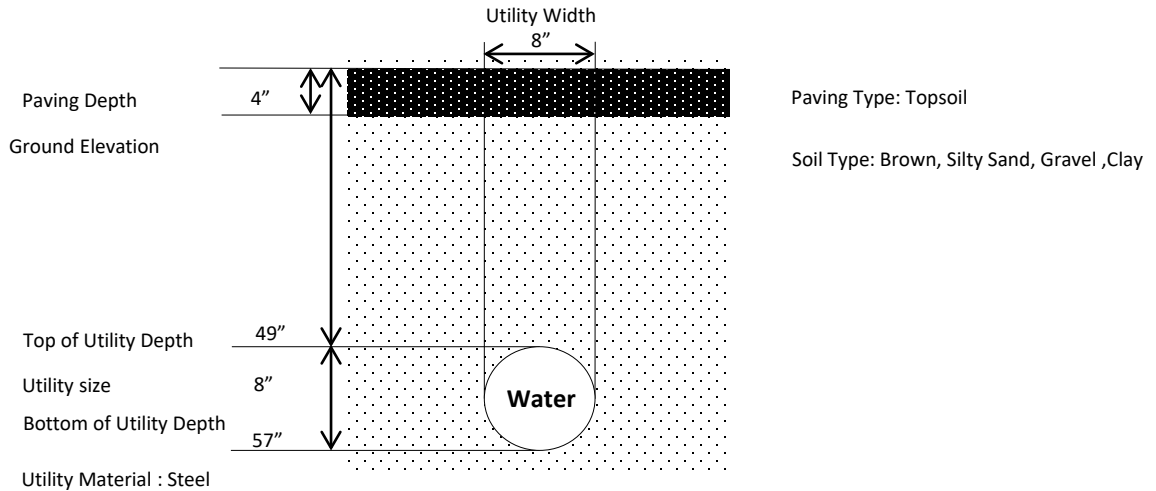
TEST HOLE ID: TP-1

PROJECT LOCATION: Rosedale, MD

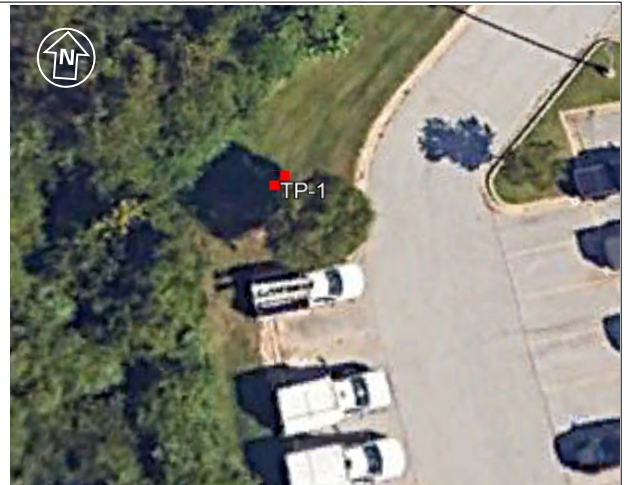
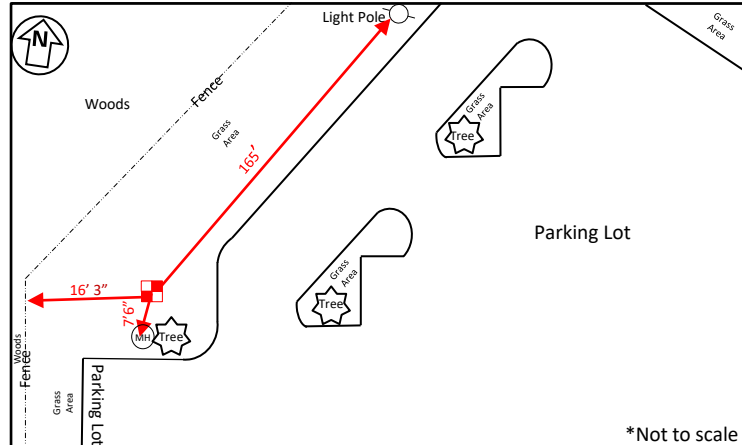
DATE DUG: 3/14/2024

UTILITY SERVICE ☐ Communication ☐ Electric ☐ Gas ☒ Water ☐ Storm ☐ San. Sewer ☐ Other	UTILITY STATUS ☒ Found ☐ Not Found ☐ Does Not Match	UTILITY TYPE ☐ Duct ☒ Pipe ☐ Other ☐ N/A	UTILITY SHAPE ☒ Circular ☐ Oval ☐ Rectangular ☐ N/A	UTILITY CONDITION ☒ Good ☐ Fair ☐ Poor ☐ N/A
APPROXIMATE TEST PIT LOCATION (US SURVEY FT.) Northing: 622591.502 Easting: 1453815.221	SURVEY MARKER ☐ PK ☐ Hub ☒ Tack ☐ Chiseled ☐ Flushed ☐ Wooden Stake	SURVEY MARKER LOCATION ☐ Crown ☐ North Edge ☐ South Edge ☐ East Edge ☐ West Edge ☐ Center of Pipe ☒ Center of test pit	RIBBON/FLAGGING TAPE ☐ Red ☐ White ☐ Orange ☐ Pink ☒ Blue ☐ Yellow ☐ Green	BACKFILL MATERIAL ☐ Asphalt ☐ Sand ☐ Concrete ☐ Bentonite ☒ Onsite material

PROFILE



SKETCH



NOTE:

EXCAVATED BY: JP

LOGGED BY: JP

CHECKED BY:

PHOTOS OF UTILITIES



Test Pit TP-1
Existing 8" Steel Water pipe

APPENDIX G
Test Boring Report

1. Test Boring Summary
2. Test Boring Logs of B-1 to B-3, P-1 and SWM-1
3. Boring Location Plan

TEST BORING REPORT

Test Boring Logs, B-1 to B-3, SWM-1 & P-1 Boring Location Plan

1. Test Borings

The test borings were drilled by a hollow stem auger. The standard penetration tests (SPT's) were performed at the depths shown on the boring logs. The auger was advanced to the desired depth and standard penetration test was performed after plug was removed. Automatic hammer was used for SPT's.

2. Boring Survey

Boring stakeout and elevation survey was performed by Geotech.

3. General Notes

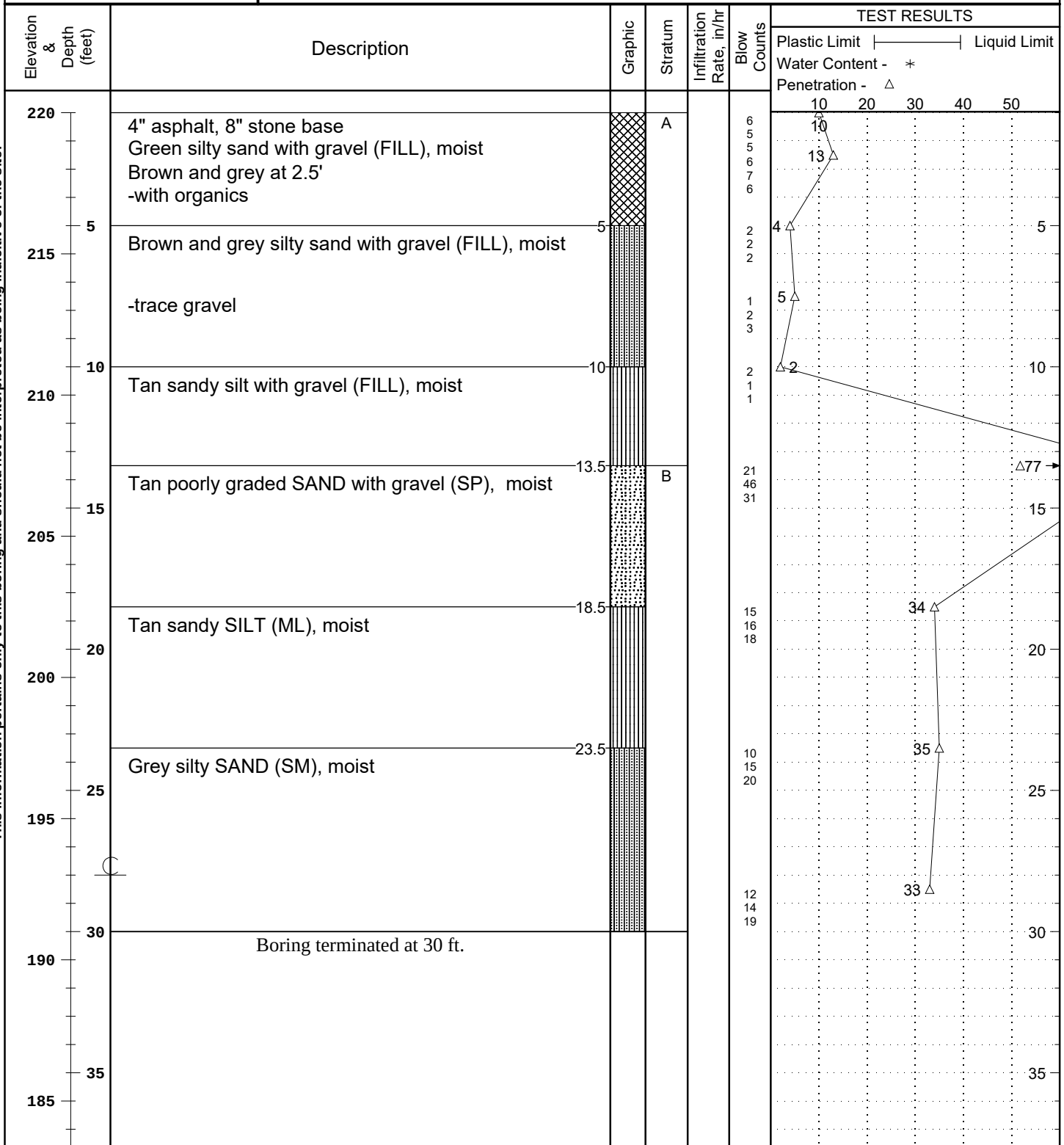
- a. Numbers in "blow count" column indicate blows required to drive a 2 inch O.D., 1-3/8 inch I.D. sampling spoon through 6 inch intervals or as indicated, using a 140 lb hammer falling 30 inches, according to ASTM D-1586.
- b. Groundwater levels shown on the logs are estimated from the available data and may vary with precipitation, porosity of the soil, site topography, etc.
- c. The boring logs and related information depict subsurface conditions only at the specific locations and at the particular time when drilled. Soil conditions at other locations may differ from conditions occurring at these boring locations.
- d. The stratification lines represent the approximate boundary between soil and rock types as determined from the drilling and sampling operation. Some variation may also be expected vertically between samples taken. The soil profile, water level observations and penetration resistance presented on these boring logs have been made with reasonable care and accuracy, and must be considered only an approximate representation of subsurface conditions to be encountered at the particular location.
- e. Soil samples were classified according to ASTM D-2487.
- f. WOH: Weight of hammer
GS: Ground Surface

GEOTECH ENGINEERS, INC.

LOG OF BORING No. B-1

PROJECT: Fullerton Maintenance Building PROJECT NO.: 442827E
 CLIENT: Grimm + Parker
 PROJECT LOCATION: 4421 Bucks Schoolhouse Road
 LOCATION: Baltimore, MD ELEVATION: 221
 DRILLER: KIM Engineering LOGGED BY: DF
 DRILLING METHOD: Hollow Stem Auger DATE: 02/28/2024
 DEPTH TO - WATER> INITIAL: ∇ None AFTER 24 HOURS: ∇ CAVING> C 28

This information pertains only to this boring and should not be interpreted as being indicative of the site.



Backfilled upon completion

GEOTECH ENGINEERS, INC.

LOG OF BORING No. B-2

PROJECT: Fullerton Maintenance Building

PROJECT NO.: 442827E

CLIENT: Grimm + Parker

PROJECT LOCATION: 4421 Bucks Schoolhouse Road

LOCATION: Baltimore, MD

ELEVATION: 220

DRILLER: KIM Engineering

LOGGED BY: DF

DRILLING METHOD: Hollow Stem Auger

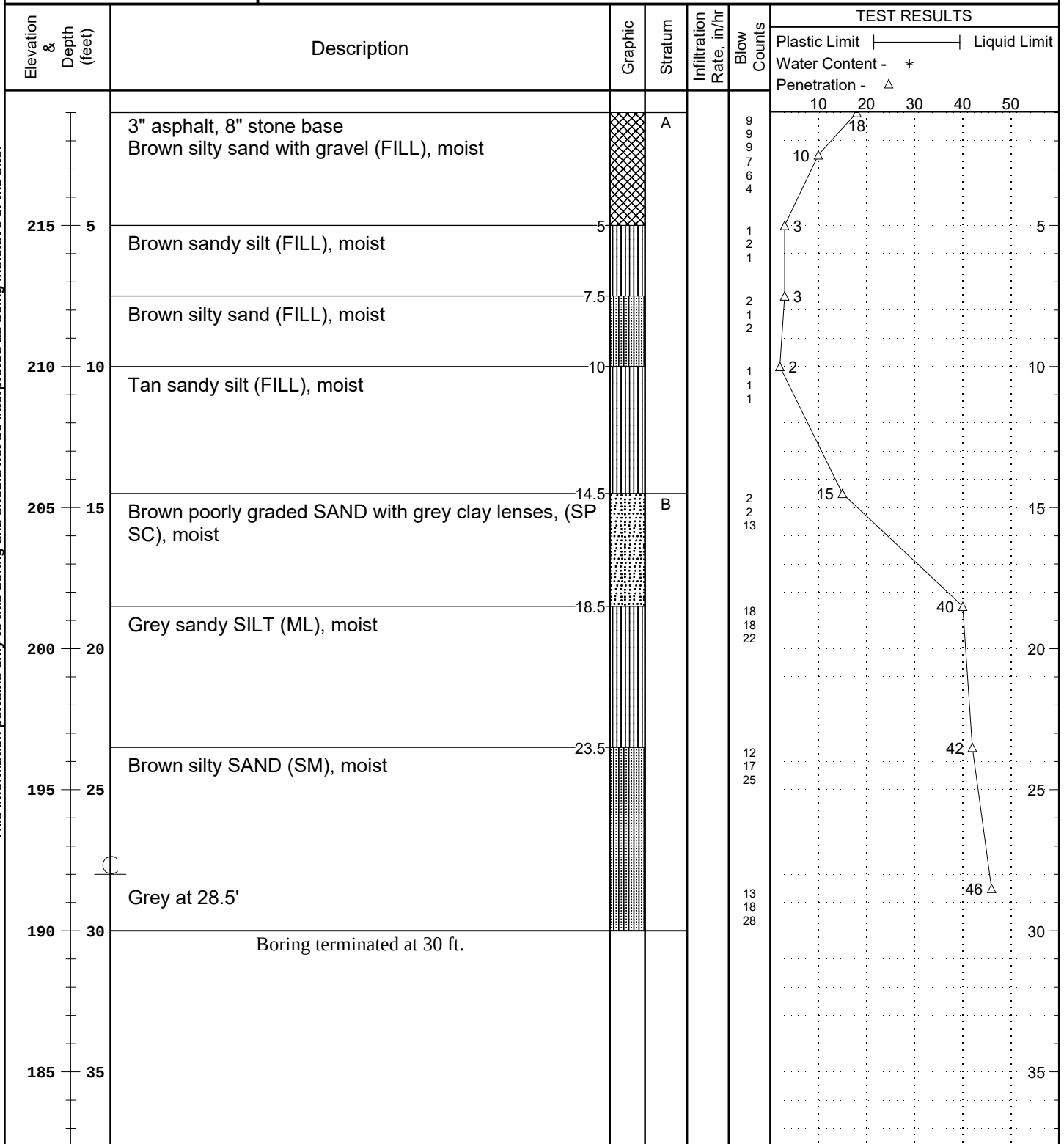
DATE: 02/28/2024

DEPTH TO - WATER> INITIAL: ∇ None

AFTER 24 HOURS: ∇ Dry

CAVING> C 28.0'

This information pertains only to this boring and should not be interpreted as being indicative of the site.



PVC pipe installed for overnight groundwater readings.

GEOTECH ENGINEERS, INC.

LOG OF BORING No. B-3

PROJECT: Fullerton Maintenance Building

PROJECT NO.: 442827E

CLIENT: Grimm + Parker

PROJECT LOCATION: 4421 Bucks Schoolhouse Road

LOCATION: Baltimore, MD

ELEVATION: 221

DRILLER: KIM Engineering

LOGGED BY: DF

DRILLING METHOD: Hollow Stem Auger

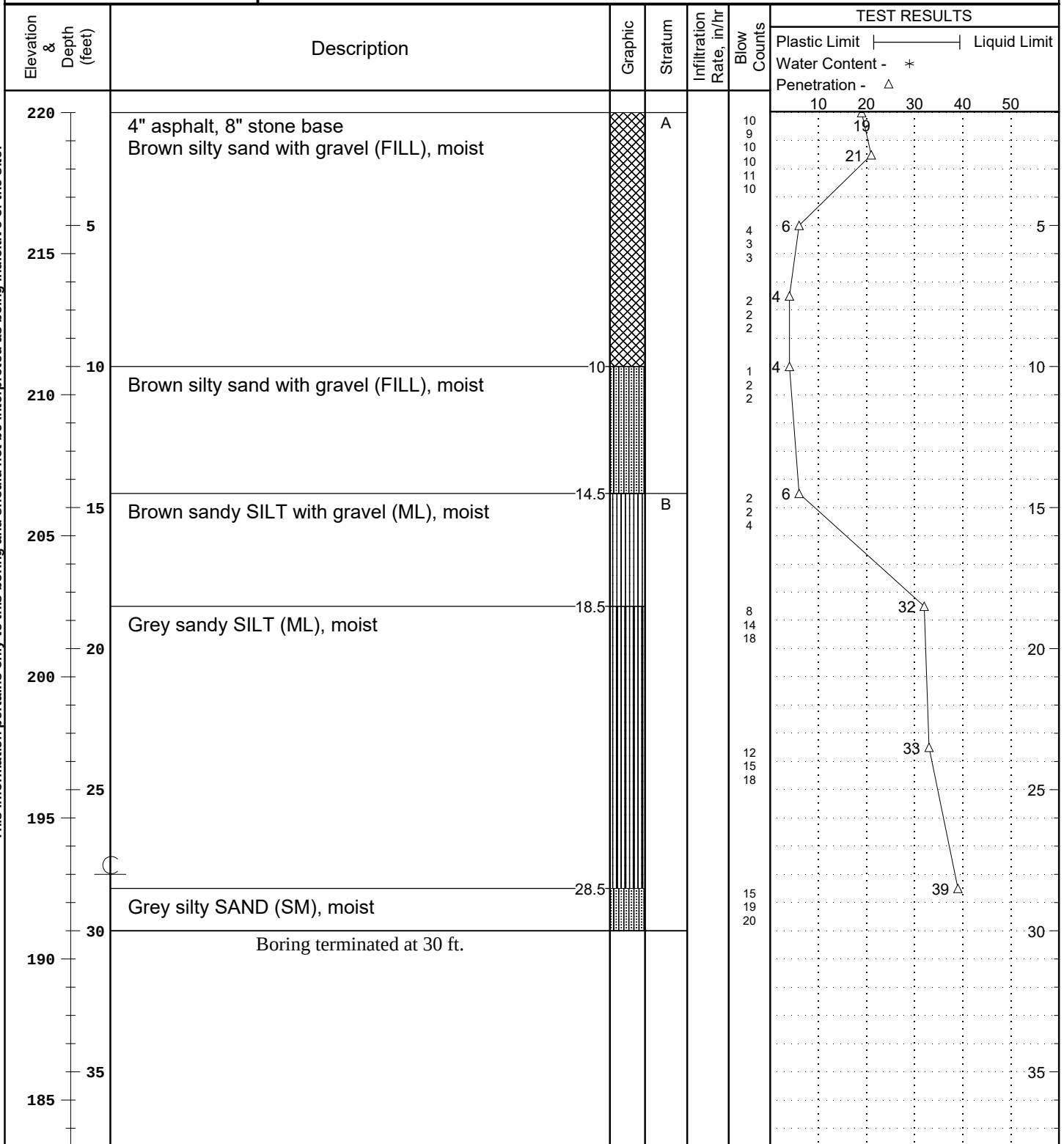
DATE: 02/28/2024

DEPTH TO - WATER> INITIAL: ∇ None

AFTER 24 HOURS: ∇

CAVING> ∇ 28.0

This information pertains only to this boring and should not be interpreted as being indicative of the site.



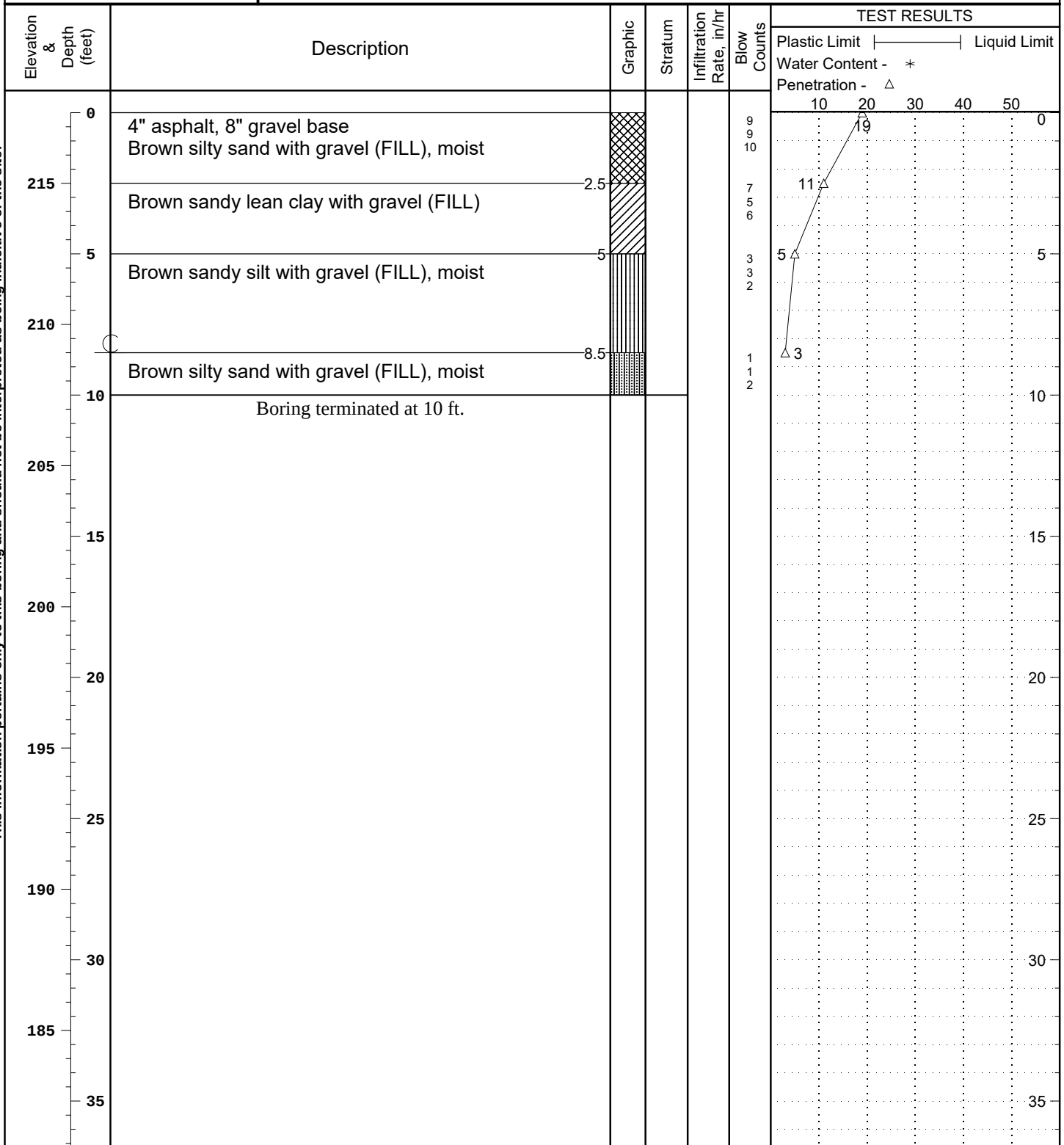
Backfilled upon completion

GEOTECH ENGINEERS, INC.

LOG OF BORING No. P-1

PROJECT: Fullerton Maintenance Building PROJECT NO.: 442827E
 CLIENT: Grimm + Parker
 PROJECT LOCATION: 4421 Bucks Schoolhouse Road
 LOCATION: Baltimore, MD ELEVATION: 217.5
 DRILLER: KIM Engineering LOGGED BY: DF
 DRILLING METHOD: Hollow Stem Auger DATE: 02/28/2024
 DEPTH TO - WATER> INITIAL: ∇ None AFTER 24 HOURS: ∇ CAVING> C 8.5

This information pertains only to this boring and should not be interpreted as being indicative of the site.



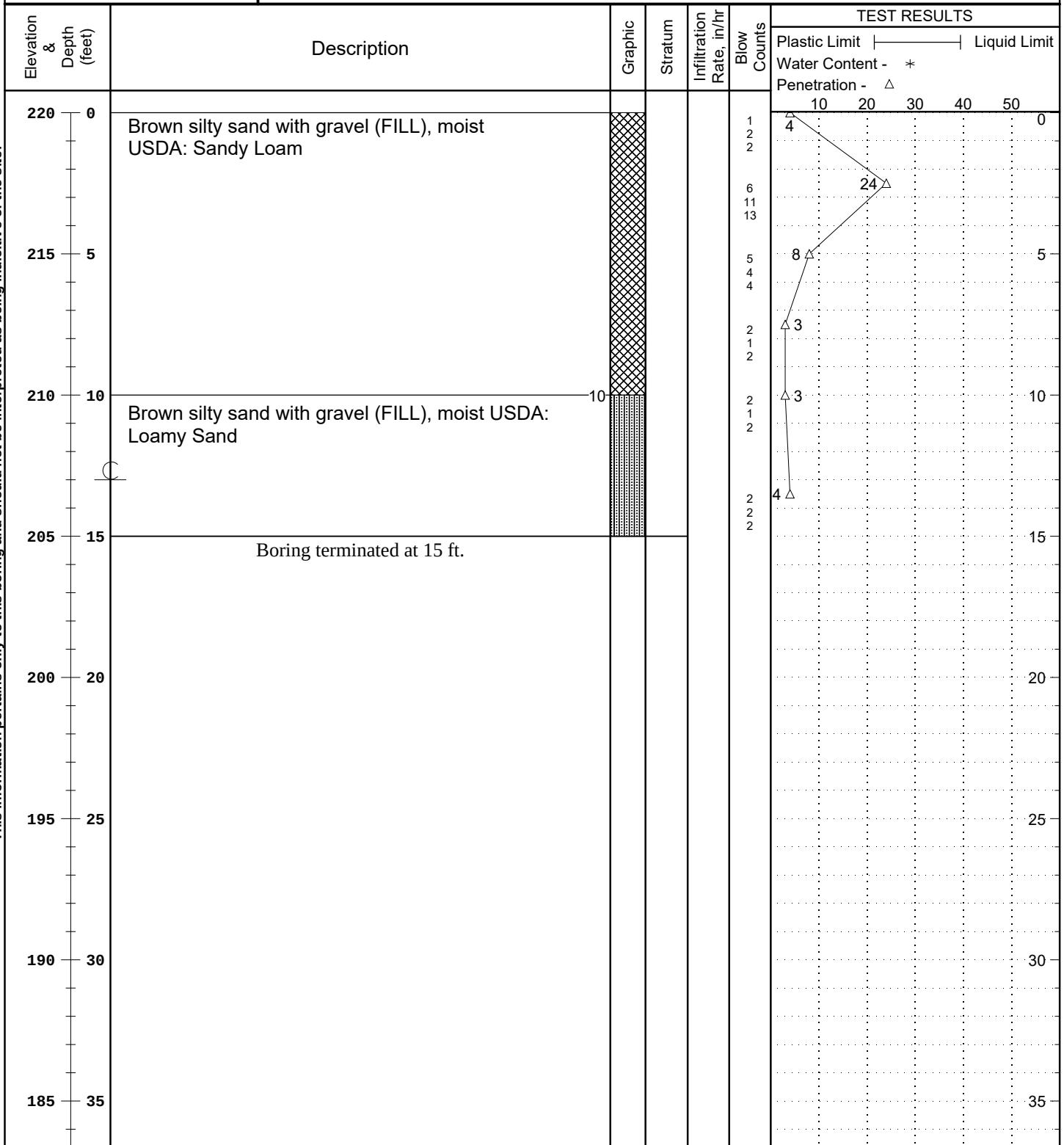
Backfilled upon completion

GEOTECH ENGINEERS, INC.

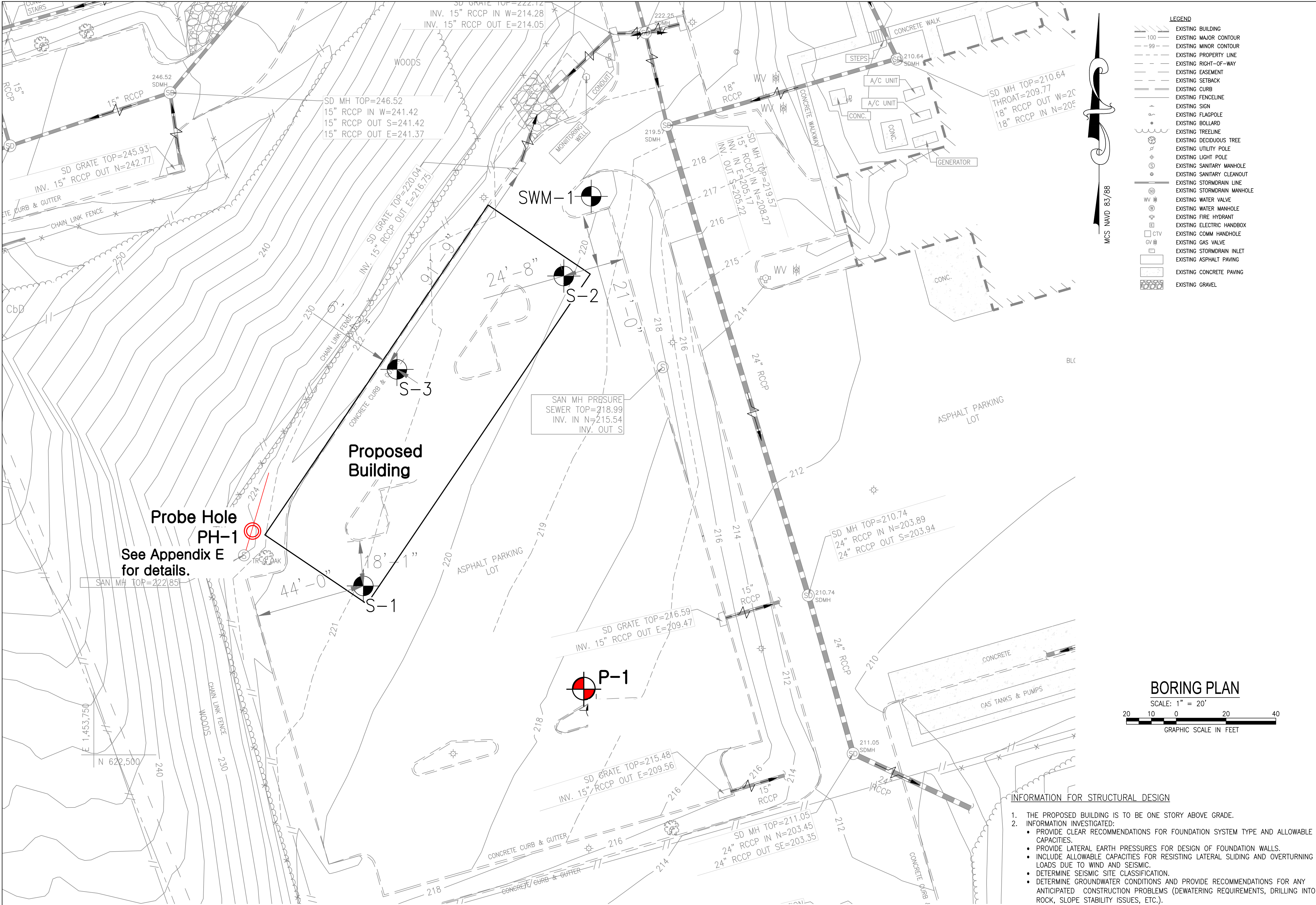
LOG OF BORING No. SWM-1

PROJECT: Fullerton Maintenance Building PROJECT NO.: 442827E
 CLIENT: Grimm + Parker
 PROJECT LOCATION: 4421 Bucks Schoolhouse Road
 LOCATION: Baltimore, MD ELEVATION: 220
 DRILLER: KIM Engineering LOGGED BY: DF
 DRILLING METHOD: Hollow Stem Auger DATE: 02/28/2024
 DEPTH TO - WATER> INITIAL: ∇ None AFTER 24 HOURS: ∇ Dry CAVING> ∇ 13.0

This information pertains only to this boring and should not be interpreted as being indicative of the site.



PVC pipe installed for overnight groundwater readings.



VICINITY MAP

SCALE: 1" = 500'

GRAPHIC SCALE IN FEET

GENERAL NOTES:

- FIELD RUN TOPOGRAPHICAL SURVEY PERFORMED ON JULY 21ST, 2023. SUPPLEMENTED WITH BALTIMORE COUNTY GIS INFORMATION AND RECORD DRAWINGS.
- EXISTING UNDERGROUND UTILITIES DESIGNATED ON THE PLANS ARE BASED ON CURRENTLY AVAILABLE INFORMATION AND ARE SHOWN FOR REFERENCE ONLY. THE OWNER AND ENGINEER DISCLAIM ANY RESPONSIBILITY FOR THE ACCURACY OR COMPLETENESS OF SAID INFORMATION BEYOND THE DESIGNATION INDICATED. THE QUALITY LEVEL DESIGNATED IS IN ACCORDANCE WITH ASCE "STANDARD GUIDELINE FOR THE COLLECTION AND DEPICTION OF EXISTING SUBSURFACE UTILITY DATA" (CI/ASCE 38-02). THE CONTRACTOR SHALL MAKE HIMSELF FAMILIAR WITH THOSE STANDARDS PRIOR TO ANY RELIANCE ON THE INFORMATION SHOWN ON THESE PLANS.
- PRIOR TO ANY EXCAVATION, IN THE ABSENCE OF QUALITY LEVEL A OR B DESIGNATION, THE CONTRACTOR SHALL VERIFY, TO HIS OWN SATISFACTION, THE EXISTENCE, DEPTH, SIZE, MATERIAL, AND LOCATION OF ALL UNDERGROUND UTILITIES, AND DETERMINE WHETHER THOSE UTILITIES ARE LIVE. ANY EARTHWORK IN LOCATIONS WHERE UTILITIES ARE POSSIBLE SHALL BE DONE WITH EXTREME CAUTION.
- THE GIVING OF INFORMATION ON THE PLANS WILL NOT RELIEVE THE CONTRACTOR OF HIS OBLIGATION TO SUPPORT AND PROTECT ALL DESIGNATED OR UNDESIGNATED EXISTING UTILITIES AND APPURTENANCES. SHOULD ANY EXISTING UTILITY BE DAMAGED BY THE CONTRACTOR, THE CONTRACTOR SHALL REPAIR THE DAMAGE CAUSED TO THE UTILITY OWNER'S SATISFACTION, AT THE CONTRACTOR'S EXPENSE.
- LIVE UNDERGROUND UTILITIES MAY EXIST WITHIN THE WORK AREA. CONTRACTOR SHALL USE EXTREME CAUTION AND SHALL COMPLY WITH APPLICABLE FEDERAL, STATE AND LOCAL REGULATIONS.
- INFORMATION SHOWN ON THIS DRAWING HAS BEEN PROVIDED AS A GUIDE TO ASSIST THE CONTRACTOR IN ESTABLISHING THE LOCATIONS OF PROPOSED CONSTRUCTION WITH RESPECT TO EXISTING SITE IMPROVEMENTS. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO PROVIDE ALL CONSTRUCTION SURVEY STAKEOUT REQUIRED AND TO CONFIRM ALL INFORMATION SHOWN HEREON.
- SEE THIS SHEET FOR SITE BENCHMARKS. CONTRACTOR SHALL BE RESPONSIBLE FOR ESTABLISHING AND MAINTAINING TEMPORARY BENCHMARKS THROUGHOUT THE DURATION OF THE PROJECT FOR CONSTRUCTION LAYOUT PURPOSES.
- EXISTING UTILITY INFORMATION IS DERIVED FROM SURVEY, BALTIMORE COUNTY GIS AND BALTIMORE COUNTY RECORD PLANS.

GENERAL SURVEY NOTES:

- COORDINATES AND ELEVATIONS SHOWN HEREON ARE REFERRED TO THE NORTH AMERICAN DATUM OF 1983 (2011) AND NORTH AMERICAN VERTICAL DATUM OF 1988 AND ARE BASED ON THE FOLLOWING CONTROL STATIONS:

CONTROL	NORTH	EAST	ELEVATION
BCO 332A	N 621,896.749	E 1,452,932.407	248.62
BCO 333A	N 621,523.650	E 1,453,586.516	257.25
- FIELD SURVEYS WERE PERFORMED ON 07/21/2023
- SITE DATA:
 - MAP: 8 - GRID 6 - PARCEL 172
 - OWNERSHIP: BALTIMORE COUNTY, MARYLAND
 - DEED: /05403/0702/
 - ADDRESS: BUCKS SCHOOLHOUSE RD, BALTIMORE, MD 21237

UTILITY DESIGNATION DESCRIPTION:

QUALITY LEVEL D (QL-D):
INCLUDES UTILITIES DESIGNATED THROUGH RECORD DOCUMENTS. THIS DATA COULD BE DIGITAL RECORDS, PAPER RECORDS, OR GIS DATA. THE AVAILABLE DATA COULD BE LIMITED AND NOT PRODUCE A COMPLETE PICTURE OF WHAT IS ONSITE. THE COMPLETENESS AND ACCURACY OF THE INFORMATION COULD BE COMPROMISED. HOWEVER, THE DATA COLLECTED IS SHOWN AND DESIGNATED SO AS TO REFLECT THE POTENTIAL FOR THE EXISTENCE OF UTILITIES.

QUALITY LEVEL C (QL-C):
INCLUDES UTILITIES DESIGNATED THROUGH THE PROCESS OF SURVEYING THE VISIBLE UTILITY SURFACE FEATURES. THIS DATA IS COMPILED WITH THE QUALITY LEVEL D DATA TO PROVIDE AN INCREASED, NOT ABSOLUTE, LEVEL OF HORIZONTAL POSITION ACCURACY FOR UNDERGROUND, NON-VISIBLE, QUALITY LEVEL D INFORMATION.

QUALITY LEVEL B (QL-B):
INCLUDES DESIGNATING THE UNDERGROUND UTILITIES BY MARKINGS PROVIDED THROUGH AN 811 CALL. BY CONTACTING AN INDIVIDUAL UTILITY COMPANY, OR PERFORMING TRACING OR GROUND PENETRATING RADAR. THE DESIGNATED UTILITY MARKINGS ARE THEN SURVEYED AND ADDED TO THE DRAWING. THIS DATA IS ADDED TO THE DATA COLLECTED FROM QUALITY LEVELS D AND C TO PROVIDE AN INCREASED LEVEL OF HORIZONTAL POSITION ACCURACY FOR UNDERGROUND, NON-VISIBLE UTILITIES.

BORING DATA					
TEST PIT	MD-Northing	MD-Easting	Existing Elev. (Ft)	Proposed Elev. (Ft)	Boring Depth (Ft)
P-1	1453951.75	622517.83	218.00	217.50	Ex. Grade -10
S-1	1453858.25	622567.83	221.00	220.78	Ex. Grade -30
S-2	1453938.75	622692.33	220.00	220.78	Ex. Grade -30
S-3	1453871.75	622654.83	221.00	220.78	Ex. Grade -30
SWM-1	1453949.75	622724.33	219.00	218.00	Ex. Grade -15

SEAL	PROFESSIONAL CERTIFICATION		AS-BUILT / REVISION		BY	DATE	P.W.A NO.	KEY SHEET	POSITION SHT	DRAWING SCALE	PROPERTY MANAGEMENT									
	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. _____ EXPIRATION DATE: _____ ENGINEER: _____ DGN BY: _____ AS-BUILT PER RECORD PRINT BY: _____ DATE: _____ CHKD BY: _____		CONTRACT COMPLETION BOX		TRAFFIC		HIGHWAYS		STRUCTURES		STORM DRAINS		SEWER		WATER		FIELD ENGINEER		APPROVED BY: _____ DATE: _____ PROPERTY MANAGER	
BUREAU OF ENGINEERING AND CONSTRUCTION		TRAFFIC		HIGHWAYS		STRUCTURES		STORM DRAINS		SEWER		WATER		FIELD ENGINEER						
REVIEWED BY: _____																				
DATE REVIEWED: _____																				
DATE: _____																				

SUBDIVISION: WHITE MARSH

JETT VAC TRUCK GARAGE
BORING PLAN
4421 BUCKS SCHOOLHOUSE ROAD BALTIMORE, MD 21237

Boring Location Plan

**APPENDIX F
Geotech**

ELECTION DISTRICT: 14C5



DRAWING NUMBER

CONTRACT NUMBER

SECTION 02 41 19 - SELECTIVE DEMOLITION**PART 1 - GENERAL****1.1 SUMMARY**

- A. This Section includes the following:
 - 1. Demolition and removal of selected portions of building.

1.2 DEFINITIONS

- A. Remove: Detach items from existing construction and legally dispose of them off-site, unless indicated to be removed and salvaged or removed and reinstalled.
- B. Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.
- C. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.
- D. Demolish: Tearing down, destruction, breakup, razing or removal of the whole or part of a building or structure, or a free standing machinery or equipment that is directly related to the function of the structure.
- E. Recycle: Recovery of demolition waste for subsequent processing in preparation for reuse.

1.3 SUBMITTALS

- A. Predemolition Photographs: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by selective demolition operations.

1.4 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Standards: Comply with ANSI A10.6 and NFPA 241.
- C. Predemolition Conference: Conduct conference at Project site.

1.5 PROJECT CONDITIONS

- A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.
- B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
- C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- D. Hazardous Abatement: Coordinate hazardous materials management with abatement trades, as required. [OSHA 1926.850(e); ANSI A10.6]
 - 1. Determine lead concentrations in any suspect surface coatings, structural steel rust inhibitors and ceramic tiles prior to selective demolition. Coordinate lead management with abatement trade, as required. [29 CFR 1926.850(e) and 1926.62(d)(2)]
- E. Storage or sale of removed items or materials on-site is not permitted.
- F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

1. Maintain fire-protection facilities in service during selective demolition operations.
- G. Refer to drawing documents for items to be removed and salvaged for reuse in new construction.

1.6 WARRANTY

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

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Services/Systems: Maintain services/systems indicated to remain and protect them against damage during selective demolition operations.
- B. Service/System Requirements: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.
 1. Owner will arrange to shut off indicated services/systems when requested by Contractor.
 2. If services/systems are required to be removed, relocated, or abandoned, before proceeding with selective demolition provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
 3. Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing.
 - a. Where entire wall is to be removed, existing services/systems may be removed with removal of the wall.

3.2 PREPARATION

- A. Items to be Salvaged: Refer to drawings for items indicated to be salvaged and reinstalled.
 1. All items to be salvaged and reinstalled are to be cleaned and stored until schedule allows reinstallation.
 2. All items to be salvaged and turned over to the Owner are to be cleaned and delivered to the location provided by the Owner.
- 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. Temporary Facilities: Provide temporary partitions 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. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
 3. Cover and protect furniture, furnishings, and equipment that have not been removed.
 4. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Division 1.

3.3 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. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
 2. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
 3. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain fire watch and portable fire-suppression devices during flame-cutting operations.
 4. Maintain adequate ventilation when using cutting torches.
 5. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
 6. Dispose of demolished items and materials promptly.
 7. Pollution Controls: Use temporary enclosures and other suitable methods to limit dust and dirt rising and scattering in air. Comply with governing regulations pertaining to environmental protection.
 8. Clean adjacent structures and improvements of dust, dirt, and debris caused by demolition operations. Return adjacent areas to condition existing prior to start of work.
- B. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.4 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

- A. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, then remove masonry between saw cuts.
- B. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, then break up and remove.
- C. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI-WP and its Addendum.
1. Remove residual adhesive and prepare substrate for new floor coverings by one of the methods recommended by RFCI.
- D. Air-Conditioning Equipment: Remove equipment without releasing refrigerants.
- E. Hazardous Materials:
1. Coordinate hazardous materials management with abatement trades, as required." [OSHA 1926.850(e); ANSI A10.6]
 2. Determine lead concentrations in any suspect surface coatings, structural steel rust inhibitors and ceramic tiles prior to selective demolition. Coordinate lead management with abatement trade, as required. [29 CFR 1926.850(e) and 1926.62(d)(2)]
 3. CAUTION: Lamp ballasts are regulated toxic substances. PCB and DEHP WASTES shall be salvaged. [EPA 40 CFR 761]
 4. CAUTION: Hydraulic door closures may contain PCB oils. Recover hydraulic door closures intact for salvage and coordinated delivery to Owner. [EPA 40 CFR 761 and 29 CFR 1926.850(e)]
 5. CAUTION: Fluorescent tubes, batteries and tilt-switch thermostats contain MERCURY. [29 CFR 1926.850(e)]

3.5 DISPOSAL OF DEMOLISHED MATERIALS

- A. General: Except for items or materials indicated to be recycled, reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.

1. Do not allow demolished materials to accumulate on-site.
 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
 3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
- B. Burning: Do not burn demolished materials.
- C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.
- 3.6 CLEANING
- A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 02 41 19

SECTION 03 10 00 - 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.
- C. Corners: Chamfered, rigid plastic or wood strip type, $\frac{3}{4}$ x $\frac{3}{4}$ 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, $\frac{3}{4}$ 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 03 10 00

SECTION 03 20 00 - 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 in², 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.

2.2 FABRICATION

- A. Fabricate concrete reinforcing in accordance with CRSI (DA4) – Manual of Standard Practice.
- B. Welding of reinforcement is not permitted.
- C. 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 03 20 00

SECTION 03 30 00 - CAST-IN-PLACE CONCRETE**PART 1 - GENERAL****1.1 SECTION INCLUDES**

- A. Slabs on grade.
- B. Footings.
- C. Grade beams.
- D. Piers.
- E. Joint devices associated with concrete work.
- F. 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 39 00 – Concrete Curing.
- D. Section 07 95 13 – Expansion Joint Cover Assemblies.
- E. Section 07 90 05 – Joint Sealers.

1.3 REFERENCE STANDARDS

- A. ACI 211.1 – Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete; American Concrete Institute.
- B. ACI 301 – Specifications for Structural Concrete for Buildings; American Concrete Institute.
- C. ACI 302.1R – Guide for Concrete Floor and Slab Construction; American Concrete Institute.
- D. ACI 304R – Guide for Measuring, Mixing, Transporting, and Placing Concrete; American Concrete Institute.
- E. ACI 305R – Hot Weather Concreting; American Concrete Institute.
- F. ACI 306R – Cold Weather Concreting; American Concrete Institute.
- G. ACI 318 – Building Code Requirements for Structural Concrete and Commentary; American Concrete Institute.
- H. ASTM C 33 – Standard Specification for Concrete Aggregates.
- I. ASTM C 39/C 39M – Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
- J. ASTM C 94/C 94M – Standard Specification for Ready-Mixed Concrete.
- K. ASTM C 150 – Standard Specification for Portland Cement.
- L. ASTM C 173/C 173M – Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
- M. ASTM C 260 – Standard Specification for Air-Entraining Admixtures for Concrete.
- N. ASTM C 494/ C 494M – Standard Specification for Chemical Admixtures for Concrete.
- O. ASTM C 618 – Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
- P. ASTM C 881/C 881M – Standard Specification for Epoxy-Resin Base Bonding Systems for Concrete.

- Q. ASTM C 989 – Standard Specification for Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars.
- R. ASTM C 1077 – Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation.
- S. ASTM C 1107/C 1107M – Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Non-Shrink).
- T. ASTM C 1240 – Standard Specification for Silica Fume Used in Cementitious Mixtures.
- U. ASTM D 1751 – Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non-Extruding and Resilient Bituminous Types).
- V. ASTM E 96 – Standard Test Methods for Water Vapor Transmission of Materials.
- W. ASTM E 329 – Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials used in Construction.
- X. IBC 2021 – International Building Code.

1.4 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. Embodied Carbon Data: Informational.
 - 1. Bill of sale and/or total quantity (per each mix design).
 - 2. Plant specific Environmental Product Declaration (EPD) for each concrete mixture proposed for the project accompanying each concrete mixture submittal.
 - a. It shall be permitted to substitute plant-specific EPDs with those listed in NRMCA Member Industry Average EPD for Ready Mixed Concrete if the proposed mixtures are similar to those listed and the concrete producer participated in providing data for the NRMCA Cradle-to-Gate Life Cycle Assessment of Ready-Mixed Concrete.
 - b. Independently verified as defined by ISO 14025

1.5 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. Plant Qualification:

1. Concrete shall be supplied from concrete plants with current certification under the NRMCA Certification of Ready Mixed Concrete Production Facilities.
 2. Documentation that the concrete supplier participated in supplying data to the NRMCA Cradle-to-Gate Life Cycle Assessment of Ready-Mixed Concrete.
- D. Perform work of this section in accordance with ACI 301 and ACI 318.
1. Maintain one copy of each document on site.
- E. Follow recommendations of ACI 305R when concreting during hot weather.
- F. Follow recommendations of ACI 306R when concreting during cold weather.
- G. 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.
- H. 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.

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.
- H. Regional Materials: Provide cement and aggregate manufactured and of primary raw materials extracted or recovered within 500 mile radius of Project Site.

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. Con Seal 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 minimum 1 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.
 - 3. Fly Ash or Calcined Pozzolan Content: Not to exceed 25% of cementitious material by weight.
 - 4. Silica Fume Content: Not to exceed 10% of total cementitious material by weight.
 - 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. Entrained air content for trowel-finished interior slabs shall not exceed 3%, determined in accordance with ASTM C 173/C 173M.
 - 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.
 - 1. Unroll vapor barrier with the longest dimension parallel with the direction of the concrete placement and face laps away from the expected direction of the placement whenever possible.
 - 2. Extend vapor barrier to the foundation wall and turn up vertically to terminate at the top of the slab. Vapor barrier shall be installed behind the isolation joint material and sealed to the masonry or concrete. Where obstructed by impediments, such as dowels, seal penetrations using manufacturer's textured seal tape per manufacturer's instructions. Ensure the concrete or masonry substrate is clean and dry prior to adhering tape.
 - 3. Overlap joints 6 inches and seal with manufacturer's seam tape.
 - 4. Apply seam tape to a clean and dry vapor barrier.
 - 5. Seal all penetrations (including pipes) per manufacturer's instructions.
 - 6. Avoid the use of non-permanent stakes driven through vapor barrier.
 - 7. If non-permanent stakes are driven through vapor barrier, repair as recommended by vapor barrier manufacturer.
 - 8. Repair damaged areas with vapor barrier material of similar (or better) permeance, puncture and tensile.

3.3 PLACING CONCRETE

- A. Place concrete in accordance with ACI 304R.
- B. Place concrete for floor slabs in accordance with ACI 302.1R.
- C. Ensure reinforcement, inserts, waterstops, embedded parts, and formed construction joint devices will not be disturbed during concrete placement.
- D. Separate slabs on grade from vertical surfaces with joint filler.
- E. Place joint filler in coordination with floor slab pattern placement sequence. Set top to required elevations. Secure to resist movement by wet concrete.
- F. 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.
- G. Install joint devices in accordance with manufacturer's instructions.
- H. Install construction joint devices in coordination with floor slab pattern placement sequence. Set top to required elevations. Secure to resist movement by wet concrete.
- I. 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.

- J. Apply sealants in joint devices in accordance with Section 07 90 05.
- K. Maintain records of concrete placement. Record date, location, quantity, air temperature and test samples taken.
- L. Place concrete continuously between predetermined expansion, control and construction joints.
- M. Do not interrupt successive placement. Do not permit cold joints to occur.
- N. Place slabs on grade with saw cut pattern indicated.
- O. 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 1/4 depth of slab thickness.

3.4 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 1/4 inch or more in height.
- C. Exposed Form Finish: Rub down or chip off and smooth fins or other raised areas 1/4 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 00.

3.5 CURING AND PROTECTION

- A. Comply with requirements of Section 03 39 00.

3.6 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.
- 3.7 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 03 30 00

SECTION 03 35 00 - 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 silicate 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 03 35 00

SECTION 03 35 46.23 - CONCRETE FLOOR ENHANCEMENT**PART 1 - GENERAL****1.1 SUMMARY**

- A. Section includes products and procedures for enhancing concrete floors into a finished surface and accessories indicated, specified, or required to complete usable finish.
- B. Locations:
 - 1. Interior concrete floors scheduled without other finish including, but not limited to, floors scheduled to be Sealed.
- C. Coordinate with concrete trade for Work specified in other Division 3 sections.

1.2 DEFINITIONS

- A. Concrete Floor Enhancement: The act of changing a concrete floor surface, with or without aggregate exposure, to specified level of enhanced finish.

1.3 ACTION SUBMITTALS

- A. Product Data: Manufacturer's technical literature for each product indicated, specified, or required. Include manufacturer's technical data, application instructions, and recommendations.
 - 1. Submit documentation from the impregnating stain protection manufacturer indicating acceptance and compatibility of all products and burnishing pads and equipment.

1.4 INFORMATIONAL SUBMITTALS

- A. Installer Qualifications: Certificates for company, list of successful past jobs, principal personnel, experience, and training specified in PART 1.5 "Quality Assurance" Article.
- B. Field Quality Control - Dynamic Coefficient of Friction Test Reports: Reports of testing specified in PART 3 "Field Quality Control" Article.
- C. Field Quality Control - Static Coefficient of Friction Test Reports: Report of testing specified in Part 3 "Field Quality Control" article.
- D. Maintenance Data: For inclusion in maintenance manual required by Division 1.
 - 1. Include instructions for maintenance of installed work, including methods and frequency recommended for maintaining optimum condition under anticipated use.
 - 2. Include precautions against cleaning products and methods which may be detrimental to finishes and performance.

1.5 QUALITY ASSURANCE

- A. Contractor Qualifications:
 - 1. Experience: Company having performed 20 jobs with specified work similar in design, products, and extent to scope of this Project; with a record of successful in-service performance; and with sufficient production capability, facilities, and personnel to produce specified work.
 - 2. Supervision: Maintain competent supervisor who is at Project during times specified work is in progress.
 - 3. Manufacturer Qualification: Holds certificate by manufacturer to apply liquid applied products.
- B. Walkway Auditor: Certified by CPAA or NFSI to test bonded abrasive polished concrete floors for dynamic and static coefficient of friction according to ANSI B101.1 and B101.3.

- C. Coefficient of Friction: Achieve following coefficient of friction by field quality control testing in accordance to the following standards:
1. ANSI B101.1 Static Coefficient of Friction - Achieve a minimum of .42 for level floor surfaces.
 2. ANSI B101.3 Dynamic Coefficient of Friction - Achieve a minimum of .35 for level floor surfaces.
- D. Pre-Installation of Concrete Conference: Prior to placing concrete for areas scheduled for polishing, conduct conference at Project to comply with requirements of applicable Division 1 Sections.
1. Required Attendees:
 - a. Owner.
 - b. Architect.
 - c. Contractor, including supervisor.
 - d. Concrete producer.
 - e. Concrete finisher, including supervisor.
 - f. Concrete treatment contractor, including supervisor.
 - g. Technical representative of liquid applied product manufacturers.
 - h. Walkway auditor.
 2. Minimum Agenda: Installer shall demonstrate understanding of work required by reviewing and discussing procedures for, but not limited to, following:
 - a. Review Contract Document requirements.
 - b. Review approved submittals.
 - c. Review concrete placement and finishing procedures, including, but not limited to:
 - 1) Applicable Division 3 Section on cast-in-place concrete:
 - a) Specified curing methods/procedures.
 - b) Protection of concrete substrate during construction.
 - c) Exposed Surfaces: Use steel-reinforced plastic power trowel blades (instead of steel) to control dark burnish marks; "Poly Pro" steel-reinforced power trowel blades by Wagman Metal Products Inc. or equal.
 - d) Project phasing and scheduling for each step of operations including, but not limited to 1) processes for removing cure and seal and 2) quality and size of all equipment committed to project.
 - e) Details of each step of operations.
 - i. Application of liquid applied products.
 - ii. Protecting concrete floors after work is complete.
 3. Reports: Record discussions, including decisions and agreements reached, and furnish copy of record to each party attending.

1.6 FIELD CONDITIONS

- A. Damage and Stain Prevention: Take precautions to prevent damage and staining of concrete surfaces to be polished.
1. Prohibit use of markers, spray paint, and soapstone.
 2. Prohibit improper application of liquid membrane film forming curing compounds.
 3. Prohibit vehicle parking over concrete surfaces.
 4. Prohibit pipe-cutting operations over concrete surfaces.
 5. Prohibit storage of any items over concrete surfaces for not less than 28 days after concrete placement.
 6. Prohibit ferrous metals storage over concrete surfaces.
 7. Protect from petroleum, oil, hydraulic fluid, or other liquid dripping from equipment working over concrete surfaces.
 8. Protect from acids and acidic detergents contacting concrete surfaces.

9. Protect from painting activities over concrete surfaces.
- B. Environmental Limitations: Comply with manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting liquid applied product application.

PART 2 - PRODUCTS

2.1 LIQUID APPLIED PRODUCTS

- A. Liquid Densifier: An Aqueous solution of Silicon Dioxide dissolved in one of the following Hydroxides that penetrates into the concrete surface and reacts with the Calcium Hydroxide to provide a permanent chemical reaction that hardens and densifies the wear surface of the cementitious portion of the concrete. All of the following have the same chemistry varying only by the alkali used for solubility of the Silicon Dioxide.
 1. Curecrete; Ashford Formula. (Basis-of-Design)
 2. Euclid Chemical; EUCO Diamond Hard.
 3. L&M; Seal Hard.
- B. Sealer - Impregnating Stain Protection: Non-film forming stain and food resistant penetrating sealer designed to be applied to densified and polished concrete which meets the requirements of OSHA for slip resistance as tested by ASTM D 2047 and stain resistance of ASTM D 1308.
 1. Retro Guard. (Basis-of-Design)
 2. Scofield, a Sika Brand; SCOFIELD Formula One Guard-S.
 3. PROSOCO, Inc.; LSGuard.

2.2 ACCESSORIES

- A. Repair Material: A product that is designed to repair cracks and surface imperfections. The specified material must have sufficient bonding capabilities to adhere after the polishing to the concrete surface and provide abrasion resistance equal to or greater than the surrounding concrete substrate.
- B. Burnishing Pads: Diamond-impregnated concrete polishing pads; subject to acceptance of representative of impregnating stain protection manufacturer.
 1. Substrate Technology, Inc. (Basis-of-Design)
 2. Armadillo
 3. Gorilla
 4. Norton, Saint-Gobain.
 5. 3m
- C. Protective Cover: Skudoo Heavy Commercial Matt, Ram Board or Scofield Proguard Duracover.

2.3 FINISHING EQUIPMENT

- A. Field Equipment:
 1. A multiple head, counter rotating, walk behind or ride on machine, of various size and weights, with diamond tooling affixed to the head for the purpose of grinding concrete. Excludes janitorial maintenance equipment.
 2. Wet finishing only, use slurry extraction equipment suitable for slurry removal and containment prior to proper disposal.
 3. Industrial auto scrubbers.
- B. Edge Equipment: Hand-held or walk-behind machines which produces same results, without noticeable differences, as field equipment.
- C. Burnishing Equipment: High speed walk-behind or ride-on machines capable of generating 1000 to 2000 revolutions per minute and with sufficient head pressure of not less than 20 pounds to raise floor temperature by 20 degrees F.

- D. Tooling: Abrasive tools that contain industrial grade diamonds within a bonded matrix (such as metallic, resinous, ceramic, etc) that are attached to rotating heads to refine the concrete substrate.
 - 1. Bonded Abrasive: Abrasive medium that is held within a bonding that erodes away to expose new abrasive medium as it is used.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions:
 - 1. Examine substrates to be polished for compliance with requirements and other conditions affecting performance.
 - a. Concrete Finished Floor Flatness according to applicable Division 3 Section on cast-in-place concrete.
 - b. Concrete curing methods according to applicable Division 3 Section on cast-in-place concrete.
 - c. Concrete Compression strength per according to applicable Division 3 Section on cast-in-place concrete.
- B. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents.
- C. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 PREPARATION

- A. Cleaning New Concrete Surfaces:
 - 1. Prepare and clean concrete surfaces.
 - 2. Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, paint splatter, and other contaminants incompatible with liquid applied products and specialty concrete finishing.
 - 3. Inspect and ensure cure and seal has been completely removed.

3.3 PROCESS

- A. Perform all procedures to ensure a consistent appearance from wall to wall.
- B. Areas Greater than 40 SF:
 - 1. Following preparation steps apply liquid densifier according to manufacturer's directions.
 - 2. Apply three medium applications of impregnating stain protection and allow to cure for 24 hours.
 - 3. Burnish with propane burnisher and STI Black burnishing pad until impregnating stain protection no longer increases in gloss.
- C. Other Areas 40 SF or less:
 - 1. Following preparation steps apply liquid densifier according to manufacturer's directions.
 - 2. Apply three medium applications of impregnating stain protection and allow to cure for 24 hours.

3.4 FIELD QUALITY CONTROL

- A. Field Testing: Engage a qualified walkway auditor to perform field testing to determine if polished concrete floor finish complies with specified coefficient of friction;
 - 1. ANSI B101.1 for static coefficient of friction.
 - 2. ANSI B101.3 for dynamic coefficient of friction.

3.5 CLOSEOUT ACTIVITIES

- A. Maintenance Training: Train Owner's designated personnel in proper procedures for maintaining polished concrete floor.

3.6 PROTECTION

- A. Covering: After completion of polishing, protect polished floors from subsequent construction activities with protective covering.

END OF SECTION 03 35 46.23

SECTION 03 39 00 - 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 03 39 00

SECTION 05 12 00 - STRUCTURAL STEEL FRAMING**PART 1 - GENERAL****1.1 SECTION INCLUDES**

- A. Structural steel framing members, support members.
- B. Base 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 123/A 123M – Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- F. ASTM A 153/A 153M – Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- G. ASTM A 307 – Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
- H. ASTM A 500 – Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
- I. ASTM A 563 – Standard Specification for Carbon and Alloy Steel Nuts.
- J. ASTM C 1107/C 1107M – Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Non-Shrink).
- K. ASTM E 94 – Standard Guide for Radiographic Examination.
- L. ASTM E164 – Standard Practice for Ultrasonic Contact Examination of Weldments.
- M. ASTM E 165 – Standard Test Method for Liquid Penetrant Examination.
- N. ASTM E 709 – Standard Guide for Magnetic Particle Examination.
- O. ASTM F 436 – Standard Specification for Hardened Steel Washers.
- P. ASTM F 959 – Standard Specification for Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners.
- Q. ASTM F 1554 – Standard Specification for Anchor Bolts, Steel, 36, 55 and 105 ksi Yield Strength.

- R. 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
- S. AWS A2.4 – Standard Symbols for Welding, Brazing, and Non-Destructive Examination.
 - 1. American Welding Society.
- T. AWS D1.1/D1.1M – Structural Welding Code – Steel; American Welding Society.
- U. IBC 2018 – International Building Code.

1.3 DEFINITIONS

- A. Embodied Carbon Footprint: embodied carbon is the carbon dioxide equivalent (CO₂e) footprint of a building or infrastructure project before it becomes operational. Embodied carbon is distinct from operational carbon - the carbon that comes from energy, heat, lighting, etc. Embodied carbon is generally expressed as Global Warming Potential. Typically, the embodied carbon is the initial embodied carbon which only accounts for the cradle to gate impacts.
- B. Global Warming Potential: Global warming potential (GWP) is the heat absorbed by any greenhouse gas in the atmosphere, as a multiple of the heat that would be absorbed by the same mass of carbon dioxide. GWP is 1 for CO₂. For other gases it depends on the gas and the time frame. GWP for concrete is expressed in kg of CO₂e per unit of concrete (cubic yard or cubic meter)
- C. Environmental Product Declaration: An Environmental Product Declaration (EPD) quantifies environmental information on the life cycle of a product to enable comparisons between products fulfilling the same function. EPDs are conducted in accordance with a Product Category Rule for the specific product being evaluated. (International Organization for Standardization 14025 as a Type III declaration)
- D. Product Category Rule: Product Category Rules (PCR) are a set of rules, requirements and guidelines for developing Environmental Product Declarations (EPD) for one or more product categories. The PCR for concrete is published by NSF International.
- E. Life Cycle Assessment: Life cycle assessment (LCA) is a methodology for assessing environmental impacts associated with all the stages of the life cycle of a commercial product, process, or service.

1.4 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.
- G. Embodied Carbon Data: Informational.
 1. Bill of sale and/or total tonnage (per mill source).
 2. Environmental Product Declaration (EPD):
 - a. Includes global warming potential (GWP)
 - b. Independently verified as defined by ISO 14025
 - c. Mill-specific, for each material/shape source.
 - 1) If not available, submit industry-wide EPD, of matching production method (electric arc furnace, blast furnace, etc.), for each material/shape source.

1.5 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.
 3. Fabricator shall be an AISC Certified Building Fabricator (BU) and shall maintain the certification for the duration of the project. Fabricators that are not AISC Certified shall meet the following additional requirements:

- a. Demonstrate that the fabricator has in place a quality control program for meeting IBC requirements and compliance with AISC recommendations and standards.
 - b. At no additional cost to the Owner, provide an independent shop inspection for compliance with IBC, AISC and AWS recommendations and standards. The independent inspection agency shall be different than the testing agency engaged by the Owner.
 - c. Shop inspection tasks required by AISC 360 to be performed by the fabricator's quality control personnel, shall be overseen by the independent inspector hired by the fabricator.
 - d. At completion of fabrication, and prior to erecting steel, submit a certificate of compliance signed and sealed by the third party inspector, stating that the steel fabrication complies with the requirements of the construction documents.
 - e. Shop drawings shall be signed and sealed by a professional engineer, registered in the local jurisdiction, responsible for the design of the connections. The professional engineer shall carry a minimum of \$1,000,000.00 of professional liability insurance.
 - f. The steel fabricator shall provide field repair details, along with computations, for all required field modifications. The details and calculations shall be signed and sealed by the same professional engineer that certified the shop drawings.
- 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.
 2. Erector shall be an AISC Certified Building Steel Erector (CSE) and shall maintain the certification for the duration of the project. Erectors that are not AISC Certified shall meet the following additional requirements:
 - a. Provide an erection procedure safety document with cover letter, signed and sealed by a professional engineer registered in the State of Maryland, that states the document has been reviewed and is in conformance with erection procedures required by AISC.
- 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.

1.6 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.

1.7 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.

1.8 UNIT PRICES

- A. Provide unit prices for additions to and deductions from the contract.
- B. Unit prices shall include all labor and material required for the complete installation of structural steel work, including shop drawing preparation and revisions, ordering materials, engineering, fabrication, delivery, erection and painting.
- C. Provide unit prices for two (2) classifications of steel, which shall cover all categories of structural steel required for this project.
 - 1. Classification 1 – Main Steel Framing: This shall include columns, posts, hangers, beams, girders, trusses and connections. It shall also include base plates, bearing plates, stiffeners, angles, etc., which become part of the framing.
 - 2. Classification 2 – Light Steel Framing: This shall include sub-framing for various purposes, such as mechanical openings and framing of a similar nature that may be required for the construction of the project.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Steel 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. Rods: ASTM A 36/A 36M.
- E. Structural Bolts and Nuts: Carbon steel, ASTM A 307, Grade A.
- F. 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.
- G. 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.
- H. Anchor Rods: ASTM F 1554, Grade 36, plain, with matching ASTM A 563 nuts and ASTM F 436 washers.
- I. Load Indicator Washers: Provide washers complying with ASTM F 959 at all connections requiring pre-tensioned high-strength bolts.
- J. Welding Materials: AWS D1.1; type required for materials being welded.
- K. 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.
- L. Shop and Touch-Up Primer: Type specified in Section 09 91 20, complying with VOC limitations of authorities having jurisdiction.
- M. Touch-Up Primer for Galvanized Surfaces: Fabricator's standard, complying with VOC limitations of authorities having jurisdiction.

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. 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.
- B. 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.
- C. Provide a dry film thickness of not less than 1.5 mil.
- D. Galvanize structural steel members to comply with ASTM A 123/A 123M. Provide minimum 1.7 oz/sq ft. galvanized coating. Galvanize shelf angles, lintels and hung plates located in exterior walls. Galvanize all exterior steel.

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 05 12 00

SECTION 06 10 53 - MISCELLANEOUS ROUGH CARPENTRY**PART 1 - GENERAL****1.1 SUMMARY**

- A. Section Includes:
 - 1. Wood furring and grounds.
 - 2. Plywood backing panels.

1.2 DEFINITIONS

- A. Boards or Strips: Lumber of less than 2 inches nominal size in least dimension.
- B. Dimension Lumber: Lumber of 2 inches nominal or greater size but less than 5 inches nominal size in least dimension.

1.3 ACTION SUBMITTALS

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

1.4 INFORMATIONAL SUBMITTALS

- A. Evaluation Reports: For the following, from ICC-ES:
 - 1. Preservative-treated wood.
 - 2. Fire-retardant-treated wood.
 - 3. Power-driven fasteners.
 - 4. Post-installed anchors.
 - 5. Metal framing anchors.

1.5 QUALITY ASSURANCE

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

1.6 DELIVERY, STORAGE, AND HANDLING

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

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
 - 1. Factory mark each piece of lumber with grade stamp of grading agency.
 - 2. Dress lumber, S4S, unless otherwise indicated.
- B. Maximum Moisture Content of Lumber: 15 percent for 2-inch nominal thickness or less, 19 percent for more than 2-inch nominal thickness unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

- A. Preservative Treatment by Pressure Process: AWP A U1; Use Category UC2 for interior construction not in contact with ground.
 - 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.
- C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
- D. Application: Treat items indicated on Drawings, and the following:
 - 1. Wood blocking, furring, and similar concealed members in contact with masonry or concrete.

2.3 FIRE-RETARDANT-TREATED MATERIALS

- A. General: Where fire-retardant-treated materials are indicated, materials shall comply with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
- B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.
 - 1. Treatment shall not promote corrosion of metal fasteners.
 - 2. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D3201 at 92 percent relative humidity. Use where exterior type is not indicated.
 - 3. Design Value Adjustment Factors: Treated lumber shall be tested according to ASTM D5664, and design value adjustment factors shall be calculated according to ASTM D6841.
- C. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Kiln-dry plywood after treatment to a maximum moisture content of 15 percent.
- D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.
- E. For exposed items indicated to receive a stained or natural finish, chemical formulations shall not bleed through, contain colorants, or otherwise adversely affect finishes.
- F. Application: Treat items indicated on Drawings, and the following:

1. Concealed blocking.
2. Plywood backing panels.

2.4 MISCELLANEOUS LUMBER

- A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
1. Blocking.
 2. Nailers.
 3. Furring.
 4. Grounds.
- B. Dimension Lumber Items: Construction or No. 2 grade lumber of any of the following species:
1. Hem-fir (north); NLGA.
 2. Mixed southern pine or southern pine; SPIB.
 3. Spruce-pine-fir; NLGA.
 4. Hem-fir; WCLIB or WWP.
 5. Spruce-pine-fir (south); NeLMA, WCLIB, or WWP.
- C. Concealed Boards: 15 percent maximum moisture content of any of the following species and grades:
1. Mixed southern pine or southern pine, No. 2 grade; SPIB.
 2. Hem-fir or hem-fir (north), Construction or No. 2 Common grade; NLGA, WCLIB, or WWP.
 3. Spruce-pine-fir (south) or spruce-pine-fir, Construction or No. 2 Common grade; NeLMA, NLGA, WCLIB, or WWP.
 4. Northern species, No. 2 Common grade; NLGA.
- D. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.
- E. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.
- F. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.5 PLYWOOD BACKING PANELS

- A. Equipment Backing Panels: Plywood, DOC PS 1, Exposure 1, C-D Plugged, fire-retardant treated, in thickness indicated or, if not indicated, not less than 3/4-inch nominal thickness.

2.6 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
1. Where carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M or Type 304 stainless steel.
- B. Nails, Brads, and Staples: ASTM F1667.
- C. Screws for Fastening to Metal Framing: ASTM C1002 (non-loadbearing framing locations) or ASTM C954 (locations with 20 gage or heavier framing), length as recommended by screw manufacturer for material being fastened.
- D. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- E. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC58 or ICC-ES AC308 as appropriate for the substrate.

1. Material: Carbon-steel components, zinc plated to comply with ASTM B633, Class Fe/Zn 5.
2. Material: Stainless steel with bolts and nuts complying with ASTM F593 and ASTM F594, Alloy Group 1 or 2.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry accurately to other construction. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.
- B. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant-treated plywood backing panels with classification marking of testing agency exposed to view.
- C. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
 1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches o.c.
- D. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:
 1. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than 96 inches o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.
- E. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- F. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
 1. Use inorganic boron for items that are continuously protected from liquid water.
 2. Use copper naphthenate for items not continuously protected from liquid water.
- G. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.
- H. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.
 2. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.
 3. ICC-ES evaluation report for fastener.

3.2 INSTALLATION OF WOOD BLOCKING AND NAILER

- A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

- C. Provide permanent grounds of dressed, pressure-preservative-treated, key-beveled lumber not less than 1-1/2 inches wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

3.3 PROTECTION

- A. Protect miscellaneous rough carpentry from weather. If, despite protection, miscellaneous rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 06 10 53

SECTION 07 21 00 - THERMAL INSULATION**PART 1 - GENERAL****1.1 SUMMARY**

- A. Section Includes:
 - 1. Polyisocyanurate foam-plastic board insulation.

1.2 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Polyisocyanurate foam-plastic board insulation.

1.3 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each product, for tests performed by a qualified testing agency.
- B. Research Reports: For foam-plastic insulation, from ICC-ES.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.
- B. Protect foam-plastic board insulation as follows:
 - 1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
 - 2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site until just before installation time.
 - 3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 - PRODUCTS**2.1 POLYISOCYANURATE FOAM-PLASTIC BOARD INSULATION - FOUNDATIONS**

- A. Polyisocyanurate Board Insulation, Faced: ASTM C1289, Type 1, Class 1 & 2; closed cell polyisocyanurate foam core with durable facers on both sides.
 - 1. Application: Below grade foundation wall.
 - 2. Meets performance requirements per ASTM C578, Physical Properties Table 1 complying with Type IV.
 - 3. Free from CFCs, HCFCs, and HFCs.
 - 4. Solvent resistant: Yes
 - 5. Compressive strength: Minimum 25 PSI, tested to ASTM D1621.
 - 6. Moisture vapor transmission: Maximum 0.1 perm, tested to ASTM E96 desiccant method.
 - 7. Water absorption: Maximum 0.3 percent by volume, tested to ASTM C272.
 - 8. Service temperature: Minus 100 to plus 250 degrees F.
 - 9. Products: Subject to compliance with requirements, provide one of the following:
 - a. Atlas Roofing Corporation; EnergyShield XR polyiso continuous insulation.
 - b. Rmax, Inc.; RMAX Below Grade.
 - 10. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and applications.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.
- C. Install insulation with manufacturer's R-value label exposed after insulation is installed.
- D. Extend insulation to entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

END OF SECTION 07 21 00

SECTION 07 92 00 - JOINT SEALANTS**PART 1 - GENERAL****1.1 SUMMARY****A. Section Includes:**

1. Nonstaining silicone joint sealants.
2. Urethane joint sealants.
3. Mildew-resistant joint sealants.
4. Butyl joint sealants.
5. Latex joint sealants.
6. Semi-rigid joint fillers.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at project site.

1.3 ACTION SUBMITTALS

- A. Product Data: For each joint-sealant product; identify each product consistent with Types used within this Section.

1. Sealant Products:

- a. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.
- b. List of backing materials approved for use with the specific product.
- c. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
- d. Substrates the product should not be used on.
- e. Substrates for which laboratory adhesion and/or compatibility testing is required.
- f. Sample product warranty.
- g. Certification by manufacturer indicating that product complies with specification requirements.

2. Accessory Products: Submit manufacturer's technical data sheet for each product to be used, including physical characteristics, installation instructions, and recommended tools.

- B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

- C. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch- wide joints formed between two 6-inch- long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

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

1. Joint-sealant application, joint location, and designation; designations must be consistent with Types used within this Section.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.
4. Joint-sealant color.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified testing agency.

- B. Product Test Reports: For each kind of joint sealant, for tests performed by a qualified testing agency.

- C. Installation Plan: Submit at least four weeks prior to start of installation.

- D. Preinstallation Field Adhesion Test Plan: Submit at least two weeks prior to start of installation.
 - E. Field Quality Control Plan: Submit at least two weeks prior to start of installation.
 - F. Preconstruction Laboratory Test Schedule: Include the following information for each joint sealant and substrate material to be tested:
 - 1. Joint-sealant location and designation.
 - 2. Manufacturer and product name.
 - 3. Type of substrate material.
 - 4. Proposed test.
 - 5. Number of samples required.
 - G. Preconstruction Laboratory Test Reports: From sealant manufacturer, indicating the following:
 - 1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
 - 2. Interpretation of test results and written recommendations for primers and substrate preparation are needed for adhesion.
 - H. Preconstruction Field-Adhesion-Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on testing specified in "Preconstruction Testing" Article.
 - I. Field-Adhesion-Test Reports: For each sealant application tested.
 - J. Field Quality Control Log: Submit filled out log for each length or instance of sealant installed, within 10 days after completion of inspections/tests; include bagged test samples and photographic records, if any.
 - K. Sample Warranties: For special warranties.
- 1.5 CLOSEOUT SUBMITTALS
- A. Manufacturers' special warranties.
 - B. Installer's special warranties.
- 1.6 QUALITY ASSURANCE
- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three ten years documented experience.
 - 1. Manufacturer must designate a representative authorized to prepare a manufacturer's certificate, indicating compatibility of materials intended for each application.
 - B. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.
 - C. Product Testing: Test joint sealants using a qualified testing agency.
 - 1. Testing Agency Qualifications: Qualified according to ASTM C1021 to conduct the testing indicated.
 - D. Installation Plan: Include schedule of sealed joints, including the following.
 - 1. Installation Log Form: Include the following data fields, with known information filled out.
 - a. Substrates.
 - b. Sealant used.
 - c. Stated movement capability of sealant.
 - d. Confirmation that primer was used.
 - e. Size and actual backing material used.
 - f. Date of installation.
 - g. Name of installer.
 - h. Actual joint width; provide space to indicate maximum and minimum width.
 - i. Actual joint depth to face of backing material at centerline of joint.

- j. Air temperature.
 - E. Preinstallation Field Adhesion Test Plan: Include destructive field adhesion testing of one sample of each combination of sealant type and substrate, except interior acrylic latex sealants, and include the following for each tested sample.
 - 1. Identification of testing agency.
 - 2. Name(s) of sealant manufacturers' field representatives who will be observing
 - 3. Preinstallation Field Adhesion Test Log Form: Include the following data fields, with known information filled out.
 - a. Substrate; if more than one type of substrate is involved in a single joint, provide two entries on form, for testing each sealant substrate side separately.
 - b. Test date.
 - c. Sealant used.
 - d. Stated movement capability of sealant.
 - e. Test method used.
 - f. Date of installation of field sample to be tested.
 - g. Date of test.
 - h. Copy of test method documents.
 - i. Age of sealant upon date of testing.
 - j. Test results, modeled after the sample form in the test method document.
 - k. Indicate use of photographic record of test.
 - F. Field Quality Control Plan:
 - 1. Visual inspection of entire length of sealant joints.
 - 2. Non-destructive field adhesion testing of sealant joints, except interior acrylic latex sealants.
 - a. For each different sealant and substrate combination, allow for one test every 12 inches in the first 10 linear feet of joint and one test every 24 inches thereafter.
 - b. If any failures occur in the first 10 linear feet, continue testing at 12 inch intervals at no extra cost to Owner.
 - 3. Field testing agency's qualifications.
 - 4. Field Quality Control Log Form: Show same data fields as on Preinstallation Field Adhesion Test Log, with known information filled out and lines for multiple tests per sealant/substrate combinations; include visual inspection and specified field testing; allow for possibility that more tests than minimum specified may be necessary.
- 1.7 MOCKUPS
- A. Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section.
- 1.8 PRECONSTRUCTION TESTING
- A. Preconstruction Laboratory Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.
 - 1. Adhesion Testing: Use ASTM C794 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
 - 2. Compatibility Testing: Use ASTM C1087 to determine sealant compatibility when in contact with glazing and gasket materials.
 - 3. Stain Testing: Use ASTM C1248 to determine stain potential of sealant when in contact with masonry substrates.
 - 4. Submit manufacturer's recommended number of pieces of each type of material, including joint substrates, joint-sealant backings, and miscellaneous materials, but no less than 8 pieces.
 - 5. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.

6. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures, including use of specially formulated primers.
 7. Testing will not be required if joint-sealant manufacturers submit data that are based on previous testing, not older than 24 months, of sealant products for adhesion to, staining of, and compatibility with joint substrates and other materials matching those submitted.
- B. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates as follows:
1. Locate test joints where indicated on Project or, if not indicated, as directed by Architect.
 2. Conduct field tests for each kind of sealant and joint substrate.
 3. Notify Architect seven days in advance of dates and times when test joints will be erected.
 4. Arrange for tests to take place with joint-sealant manufacturer's technical representative present.
 5. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1.1 in ASTM C1193 or Method A, Tail Procedure, in ASTM C1521.
 - a. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
 6. Report whether sealant failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
 7. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

1.9 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.

1.10 WARRANTY

- A. General: Include coverage for installed sealants and accessories that fail to achieve watertight seal, exhibit loss of adhesion or cohesion, or do not cure.
- B. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
1. Warranty Period: Two years from date of Substantial Completion.
- C. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
1. Warranty Period:
 - a. Silicone Sealants: Twenty years from date of Substantial Completion for vertical applications.
 - b. Silicone sealants for horizontal applications and other sealant types: Five years from date of substantial Completion.

- D. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:
1. Movement of the structure caused by stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
 2. Disintegration of joint substrates from causes exceeding design specifications.
 3. Mechanical damage caused by individuals, tools, or other outside agents.
 4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain joint sealants from single manufacturer[**for each sealant type**].

2.2 JOINT SEALANTS, GENERAL

- A. Prohibit methylene chloride and perchloroethylene in sealants.
- B. Minimum movement joint width 1/4-inch; minimum non-moving joint 1/8-inch.
- C. Installer must use primer for exterior assembly applications, including interior face of exterior wall joints, regardless if the manufacturer may otherwise relieve the installer of primer use under conditions within acceptable parameters; installer will only be relieved of primer use when manufacturer documents the application to be non-compliant to tested assembly.
- D. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.
- E. Stain-Test-Response Characteristics: Where sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.
- F. Suitability for Contact with Food: Where sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.
- G. Colors of Exposed Joint Sealants: Custom color to be provided by Architect or as director to match adjacent materials.

2.3 JOINT SEALANT APPLICATIONS

- A. Scope:
1. 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. In sound-rated wall and ceiling assemblies, gaps at electrical outlets, wiring devices, piping, and other openings; between wall/ceiling and other construction; and other flanking sound paths.
 - 1) Exception: Such gaps and openings in gypsum board finished stud walls and suspended ceilings.
 - 2) Exception: Through-penetrations in sound-rated assemblies that are also fire-rated assemblies.
 - c. Other joints indicated below.
 2. Do not seal the following types of joints:
 - a. Joints indicated to be treated with manufactured expansion joint cover or some other type of sealing device.
 - b. Joints where sealant is specified to be provided by manufacturer of product to be sealed.

- c. Joints where installation of sealant is specified in another section.
 - d. Joints between suspended panel ceilings/grid and walls.
- B. Sound-Rated Assemblies: Walls and ceilings identified as "STC-rated", "sound-rated", or "acoustical".

2.4 NONSTAINING SILICONE JOINT SEALANTS

- A. Nonstaining Joint Sealants: No staining of substrates when tested according to ASTM C1248.
- B. Type A - Nonstaining Silicone Sealant: Nonstaining, single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. GE Construction Sealants; Momentive Performance Materials Inc.; Silpruf NB.
 - b. Pecora Corporation; Pecora 890NST.
 - c. Sika Corporation; Joint Sealants; Sikasil WS-295.
 - d. The Dow Chemical Company; DOWSIL 795.
 - e. Tremco Incorporated; Spectrem 1.
 - 2. Interior joints.
 - a. Control and expansion joints on exposed interior surfaces of exterior walls.
 - b. Perimeter joints of exterior openings where indicated.

2.5 URETHANE JOINT SEALANTS

- A. Type B - Hybrid Urethane Sealant: ASTM C920, Grade NS, Uses M and A; single component; not expected to withstand continuous water immersion or traffic.
 - 1. Movement Capability: Plus and minus 35 percent, minimum.
 - 2. Hardness Range: 20 to 40, Shore A, when tested in accordance with ASTM C661.
 - 3. Color: Match adjacent finished surfaces.
 - 4. Manufacturers:
 - a. Master Builder Solutions; MasterSeal NP 100.
 - b. Franklin International Inc; Titebond WeatherMaster ULTIMATE MP Sealant.
 - c. Sherwin-Williams Company; Stampede 100 Low-Modulus Hybrid Urethane Sealant.
 - d. Sherwin-Williams Company; Stampede 1H Hybrid Sealant.
 - e. Tremco Commercial Sealants and Waterproofing; Dymonic FC.
 - 5. Joint Locations: As indicated for Type A sealant; Contractor may use this type of sealant or Type A at their discretion - remain consistent throughout project.
- B. Type C - Non-Sag "Traffic-Grade" Polyurethane Sealant: Single or multicomponent, nonsag, plus 25 percent and minus 25 percent movement capability, traffic-use, urethane joint sealant; ASTM C920, Grade NS, explicitly approved by manufacturer for continuous water immersion and traffic without the necessity to recess sealant below traffic surface.
 - 1. Hardness Range: 40 to 50, Shore A, when tested in accordance with ASTM C661.
 - 2. Joint Locations: Interior joints in horizontal traffic surfaces.

2.6 MILDEW-RESISTANT JOINT SEALANTS

- A. Mildew-Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.
- B. Type E - Mildew Resistant Silicone Sealant: Silicone, Mildew Resistant, Acid Curing, S, NS, 25, NT: Mildew-resistant, single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT.
 - 1. Products: Subject to compliance with requirements, provide one of the following:

- a. GE Construction Sealants; Momentive Performance Materials Inc.; SCS1700 Sanitary.
 - b. Pecora Corporation; Pecora 860.
 - c. The Dow Chemical Company; DOW CORNING® 786 SILICONE SEALANT -.
 - d. Tremco Incorporated; Tremsil 200 Sanitary.
2. Joint Locations:
- a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
 - b. Tile control and expansion joints.
 - c. Other joints as indicated.

2.7 LATEX JOINT SEALANTS

- A. Type G - Acrylic Emulsion Latex: Acrylic latex or siliconized acrylic latex, ASTM C834, Type OP, Grade NF.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Master Builder Solutions; MasterSeal NP 520.
 - b. Bostik, Inc.; Chem-Calk 600.
 - c. Momentive Performance Materials; RCS 20 Siliconized Acrylic Sealant.
 - d. Pecora Corporation; AC-20.
 - e. Sherwin-Williams Company (The); S-W Sher-Max Ultra Acrylic Sealant.
 - f. Tremco Incorporated; Tremflex 834.
 2. Joint Locations: Interior joints in vertical surfaces and horizontal non-traffic surfaces.
 - a. Vertical joints on exposed surfaces of interior unit masonry or concrete walls and partitions.
 - b. Perimeter joints between interior wall surfaces and frames of interior doors, lites and elevator entrances.
 - c. Exposed joints in sound rated construction and exposed flanking sound paths, to be painted.

2.8 SEMI-RIGID JOINT FILLERS

- A. Type H - Semi-Rigid Self-Leveling Epoxy Joint Filler: Epoxy or epoxy/polyurethane copolymer; intended for filling cracks and control joints not subject to significant movement; rigid enough to support concrete edges under traffic.
1. Composition: Multi-component, 100 percent solids by weight.
 2. Durometer Hardness: Minimum of 85 for Type A or 35 for Type D, after seven days when tested in accordance with ASTM D2240.
 3. Color: Concrete gray.
 4. Joint Width, Minimum: 1/8 inch.
 5. Joint Width, Maximum: 1/4 inch.
 6. Joint Depth: Provide product suitable for joints from 1/8 inch to 2 inches in depth including space for backer rod.
 7. Manufacturers:
 - a. Master Builder Solutions; MasterSeal CR 190.
 - b. Dayton Superior Corporation; Pro-Poxy P606.
 - c. Euclid Chemical Company; EUCO 700.
 - d. Nox-Crete; DynaFlex 502.
 - e. W.R. Meadows, Inc; Rezi-Weld Flex.
- B. Type I - Semi-Rigid Self-Leveling Polyurea Joint Filler: Two-component, 100 percent solids; intended for filling cracks and control joints not subject to significant movement; rigid enough to support concrete edges under traffic.
1. Durometer Hardness, Type A: 75, minimum, after seven days when tested in accordance with ASTM D2240.
 2. Color: Concrete gray.

3. Joint Width, Minimum: 1/8 inch.
4. Joint Width, Maximum: 3/4 inch.
5. Joint Depth: Provide product suitable for joints from 1/8 inch to 1 inch in depth excluding space for backer rod.
6. Manufacturers:
 - a. Adhesives Technology Corporation; Crackbond JF-311.
 - b. ARDEX Engineered Cements; ARDEX ARDISEAL RAPID PLUS.
 - c. Master Builder Solutions; MasterSeal CR 100.
 - d. Euclid Chemical Company; EUCO QWIKjoint UVR.
 - e. Nox-Crete; DynaFlex JF-85.
 - f. SpecChem, LLC; Rapid Flex CJ.

2.9 JOINT-SEALANT BACKING

- A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C1330; Type C (closed-cell material with a surface skin), Type O (open-cell material), Type B (bicellular material with a surface skin). or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
 1. Open cell must remain dry at all times.
- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.10 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. Preinstallation Adhesion Testing: Install a sample for each test location indicated in the test plan.
 1. Test each sample as specified in PART 1 under QUALITY ASSURANCE article.
 2. Notify Architect of date and time that tests will be performed, at least 7 days in advance.
 3. Arrange for sealant manufacturer's technical representative to be present during tests.
 4. Record each test on Preinstallation Adhesion Test Log as indicated.

5. If any sample fails, review products and installation procedures, consult manufacturer, or take whatever other measures are necessary to ensure adhesion; re-test in a different location; if unable to obtain satisfactory adhesion, report to Architect.
6. After completion of tests, remove remaining sample material and prepare joint for new sealant installation.

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
 2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
 - a. Concrete.
 - b. Masonry.
 - c. Unglazed surfaces of ceramic tile.
 3. Remove laitance and form-release agents from concrete.
 4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
 - a. Metal.
 - b. Glass.
 - c. Porcelain enamel.
 - d. Glazed surfaces of ceramic tile.
- B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 1. Do not leave gaps between ends of sealant backings.
 2. Do not stretch, twist, puncture, or tear sealant backings.
 3. Remove absorbent sealant backings that have become wet before sealant application, and replace them with dry materials.
- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

- E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
 - 1. Place sealants so they directly contact and fully wet joint substrates.
 - 2. Completely fill recesses in each joint configuration.
 - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
 - 1. Remove excess sealant from surfaces adjacent to joints.
 - 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
 - 3. Provide concave joint profile per Figure 8A in ASTM C1193 unless otherwise indicated.

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:
 - 1. Extent of Testing: Test completed and cured sealant joints as follows:
 - a. Perform 10 tests for the first 1000 feet of joint length for each kind of sealant and joint substrate.
 - b. Perform one test for each 1000 feet of joint length thereafter or one test per each floor per elevation.
 - 2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C1193 or Method A, Tail Procedure, in ASTM C1521.
 - a. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
 - 3. Inspect tested joints and report on the following:
 - a. Whether sealants filled joint cavities and are free of voids.
 - b. Whether sealant dimensions and configurations comply with specified requirements.
 - c. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion complies with sealant manufacturer's field-adhesion hand-pull test criteria.
 - 4. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant material, sealant configuration, and sealant dimensions.
 - 5. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.
- C. Evaluation of Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.5 CLEANING

- A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.6 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

END OF SECTION 07 92 00

SECTION 08 36 13 - SECTIONAL DOORS**PART 1 - GENERAL****1.1 SECTION INCLUDES**

- A. Overhead insulated sectional doors; electrically operated.
- B. Operating hardware and supports.
- C. Electrical controls.

1.2 SUBMITTALS

- A. Shop Drawings: Indicate opening dimensions and required tolerances, connection details, anchorage spacing, hardware locations, and installation details.
- B. Product Data: Show component construction, anchorage method, and hardware.
- C. Operation Data: Include normal operation, troubleshooting, and adjusting.
- D. Maintenance Data: Include data for motor and transmission, shaft and gearing, lubrication frequency, spare part sources.
- E. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.3 QUALITY ASSURANCE

- A. Conform to applicable code for motor and motor control requirements.
- B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified.

PART 2 - PRODUCTS**2.1 PERFORMANCE REQUIREMENTS**

- A. International Energy Conservation Code (IECC) Requirements:
 - 1. Air Infiltration: Maximum 0.08 cfm at 15 mph; 0.08 cfm at 25 mph.
 - 2. Thermal Values: R-value of 23 or better.

2.2 STEEL DOOR COMPONENTS

- A. Steel Doors: Flush steel, insulated; standard lift and vertical lift operating styles (refer to Drawings) with track and hardware; complying with ANSI/DASMA 102, Commercial application.
 - 1. Performance: Withstand positive and negative wind loads equal to 1.5 times design wind loads specified by local code without damage or permanent set, when tested in accordance with ASTM E 330, using 10 second duration of maximum load.
 - 2. Door Nominal Thickness: 3 inches thick.
- B. Manufacturer:
 - 1. Overhead Door Corporation; 850 Series Thermacore Insulated Steel Doors. (Basis-of-Design)
 - 2. Wayne Dalton; Thermospan.
 - 3. Raynor; ThermaSeal.
- C. Door Panels: Metal/foam/metal sandwich panel construction, with 1-3/4 inch wide PVC thermal break and patents pending weather-tight Dual Barrier tongue-in-groove meeting joints.
 - 1. Panel Thickness: 3 inches.
 - 2. Exterior Surface: Microgroove, textured.

3. Exterior Steel: Minimum 0.015 inch, hot-dipped galvanized.
4. End Stiles: Minimum 16 gauge single end stiles provided on doors up to and including 16 feet 2 inches wide; 16 gauge double end stiles provided on doors greater than 16 feet 2 inches wide up to and including 26 feet 2 inches; 14 gauge double end stiles provided on doors greater than 26 feet 2 inches wide. Provide with thermal break to prevent heat/cold transfer.
5. Finish: Factory applied liquid or powder coat providing 10-year warranty against cracking and peeling.
6. Insulation: CFC-free and HCFC-free polyurethane, fully encapsulated.
7. Glazing: Framed 1/2-inch insulating units.

2.3 DOOR COMPONENTS

- A. Track: Rolled galvanized steel, 0.090 inch thick; 2 inch wide, continuous one piece per side; galvanized steel mounting brackets 1/4 inch thick.
 1. Galvanized-steel track reinforcement and support members, complying with ASTM A 36 and ASTM A 123. Secure, reinforce, and support tracks as required for door size and weight to provide strength and rigidity without sag, sway, and vibration during opening and closing of doors.
 2. Track Configurations: Standard and Vertical-lift; refer to Drawings.
- B. Hinge and Roller Assemblies: Heavy duty hinges and adjustable roller holders of galvanized steel; floating hardened steel bearing rollers, located at top and bottom of each panel, each side.
- C. Lift Mechanism: Torsion spring on cross head shaft, with braided galvanized steel lifting cables.
 1. High cycle spring: 25,000 cycles.
- D. Jamb Weatherstripping: Roll formed steel section full height of jamb, fitted with resilient weatherstripping.
- E. Head Weatherstripping: EPDM rubber seal, one piece full length.
- F. Panel Joint Weatherstripping: Dual PVC thermal break and joint seal, one piece full length.
- G. Lock: Interior mounted slide lock with interlock switch for automatic operator..
- H. Lock Cylinders: See Section 08 71 00.

2.4 MATERIALS

- A. Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A 653/A 653M, with G60/Z180 coating, plain surface.
- B. Insulation: Rigid, foamed-in-place, polyurethane core free of CFCs and fully encapsulated.

2.5 ELECTRICAL OPERATION

- A. Electrical Characteristics:
 1. 1 hp; manually operable in case of power failure, transit speed of 12 inches per second.
- B. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70.
- C. Disconnect Switch: Factory mount disconnect switch in control panel.
- D. Electric Operator: Side mounted on cross head shaft, adjustable safety friction clutch; brake system actuated by independent voltage solenoid controlled by motor starter; enclosed gear driven limit switch; enclosed magnetic cross line reversing starter; mounting brackets and hardware.
- E. Safety Edge: At bottom of door panel, full width; electro-mechanical sensitized type, wired to stop door upon striking object; hollow neoprene covered to provide weatherstrip seal.

- F. Control Station: Standard three button (open-close-stop) momentary type control for each electric operator.
 - 1. 24 volt circuit.
 - 2. Surface mounted.
 - 3. Locate at inside door jamb.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that wall openings are ready to receive work and opening dimensions and tolerances are within specified limits.
- B. Verify that electric power is available and of the correct characteristics.

3.2 PREPARATION

- A. Prepare opening to permit correct installation of door unit to perimeter air and vapor barrier seal.
- B. Apply primer to wood frame.

3.3 INSTALLATION

- A. Install door unit assembly in accordance with manufacturer's instructions.
- B. Anchor assembly to wall construction and building framing without distortion or stress.
- C. Securely brace door tracks suspended from structure. Secure tracks to structural members only.
- D. Fit and align door assembly including hardware.
- E. Coordinate installation of electrical service. Complete power and control wiring from disconnect to unit components.

3.4 TOLERANCES

- A. Maximum Variation from Plumb: 1/16 inch.
- B. Maximum Variation from Level: 1/16 inch.
- C. Longitudinal or Diagonal Warp: Plus or minus 1/8 inch from 10 ft straight edge.
- D. Maintain dimensional tolerances and alignment with adjacent work.

3.5 ADJUSTING

- A. Adjust door assembly for smooth operation and full contact with weatherstripping.
- B. Have manufacturer's field representative present to confirm proper operation and identify adjustments to door assembly for specified operation.

3.6 CLEANING

- A. Clean doors and frames and glazing.
- B. Remove temporary labels and visible markings.

3.7 PROTECTION

- A. Protect installed products from damage during subsequent construction.
- B. Do not permit construction traffic through overhead door openings after adjustment and cleaning.

3.8 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain sectional doors.

END OF SECTION 08 36 13

SECTION 08 71 00 - DOOR HARDWARE**PART 1 - GENERAL****1.1 SUMMARY****A. Section Includes:**

1. Door hardware and related accessories.
2. Security system hardware items and coordination.

1.2 REFERENCE STANDARDS**A. The publications listed below, including the amendments, addenda and designated changes, form a part of this specification to the extent referenced.**

1. American National Standards Institute (ANSI):
 - a. A156.6, Architectural Door Trim.
 - b. A156.18, Materials and Finishes.
2. Americans with Disabilities Act (ADA): Standards for Accessible Design.
3. Door and Hardware Institute (DHI):
 - a. Abbreviations and Symbols.
 - b. Keying Systems and Terminology.
 - c. Recommended Locations for Builder's Hardware for Custom Steel Doors and Frames.
4. Electrical Code: 2023 National Electrical Code with Local Amendments.
5. Federal Specifications (FS): FF-H-111C-74 Hardware, Builders Shelf and Miscellaneous.
6. International Code Council: International Building Code (IBC).
7. National Fire Protection Association (NFPA):
 - a. Standard 80, Fire Doors and Windows.
 - b. Standard 105, Standard for Smoke Door Assemblies and Other Opening Protectives.
 - c. Standard 252, Standard Methods of Fire Tests of Door Assemblies.
8. Underwriters Laboratories, Inc. (UL):
 - a. UL-BMD, Building Materials Directory.
 - b. UL 294, Standard for Safety Access Control System Units.

1.3 ACTION SUBMITTALS**A. Supplier's Hardware Schedule: Submit a door hardware schedule in the manner and format prescribed and used herein, complying with the actual construction progress. Hardware schedules are intended for coordination of the work. Review and acceptance by the Architect or Owner do not relieve the Contractor of his exclusive responsibility to fulfill the requirements as shown and specified.**

1. Hardware Schedule Content: Based on hardware indicated, organize hardware schedule into Sets or sets showing complete designations of every item required for each door opening. Schedule shall be vertical layout similar to the format used herein. Lines shall be double spaced with pages numbered and dated.
 - a. For doors of different sizes or where hinges, locks or closers are different, a separate heading shall be used. No labeled openings shall be combined with non-labeled openings. Horizontal hardware schedules are not acceptable. Include the following:
 - 1) Number, location, hand, fire rating, size and material of each door opening (hands and swings to be determined in relation to key side of opening).
 - 2) Type, style, function, size, finish and quantity of each hardware item.

- 3) Name and manufacturer of each item.
 - 4) Fastening requirements.
 - 5) Explanation of abbreviations used (use nomenclature consistent with DHI's "Abbreviations and Symbols" wherever possible).
 - 6) Special mounting locations and instructions.
 - b. Combined submittals are not acceptable. Do not combine hardware schedules with door and frame shop drawings.
 2. Hardware Schedule Index: Furnish an index cross referencing Contract Document door number and Hardware Set, and supplier's hardware set.
 3. Schedules not adhering to these parameters will not be reviewed.
- B. Product Data:
1. Submit copies of manufacturers' specifications, maintenance and keying manuals, and installation instructions for each item of door hardware.
 2. Include photographs, catalog cuts, marked templates and other data as may be required to show compliance with these Specifications.
- C. Samples:
1. Submit full size hardware samples as requested by the Architect.
 2. Items shall remain on file in the Architect's office until all other similar items have been installed in the project. At that time, items on file will become Owner Maintenance Stock.
- 1.4 INFORMATIONAL SUBMITTALS
- A. Qualification Data: Submit Hardware Suppliers', Architectural Hardware Consultant's and Hardware Installers' qualifications verifying years of experience and hardware manufacturers' certifications; include list of completed projects having similar scope of work identified by name, location, date, reference names and phone numbers.
1. Furnish written proof of certification of all qualified installers and/or hardware installation firms/subcontractors responsible for installation of hardware specified.
 2. Certifications of installers must be submitted for approval prior to the start of installation.
- B. Templates: Provide necessary templates and/or physical hardware to all trades or factories requiring them so they may cut, reinforce or otherwise prepare their material or product to receive the hardware item. If any manufacturer requires physical hardware, ship to them such hardware via prepaid freight in sufficient time to prevent any delay in the execution of their work.
- C. Keying Schedule: Detailed keying system schedule, indicating Owner's approved keying system, for Owner's review and approval. Include the following:
1. Schematic keying diagram
 2. Index identifying each key set to unique door designations.
 3. Bitting list.
- D. Wiring Diagrams: After Hardware Schedule has received Architect's approval; submit the following:
1. Diagrammatic details of electrified door hardware. Include fire alarm and/or access control system interface where applicable.
 2. Diagrams shall be complete by opening and shall indicate connections between all components affected. Manufacturers' standard line diagrams are not acceptable. Include the following:
 - a. System schematic.
 - b. Point-to-point wiring diagram.
 - c. Riser diagram.
 - d. Elevation of each door.
 3. Operation Narrative: Describe the operation of doors controlled by electrified door hardware.

1.5 CLOSEOUT SUBMITTALS

- A. Operating Instructions and Maintenance Data: Furnish one Compact Disk containing the Operation and Maintenance information. Coordinate delivery with the post-installation job site meeting. The disk shall be clearly labeled with the project name on the front. Include the following in clearly identified individual PDF files:
1. Maintenance instructions for each item of hardware supplied.
 2. Copy of the final Door Hardware Schedules for all doors.
 3. Current catalogs for each Hardware Manufacturer provided.
 4. Names and phone numbers of the factory representatives for each item supplied.
 5. Copy of the final Keying Schedule.
 6. Copy of the final Wiring Diagrams.
- B. Maintenance Tools: Furnish a complete set of specialized tools as needed for the Government's continued adjustment, maintenance, removal and replacement of door hardware.
- C. Warranty: Special warranties specified in this Section.

1.6 QUALITY ASSURANCE

- A. Contractor: Assign all door hardware installation activities to a qualified and experienced hardware Installer; who meets the following criteria:
1. An experienced Installer who has completed door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
 2. Factory-certified training in the installation of locksets, exit devices, and door closers.
 3. At least one certified Installer must be on site during installation for the purpose of guidance and inspection of all hardware installation, to ensure compliance to manufacturers' recommended installation procedures and bid specifications.
 4. Installer shall arrange through Contractor to set up and attend pre-installation conference prior to installing door hardware. This conference shall cover mechanical and electrical hardware components including all locksets, door closers, and exit hardware.
 5. All hardware shall be installed with factory provided fasteners using factory provided installation instructions & templates.
- B. Supplier Qualifications:
1. A recognized Architectural Door Hardware Supplier, with warehousing facilities in Project's vicinity, who has been furnishing hardware in the Project's vicinity for a period of not less than five years.
 - a. Electrified Door Hardware Experience: Hardware Supplier must have completed projects with electrified door hardware 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, and who is acceptable to manufacturer of primary materials.
 2. Supplier must employ an Architectural Hardware Consultant who shall be available during the course of the Work to consult with Contractor, Architect, and Owner about finish hardware.
 3. Scheduling Responsibility: Preparation of door hardware and keying schedules.
- C. Architectural Hardware Consultant Qualifications:
1. A person who is currently certified by the Door and Hardware Institute as an Architectural Hardware Consultant and who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project.
 - a. Consultant must be knowledgeable in electrified components and systems and be able to produce wiring diagrams for review and consultation as needed.

- b. Contractor's Architectural Hardware Consultant shall certify that all submitted hardware is fully compatible.
- D. Source Limitations: Obtain each type and variety of door hardware from a single manufacturer, unless otherwise indicated.
 - 1. Provide electrified door hardware from same manufacturer as mechanical finish hardware, unless otherwise indicated. Manufacturers that are listed to perform electrical modifications, by a testing and inspecting agency acceptable to authorities having jurisdiction, are acceptable.
- E. Accessibility for Disabled Persons: Special hardware requirements for knurling, slow acting closers or other barrier free opening requirements shall be provided as indicated in the Door Hardware Sets and as required to comply with the U.S. Department of Justice's "ADA Standards for Accessible Design".
- F. Hardware for Fire Doors and Exit Doors: Hardware for fire doors shall conform to NFPA 80; hardware for exit doors shall conform to all applicable provisions of IBC. Other requirements specified shall also apply. Such hardware shall comply with the applicable UL standards for the intended use specified and be listed in UL BMD, or be labeled and listed by another testing laboratory deemed acceptable by the Authorities Having Jurisdiction (AHJ).
 - 1. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252.
 - a. Test Pressure: After five minutes into the test, neutral pressure level in furnace shall be established at 40" or less above the sill.
- G. Electrified Door Hardware: Listed and labeled as defined in the 2023 National Electrical Code, by a testing agency acceptable to AHJ, and marked for intended use.
- H. Keying Conference: Conduct conference at Project site. In addition to Owner, Contractor, and Hardware Supplier's Architectural Hardware Consultant, conference participants shall also include Hardware Installer.
 - 1. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including, but not limited to, the following:
 - a. Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
 - b. Preliminary key system schematic diagram.
 - c. Requirements for key control system.
 - d. Address for delivery of permanent keys and cores.
- I. Pre-Installation Conference: Conduct conference at Project site. Review methods and procedures related to electrified door hardware including, but not limited to, the following:
 - 1. Inspect and discuss electrical roughing-in and other preparatory work performed by other trades.
 - 2. Review sequence of operation for each type of electrified door hardware.
 - 3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 4. Review required testing, inspecting, and certifying procedures.
- J. Installation Inspections: Periodic inspections of door hardware installations will be conducted by the Owner on a continuing on-site basis throughout the time periods of installation.
 - 1. The Owner will provide feedback information relative to the acceptance or rejection of particular installations to all responsible parties.
- K. Reference Standards: Except as otherwise required by governing authorities or Contract Documents, comply with applicable provisions of Door and Hardware Institute.

1.7 PRODUCT DELIVERY

- A. Deliver door hardware to the Contractor. Direct factory shipments (drop shipments) to the job site are not acceptable.
 - 1. Deliver items of hardware at the proper times to the proper locations (shop or project site) in their original individual containers, complete with necessary appurtenances including screws, keys, manufacturers' printed instructions, and where necessary, installation templates for manufacturer's suggested installation. Mark each individual container with the manufacturer's name and catalog number as they appear in the hardware schedule.
- B. Representatives of the Contractor and the Hardware Supplier shall jointly inventory the door hardware. Replace items damaged in shipment promptly and with proper material without additional cost to the Contractor. Handle all hardware in a manner to eliminate marring, scratching or damage.
- C. Keys and Cores:
 - 1. Supply construction master keys and cores to Contractor when cylinders are delivered, for use during construction.
 - 2. Permanent Keys and Cores:
 - a. Prior to the scheduled completion of the project, manufacturer shall ship all permanent keys and cores, including permanent control keys, directly to Easter's Lock & Security Solutions via Registered Mail, Return Receipt Requested or other pre-approved means. Under no circumstance shall any permanent keys or cores be furnished direct to the Contractor.
 - b. Failure to properly comply with these requirements shall be cause for replacement of cylinder cores and keys involved at no additional cost to Owner.
- D. Key Cabinet: Deliver key cabinet to the Owner prior to building occupancy.

1.8 ELECTRICALLY OPERATED HARDWARE

- A. General Requirements:
 - 1. Furnish and install electrified locking hardware, power transfers, magnetic door contacts, etc., as required for the system to perform the functions as defined herein.
 - 2. Wherever "fail safe" electric locking hardware is specified, hardware devices shall be connected to building fire and smoke/heat alarm systems. Activation of alarm system shall disengage electric locking mechanism allowing free, unrestricted use of the opening.
 - 3. Coordinate installation of electrically operated hardware to ensure proper size wire is used to power load(s).
 - a. Voltage drop shall not exceed 5% of load's stated voltage.
 - b. Voltage drop shall be calculated by first determining resistance of load ($R=E/I$ voltage divided by AMP draw). Next, determine resistance of wire (per below chart). Divide this number by resistance of load. If result exceeds 5%, wire thickness shall be increased.
 - c. Wire length shall equal distance to load and back to supply (Lock 50 ft. from power supply; wire length = 100 ft.). Two loads powered by one pair of wires draw double current and have half (50%) of resistance.
 - d. Wire Size Resistance per 1000 feet
 - e.
 - f. 12 Gauge 1.6 OHM
 - g. 14 Gauge 2.5 OHM
 - h. 16 Gauge 4.1 OHM
 - i. 18 Gauge 6.4 OHM
 - j. 20 Gauge 10.1 OHM
 - k. 22 Gauge 16.0 OHM
- B. Provide a single point of interconnection at the hinge or power transfer.

- C. Provide a wiring interface for the project's Security System Integrator to make connections to the control systems. The wiring interface shall be a Molex-Type connector. The mating connector to which the Security system conductors are connected shall be furnished as part of the connector assembly and shall be furnished with conductor "pigtail" having a minimum length of six inches.
- D. Where required, furnish door hardware power supplies as required to power the specific equipment.
- E. Provide solenoids for direct current (DC) application with diodes for transient protection.
- F. Provide boxes or pockets in the door frame as required to accommodate magnetic door contacts, locks, power transfers, etc.; coordinate with door and frame manufacturers.
- G. Provide interconnecting conduit in the door frame between all switches, monitoring devices, and electrified hardware.

1.9 WARRANTIES

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of finish hardware that fails in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including excessive deflection, cracking, or breakage.
 - b. Faulty operation of operators and finish hardware.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.
 - 2. Minimum Warranty Periods:
 - a. Hinges: Life of the installation.
 - b. Manual Closers: Ten years from date of Substantial Completion.
 - c. Continuous Hinges: Ten years from date of Substantial Completion.
 - d. Exit Devices and Locksets:
 - 1) Mechanical: Five years from date of Substantial Completion
 - 2) Electrified: Two years from date of Substantial Completion.
 - e. All other hardware items: Two years from date of Substantial Completion.

1.10 EXTRA MATERIALS

- A. Furnish three dozen extra screws and other fasteners of each size, type and finish used. Deliver extra screws and fasteners to the Hardware Installer for use during installation. All unused screws and fasteners, and all special installation tools furnished with the hardware, shall be turned over to the Owner at the completion of the job.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Template Hardware: Hardware to be applied to metal or pre-finished doors and frames shall be made to template. Coordinate hardware locations to prevent interference with other hardware items.
- B. Identification: All hardware items shall be clearly and permanently marked by the manufacturer where it will be visible after installation.

2.2 HARDWARE ITEMS - BALTIMORE COUNTY STANDARDS

- A. Lock systems:
 - 1. For aluminum storefront doors, provide Adams Rite 4530-series deadlatches, MS1850-series deadlocks, and 4591 deadlatch paddles.

2. All lock hardware to be "Marks USA". Cores to be Medeco 6 Pin X4 BCP key way, keys cut on custom coined F3F2 key blanks. Cylindrical locks to be survivor series 175 grade 2.
 3. Mortice locks, Series 5 Classic/American Lever.
- B. Exit Devices: Provide Arrow M9900 Series Lever Rose Trim. Concealed vertical rod exit devices and floor mounted or concealed closers of any kind are not permitted.
- C. Closers: Provide Corbin Russwin DC6210-M54 Multi-Sized door closers.
1. Provide motorized closers and electrical control system where required for ADA-compliant door operation. Provide automatic swing door operator, Besam PowerSwing or equal by Dor-O-Matic, Horton Automatics, or Stanley Works. Operator to be controlled by push plates, one at interior and one at exterior of each set of doors and by microwave motion sensors, threshold area presence sensor, and safety presence sensor. Provide operator with built-in emergency release. Doors shall be provided with "break-out" capacity to allow for emergency egress. Door shall not close until motion and safety sensors detect a clear field. Operator to allow swing door to function in manual mode. Provide shop drawings, product data, and finish samples. Install per manufacturer's installation instructions and in accordance with ADAAG.
- D. Stops: Provide Don-Jo models 1407, 1413, 1440, or 1442.
- E. Flush Bolts: Provide Don-Jo model 1555 or 1557.
- F. Hinges: Provide hinges by Stanley.
- G. Push and Pull Plates: Provide Don-Jo model 71 and model 7010.
- H. Protection plates: Provide products by Don-Jo, as appropriate for door size, use, and per project requirements.

2.3 HARDWARE FINISHES

- A. Base metals: Produce hardware units of basic metal and forming method indicated, using manufacturers standard metal alloy composition, temper and hardness, but in no case of lesser quality than specified or inferred by use of a particular manufacturer's number, style or grade or as established by appropriate referenced specification listed herein.
- B. Finishes: Finishes shall conform to the quality of finish including thickness of plating or coating (if any), composition, hardness and other qualities complying with manufacturer's standards, but in no case less than the standards established by ANSI/BHMA A156.18 or Federal Specifications FF-H-111C as applicable.
1. All exposed hardware except surface closers, butt hinges and continuous hinges shall be satin stainless steel, ANSI/BHMA 630/US32D.
 - a. Factory-finish surface closers to match satin stainless steel.
 - b. Butt hinges at exterior doors and doors in wet areas shall be satin stainless steel; butt hinges at all other doors shall be satin chrome plated, ANSI/BHMA 652/US26D.
 - c. At aluminum storefront doors, continuous hinges shall be factory-finished to match storefront, coordinate with specification Division 08 Section "Aluminum-Framed Entrances" for color; continuous hinges at all other doors shall be factory-finished to match satin stainless steel.
 - d. Items of hardware not available in stainless steel shall be furnished with a stain chrome plated finish, ANSI/BHMA 626/US26D.
 2. Where painting of primed surfaces is required, refer to Division 09 specifications.

2.4 KEYING

- A. Key System: Provide the type of system required (e.g., master, grand master, great grand master); nomenclature and layout to be consistent with DHI "Keying Systems and Terminology".
1. Keying is the responsibility of the Contractor; and shall be performed by the cylinder supplier.

2. Key System Summary, Cover Sheet, and Letter of Authorization shall accompany Keying Schedule and Purchase Order sent to Factory.
- B. Keys: Provide keys of nickel silver only in the following quantities:
 1. Grand Master Keys: nine.
 2. Master Keys: Five per system.
 3. Change Keys: Four per cylinder core.
 4. Construction Master Keys: Twelve.
 5. Control keys (for removal of cores): Two permanent and three temporary/construction.
- C. Identification: Stamp permanent keys and cores with the applicable key mark for identification. These visual key control marks or codes shall not include the actual key cuts. Stamp change keys with the key change number; stamp all master keys and grand master keys "DO NOT DUPLICATE".

2.5 FASTENERS

- A. Manufacture hardware to conform to published templates, generally prepared for machine screw installation. Do not provide hardware that has been prepared for self-tapping or sheet metal screws except as specifically indicated.
 1. All hardware shall be installed using screws and attachments furnished with the hardware; no other screws or attachments and acceptable. Provide Phillips flat head or oval head screws except as otherwise indicated. Finish exposed (exposed under any condition) screws to match the hardware finish or, if exposed in surfaces of other work, to match the finish of such work as closely as possible, except as otherwise indicated.
 - a. Where wood screws are required, they shall be full thread (to the head) type. Combination wood/machine screws, in lieu of wood screws, are not acceptable.
 - b. Provide self-tapping fasteners for weather-stripping and seals applied to hollow metal frames.
 2. Provide concealed fasteners for hardware units which are exposed when the door is closed, except to the extent no standard manufactured units of the type specified are available with concealed fasteners.
 - a. Closers and exit devices shall be furnished with sex nut and shoulder bolt fasteners.
 3. Furnish fasteners which are compatible with both the unit fastened and the substrate, and which will not cause corrosion or deterioration of hardware, base material reinforcement or fastener. Furnish wall stops with "Toggler" anchors and wood screws. Furnish thresholds and floor stops with lead anchors and 1/4-20 stainless steel machine screws.

PART 3 - EXECUTION

3.1 STORAGE AND HANDLING

- A. Representatives of the Contractor and the Hardware Supplier shall jointly inventory the door hardware. Replace items damaged in shipment promptly and with proper material without additional cost to the Contractor. Handle all hardware in a manner to eliminate marring, scratching or damage.
 1. A dry, locked storage space complete with adequate shelving shall be set aside for the purpose of unpacking, sorting out, checking and storage. Control the handling and installation of hardware items, whether immediately replaceable or not, so completion of the work will not be delayed by losses before or after installation.
 2. Tag each item or package separately, with identification related to the final approved hardware schedule, and include basic installation instructions in the package. Furnish hardware items of proper design for use on doors and frames of thickness, profile, swing, security and similar requirements indicated as necessary for proper installation and function.

3.2 COORDINATION

- A. Coordinate Door Hardware Schedule submission and hardware ordering to ensure delivery of all items as directed by the Contractor.
 - 1. Prior to ordering any hardware, examine the shop drawings and details of doors and frames and other substrate suppliers to determine that the proper type and size pieces of hardware are being furnished. No extra for material or labor will be allowed for any corrections that should have been eliminated by proper prior coordination.
- B. Templates: Distribute door hardware templates for doors, frames, and other work specified to be factory prepared for installing door hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.
- C. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies, fire alarm system and detection devices, and access control system.
 - 1. Coordinate installation of the electronic security hardware with the Architect and Electrical Engineers and provide installation and technical data to the Installer and other related sub-contractors.

3.3 INSTALLATION

- A. Install each hardware item in accordance with final approved Hardware Schedule and manufacturer's instructions.
 - 1. Set hardware level, plumb and true to line and location.
 - 2. Adjust and reinforce attachment substrate as required for proper installation and operation of hardware.
 - 3. Drill and countersink units which are not factory-prepared for anchorage fasteners; space fasteners and anchors uniformly, in accordance with industry standards.
- B. Hardware Mounting Heights:
 - 1. Provide heights as indicated on Drawings, except as otherwise required for compliance with governing regulations.
 - 2. Where heights are not indicated, comply with mounting requirements of DHI "Recommended Locations for Builder's Hardware" on custom steel doors and frames.
- C. Fire Doors and Exit Doors:
 - 1. Hardware for labeled fire doors shall be installed in accordance with the requirements of NFPA 80.
 - 2. Hardware for listed exit doors shall be installed in accordance with the requirements of IBC, Chapter 10.
- D. Hinges:
 - 1. Install steel doors and wood doors to comply with reference standards, as specified in door sections.
 - 2. Where shimming is required to comply with tolerances, provide metal shims only.
- E. Electrified Hardware:
 - 1. Pre-wire and make field connections between all electrically operated and monitored hardware items including, but not limited to, locks, exit devices, power transfers and magnetic door contacts.
 - 2. All wiring must be 18-gauge or thicker.
- F. Closers:
 - 1. Do not install parallel arm closers until after weather-stripping or seals have been installed on head frame (where weather-stripping or seals are scheduled).
 - 2. Do not cut weather-stripping or seals for attachment of closer brackets or shoes.

3. Adjust closers to control door swing and to provide positive latching of doors.
 - a. Adjust closers not to exceed following manual opening forces:
 - 1) Exterior doors: As required to close and latch each leaf.
 - 2) Interior doors (non-fire-rated): Maximum 5-pound opening force.
 - 3) Fire-rated doors: As required to close and latch each leaf.
 - b. After air-handling system has been balanced, make final adjustment of all closers.
- G. Door Stops:
 1. Install stops for maximum degree of door opening swing allowed by conditions of installation.
 2. Locate floor stops so as not to create a tripping hazard.
 3. Locate wall stops centered on spindle of lever handles.
- H. Weather-stripping and Seals:
 1. Install continuous around door heads and jambs, and meeting stiles of pairs of doors.
 2. Install bottom weather-stripping and automatic door bottoms for full width of door.
 3. Do not cut weather-stripping or seals for attachment of closer brackets or shoes.
 4. Installation of Adhesive Gasketing and Seals: The following installation instructions must be strictly adhered to. Failure to comply can result in premature product failure. Contractor will be required to remove failed product entirely and properly install new materials.
 - a. Before installation, thoroughly clean the frame with the manufacturer-enclosed cleansing towelette to remove grease, dust or cleanser build-up. Before installation, wait for frame surface to completely dry (evaporate). As an alternative or substitute cleanser, use isopropyl (rubbing) alcohol. Mineral spirits or other petroleum-based cleaning products should NOT be used.
 - b. Application Temperature: Do not install if frames are below 50°F or above 100°F.
 - c. When to Install:
 - 1) Installation should take place after construction is completed, flooring is installed and final cleaning is completed.
 - 2) Paint on frame must be cured for at least 5-7 days. Paint cannot be wet under dry surface when gaskets are pressed on. Avoid quick-dry primers, which leave a powdery surface preventing sufficient adhesion.
 - 3) When applying to a wood frame, the surface must be non-porous and sealed. Follow standard industry guidelines on sealed wood frames and/or rough surface before applying.
 5. Weather-stripping, gasketing and seals must form an airtight barrier around the full perimeter of the door. There can be no gaps that allow air, light, sound, or smoke to pass through.
 - a. Contractor is responsible for adjusting the alignment of doors and seals until the above conditions are met. If gaps cannot be avoided because the door or frame is not properly sized, plumb, and level, the offending components must be replaced at contractor expense.
 6. Align rain drips with the bottom edge of the door frame rabbet.
 7. Set all rain drips and exterior thresholds in full bed of mastic sealant and attach with stainless steel fasteners.
- I. Fire Department Access Vault: Install in accordance with manufacturer's instructions in location as directed.
- J. Cylinder Cores:
 1. When notified by the Owner, remove construction cores.
 2. Upon removal of temporary cores, verify that all locking components (e.g. collars, tailpieces, etc.) are still intact.

3. It is the Contractor's responsibility to return the construction cores and keys to the manufacturer. Construction cores and keys remain the property of the Cylinder Manufacturer.
 4. Permanent cores will be installed by Easter's Lock & Security Solutions.
- K. Key Cabinet: Install in accordance with manufacturer's instructions in location as directed. Instruct the Owner in the use of the key control system.
1. Keys shall be tagged, neatly installed within the key cabinet.
 2. Submit documentation of keying compliance including copies of signed transmittals for all building keys and cabinet provided by the Hardware Supplier.
- 3.4 ADJUST AND CLEAN
- A. General: To ensure proper operation and function of every unit, adjust and check each operating item of hardware and each door. Lubricate moving parts with type lubrication recommended by the manufacturer (graphite-type if no other recommended). Replace unit that cannot be adjusted and lubricated to operate freely and smoothly as intended for the application made.
1. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain door hardware and door hardware finishes. Verify that the Owner has been supplied with manufacturers' installation and maintenance manuals, catalogs, and any special adjusting tools normally supplied by the manufacturer.
- B. Continuity Testing: Inspect all connections between electrically operated and monitored hardware items including, but not limited to, electrified locks and exit devices, power transfers and power supplies. Upon completion of inspection, furnish the Architect with itemized report indicating any problems found and steps taken to repair anomalies.
- C. Final Adjustment: Wherever hardware is installed more than one month prior to acceptance or occupancy of a space or area, return to the work during the week prior to acceptance or occupancy, and perform a final check and adjustment of all hardware items in such space or area. Clean and re-lubricate as necessary to restore proper function and finish of hardware and doors.
1. Prior to acceptance of any electrical hardware system, an operational test shall be performed to determine if devices are functioning as intended by the specifications. Wiring shall be tested for correct voltage, current-carrying capacity, and proper grounding. Stray voltages in lock wiring shall be eliminated to prevent locking devices from releasing in critical situations.
 2. Factory representatives shall inspect all exit devices and door closers prior to final acceptance to ensure proper installation and adjustment. A written report shall be filed with the Architect and Owner after inspection.
- D. Six-Month Adjustment: Approximately six months after date of Substantial Completion, Installer shall perform the following:
1. Examine and readjust each item of door hardware as necessary to ensure function of doors, door hardware, and electrified door hardware.
 2. Consult with and instruct Owner's maintenance personnel on recommended maintenance procedures.
 3. Replace door hardware items that have deteriorated or failed due to faulty design, materials, or installation of door hardware units.
 4. Prepare a written report of current and predictable problems (of substantial nature) in the performance of the hardware.
 5. Update Owner's Operations and Maintenance Manuals as needed and furnish any additional special tools needed for continued maintenance of the hardware.

END OF SECTION 08 71 00

SECTION 09 91 23 - INTERIOR PAINTING**PART 1 - GENERAL****1.1 SUMMARY**

- A. Section Includes:
 - 1. Primers.
 - 2. Water-based finish coatings.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
 - 1. Include preparation requirements and application instructions.
 - 2. Indicate VOC content.
- B. Samples for Initial Selection: For each type of topcoat product.
- C. Samples for Verification: For each type of paint system and each color and gloss of topcoat.
 - 1. Submit Samples on rigid backing, 8 inches square.
 - 2. Apply coats on Samples in steps to show each coat required for system.
 - 3. Label each coat of each Sample.
 - 4. Label each Sample for location and application area.
- D. Product Schedule: Use same designations indicated on Drawings and in the Interior Painting Schedule to cross-reference paint systems specified in this Section. Include color designations.

1.3 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Paint Products: 5 percent, but not less than 1 gal. of each material and color applied.

1.4 QUALITY ASSURANCE

- A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Architect will select one surface to represent surfaces and conditions for application of each paint system.
 - a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft..
 - b. Other Items: Architect will designate items or areas required.
 - 2. Final approval of color selections will be based on mockups.
 - a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
 - 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.6 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.
- B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures of less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 PAINT PRODUCTS, GENERAL

- A. Material Compatibility:
 1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
- B. Colors: As selected by Architect from manufacturer's full range.
 1. Twenty percent of surface area will be painted with deep tones.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 1. Masonry: 12 percent.
 2. Wood: 15 percent.
 3. Gypsum Board: 12 percent.
- C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.
- D. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.
- E. Proceed with coating application only after unsatisfactory conditions have been corrected.
 1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations applicable to substrates and paint systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
 - D. Preparation of Existing Finished Surfaces to be Refinished: Conform to the following unless the paint applicator can demonstrate that such paint does not contain lead:
 1. Provide local enclosure to limit area of dust scattering.
 2. Provide disposable floor and ground protection to catch dust and flakes.
 3. Conduct scratch tests to determine adhesion of existing finish. Scrape to remove loose paint.
 4. Scrub with detergent and warm, clean water to remove coatings and contaminants. Thoroughly rinse with clean, warm water before washed water dries.
 5. Sand edges of pealed areas to provide smooth transition.
 6. Sand entire area with fine sandpaper for adhesion.
 7. Conduct tests to determine compatibility of existing finish with specified new finish paint systems. Provide barrier coat if required.
 8. After preparation, HEPA vacuum all surfaces within enclosure or within the area.
 9. Wipe all horizontal surfaces.
 10. Remove temporary protection and coverings in a manner to enclose dust and debris within disposable covering and dispose of legally.
 - E. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.
 - F. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer, but not less than the following:
 1. SSPC-SP 3.
 - G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
 - H. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
 - I. Wood Substrates:
 1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
 2. Sand surfaces that will be exposed to view, and dust off.
 3. Prime edges, ends, faces, undersides, and backsides of wood.
 4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.
 - J. Cotton or Canvas Insulation Covering Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.
- 3.3 INSTALLATION
- A. Apply paints according to manufacturer's written instructions.
 1. Use applicators and techniques suited for paint and substrate indicated.
 2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
 3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
 4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

- B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- E. Painting Fire-Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
 - 1. Paint the following work where exposed in occupied spaces:
 - a. Equipment, including panelboards.
 - b. Uninsulated metal piping.
 - c. Uninsulated plastic piping.
 - d. Pipe hangers and supports.
 - e. Metal conduit.
 - f. Plastic conduit.
 - g. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
 - h. Other items as directed by Architect.
 - i. Refer to MEP for additional items.
 - 2. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

3.4 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
 - 1. Do not clean equipment with free-draining water and prevent solvents, thinners, cleaners, and other contaminants from entering into waterways, sanitary and storm drain systems, and ground.
 - 2. Dispose of contaminants in accordance with requirements of authorities having jurisdiction.
 - 3. Allow empty paint cans to dry before disposal.
 - 4. Collect waste paint by type and deliver to recycling or collection facility.
- 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.

3.5 INTERIOR PAINTING SCHEDULE

- A. Concrete Masonry Units:
 - 1. Semi-Gloss Sheen:
 - a. Benjamin Moore & Co.:
 - 1) Block Filler (Unpainted Surfaces) - 2 Coats: Ultra Spec Hi-Build Masonry Block Filler (571).
 - 2) First and Second Color Coats: Ultra Spec 500 Waterborne Interior Semi-Gloss N539.

- b. Behr Process Corporation:
 - 1) Block Filler (Unfinished Surfaces) - 2 Coats: Behr Pro Block Filler Primer, PR50
 - 2) First and Second Color Coats: Behr Pro i300 Interior Semi-Gloss Paint, PR370
 - c. PPG Architectural Coatings; PPG Paints:
 - 1) Block Filler (Unpainted Surfaces) - 2 Coats: Speedhide Latex Block Filler 6-15XI.
 - 2) First and Second Color Coats: Speedhide Zero Interior Semi-Gloss Latex Enamel, 6-4510XI Series.
 - d. Sherwin-Williams Company:
 - 1) Block Filler (Unpainted Surfaces) - 2 Coats: Conflex Block Filler CF1W50.
 - 2) First and Second Color Coats: ProMar 200 Zero VOC Interior Latex S/G, B31-2650 Series.
 - e. McCormick Paints:
 - 1) Block Filler (Unpainted Surfaces) - 2 Coats: McCormick Interior/Exterior Latex Block Filler 01015.
 - 2) First and Second Color Coats: McCormick Total Advantage Zero VOC Professional Coating Semi-Gloss 10 Series.
- B. Gypsum Board:
- 1. Flat Sheen:
 - a. Benjamin Moore & Co.:
 - 1) Primer (Unpainted Surfaces): Ultra Spec 500 Waterborne Zero VOC Primer Sealer N534.
 - 2) First and Second Coats: Ultra Spec 500 Waterborne Zero VOC Flat N536.
 - b. Behr Process Corporation:
 - 1) Primer (Unpainted Surfaces) Drywall Plus Interior Drywall Primer & Sealer, 73
 - 2) First and Second Coats: Behr Pro i300 Interior Flat Paint, 310
 - c. PPG Paints:
 - 1) Primer (Unpainted Surfaces): Speedhide Zero Int. Latex Quick Drying Primer/Sealer, 6-4900XI.
 - 2) First and Second Coats: Speedhide Zero Interior Flat Latex I, 6-4110XI Series.
 - d. Sherwin-Williams Company:
 - 1) Primer (Unpainted Surfaces): ProMar 200 Zero VOC Interior Latex Primer, B28W2600.
 - 2) First and Second Coats: ProMar 200 Zero VOC Interior Latex Flat, B30-2650 Series.
 - e. McCormick Paints:
 - 1) Primer (Unpainted Surfaces): McCormick 1st Step Interior Vinyl Primer Sealer 06431.
 - 2) First and Second Coats: McCormick Total Advantage Zero VOC Professional Coating Flat 08 Series.
 - 2. Low-Luster, Satin or Eggshell Sheen:
 - a. Benjamin Moore & Co.:

- 1) Primer (Unfinished Surfaces): Ultra Spec 500 Waterborne Interior Primer Sealer N534.
 - 2) First and Second Coats: Ultra Spec 500 Waterborne Zero VOC Eggshell Enamel N538.
 - b. Behr Process Corporation:
 - 1) Primer (Unpainted Surfaces) Drywall Plus Interior Drywall Primer & Sealer, 73
 - 2) First and Second Coats: Behr Pro i300 Interior Eggshell Paint, 330
 - c. PPG Paints:
 - 1) Primer (Unfinished Surfaces): Speedhide Zero Latex Quick Drying Primer/Sealer, 6-4900XI.
 - 2) First and Second Coats: Speedhide Zero Interior Eggshell Latex 6-4310XI Series.
 - d. Sherwin-Williams Company:
 - 1) Primer (Unfinished Surfaces): ProMar 200 Zero VOC Interior Latex Primer, B28W2600.
 - 2) First and Second Coats: ProMar 200 Zero VOC Interior Latex Eg-Shel, B20-2650 Series.
 - e. McCormick Paints:
 - 1) Primer (Unpainted Surfaces): McCormick 1st Step Interior Vinyl Primer Sealer 06431.
 - 2) First and Second Coats: McCormick Total Advantage Zero VOC Professional Coating Eggshell 09 Series.
- C. Woodwork and Hardboard - Painted:
 1. Semi-Gloss Sheen:
 - a. Benjamin Moore & Co.:
 - 1) Undercoat (Unfinished Surfaces): Fresh Start 100% Acrylic Superior Primer 023.
 - 2) First and Second Coats: Ultra Spec 500 Waterborne Interior Zero VOC Semi-Gloss 539.
 - b. Behr Process Corporation:
 - 1) Primer (Unpainted Surfaces): Drywall Plus Interior Drywall Primer & Sealer, 73
 - 2) First and Second Coats: Behr Pro i300 Interior Semi-Gloss Paint, 370
 - c. PPG Architectural Coatings; PPG Paints:
 - 1) Undercoat (Unfinished Surfaces): 17-921 Seal Grip Interior/Exterior Acrylic Universal Primer.
 - 2) First and Second Coats: Speedhide Zero Interior Semi-Gloss Latex Enamel, 6-4510XI Series.
 - d. Sherwin-Williams Company:
 - 1) Undercoat (Unfinished Surfaces): PrepRite ProBlock Latex Primer/Sealer B51W620.
 - 2) First and Second Coats: ProMar 200 Zero VOC Interior Latex S/G, B31-2600 Series; or Pro Industrial Acrylic Coating S/G B66-650.
 - e. McCormick Paints:
 - 1) Undercoat (Unpainted Surfaces): McCormick Unix Multi-Purpose Stain Blocking Interior/Exterior Primer 06460.

- 2) First and Second Coats: McCormick Total Advantage Zero VOC Professional Coating Semi-Gloss 10 Series.
- D. Mechanical and Electrical Items: Use 3-coat system best suited to substrate, satin finish. Use heat resistant materials where required.
- E. Ferrous Metal:
 1. Semi-Gloss Sheen:
 - a. Benjamin Moore & Co.:
 - 1) Primer (Unfinished Surfaces): Ultra Spec HP Acrylic Metal Primer HP04.
 - 2) First and Second Coats: Ultra Spec 500 Waterborne Interior Semi-Gloss 539.
 - b. Behr Process Corporation:
 - 1) Primer (Unfinished Surfaces): Multi-Surface Interior/Exterior Primer & Sealer, 436
 - 2) First and Second Coats: Behr Pro i300 Interior Semi-Gloss Paint, 370
 - c. PPG Paints:
 - 1) Primer (Unfinished Surfaces): Pitt Tech Plus 4020 PF
 - 2) First and Second Coats: Speedhide Zero Interior Semi-Gloss Latex Enamel, 6-4510XI Series.
 - d. Sherwin-Williams Company:
 - 1) Primer (Unfinished Surfaces): Pro-Cryl Universal Primer, B66-1310 Series.
 - 2) First and Second Coats: Pro Industrial Acrylic Coating S/G, B66-650.
 - e. McCormick Paints:
 - 1) Primer (Unfinished Surfaces): McCormick Unix Multi-Purpose Stain Blocking Interior/Exterior Primer 06460.
 - 2) First and Second Coats: McCormick Interlok Interior/Exterior Acrylic Semi-Gloss Urethane DTM 45 Series.
 2. Pigmented Polyurethane over Zinc-Rich and Epoxy System: High contact/high traffic areas such as, but not limited to doors and frames.
 - a. Benjamin Moore & Company:
 - 1) Prime Coat: Corotech 100% Solids Epoxy Pre-Primer V155.
 - 2) Intermediate Coat: Ultra Spec HP Acrylic Metal Primer HP04.
 - 3) Topcoat - Semi-gloss: Coronado Rust Scat Waterborne Acrylic Enamel C90.
 - b. International Paint LLC:
 - 1) Prime Coat: Catha-Coat 302H.
 - 2) Intermediate Coat: Bar-Rust 231 Series.
 - 3) Topcoat - Semi-Gloss: Devthane378 Series.
 - c. PPG Paints:
 - 1) Prime Coat: 4020 PF.
 - 2) Intermediate Coat: PITT-GLAZE® WB1 Interior Pre-Catalyzed Water-Borne Acrylic Epoxy.
 - 3) Topcoat: PITT-GLAZE® WB1 Interior Pre-Catalyzed Water-Borne Acrylic Epoxy.
 - d. Sherwin-Williams Company:
 - 1) Prime Coat: Pro Industrial Pro-Cryl Universal Acrylic Primer B66-1310.
 - 2) Intermediate Coat: S-W Acrolon Waterbased Acrolon 100 WB Urethane.
 - 3) Topcoat: S-W Acrolon Waterbased Acrolon 100 WB Urethane.

- e. Tnemec Company, Inc.:
 - 1) Prime (Shop) Coat: Series 94H2O Hydro-Zinc. Refer to applicable Division 05 Sections.
 - 2) Intermediate Coat: Series 287 Enviro-Pox.
 - 3) Topcoat - Semi-Gloss: Series 248-clear Everthane.
- F. Zinc-Coated (Galvanized) Metal:
 - 1. Semi-Gloss Sheen:
 - a. Benjamin Moore & Co.:
 - 1) Primer (Unfinished Surfaces): Ultra Spec HP Acrylic Metal Primer HP04.
 - 2) First and Second Coats: Ultra Spec 500 Waterborne Interior Semi-Gloss 539.
 - b. Behr Process Corporation:
 - 1) Primer (Unfinished Surfaces): Multi-Surface Interior/Exterior Primer & Sealer, 436
 - 2) First and Second Coats: Behr Pro i300 Interior Semi-Gloss Paint, 370
 - c. PPG Paints:
 - 1) Primer (Unfinished Surfaces): Pitt Tech Plus 4020PF
 - 2) First and Second Coats: Speedhide Zero Interior Semi-Gloss Latex Enamel, 6-4510XI Series.
 - d. Sherwin-Williams Company:
 - 1) Primer (Unfinished Surfaces): ProCryl Universal Primer, B66-1310 Series.
 - 2) First and Second Coats: ProMar 200 Zero VOC Latex Semi-Gloss, B31-2600 Series, or Pro Industrial Acrylic Coating Semi-Gloss, B66-650.
 - e. McCormick Paints:
 - 1) Primer (Unfinished Surfaces): McCormick Unix Multi-Purpose Stain Blocking Interior/Exterior Primer 06460.
 - 2) First and Second Coats: McCormick Interlok Interior/Exterior Acrylic Semi-Gloss Urethane DTM 45 Series.
 - 2. Pigmented Polyurethane over Zinc-Rich and Epoxy System: High contact/high traffic areas such as, but not limited to doors and frames.
 - a. Benjamin Moore & Company:
 - 1) Prime Coat: Corotech 100% Solids Epoxy Pre-Primer V155.
 - 2) Intermediate Coat: Ultra Spec HP Acrylic Metal Primer HP04.
 - 3) Topcoat - Semi-gloss: Coronado Rust Scat Waterborne Acrylic Enamel C90.
 - b. International Paint LLC:
 - 1) Prime Coat: Catha-Coat 302H.
 - 2) Intermediate Coat: Bar-Rust 231 Series.
 - 3) Topcoat - Semi-Gloss: Devthane378 Series.
 - c. PPG Paints:
 - 1) Prime Coat: 4020 PF.
 - 2) Intermediate Coat: PITT-GLAZE® WB1 Interior Pre-Catalyzed Water-Borne Acrylic Epoxy.
 - 3) Topcoat: PITT-GLAZE® WB1 Interior Pre-Catalyzed Water-Borne Acrylic Epoxy.
 - d. Sherwin-Williams Company:
 - 1) Prime Coat: Pro Industrial Pro-Cryl Universal Acrylic Primer B66-1310.
 - 2) Intermediate Coat: S-W Acrolon Waterbased Acrolon 100 WB Urethane.

- 3) Topcoat: S-W Acrolon Waterbased Acrolon 100 WB Urethane.
- e. Tnemec Company, Inc.:
 - 1) Prime (Shop) Coat: Series 94H2O Hydro-Zinc. Refer to applicable Division 05 Sections.
 - 2) Intermediate Coat: Series 287 Enviro-Pox.
 - 3) Topcoat - Semi-Gloss: Series 248-clear Everthane.
- G. Cotton or Canvas Insulation-Covering Substrates, Including Pipe and Duct Coverings:
 - 1. Benjamin Moore & Co.:
 - a. Primer: Ultra Spec 500 Interior Zero VOC Latex Primer N534.
 - b. First and Second Coats: Ultra Spec 500 Interior Zero VOC Latex Eggshell, N538.
 - 2. Behr Process Corporation:
 - a. Primer: Kilz 2 Interior/Exterior Water-Base Primer, 2000
 - b. First and Second Coats: Behr Pro i300 Interior Eggshell Paint, PR330
 - 3. PPG Paints:
 - a. Primer: Speedhide Zero Int. Latex Quick Drying Primer/Sealer, 6-4900XI.
 - b. First and Second Coats: Speedhide Zero Interior Eggshell Latex Enamel, 6-4310XI Series.
 - 4. Sherwin-Williams Company:
 - a. Primer: PrepRite ProBlock Latex Primer/Sealer, B51W620.
 - b. First and Second Coats: ProMar 200 Zero VOC Latex Eg-Shel, B202600 Series.
 - 5. McCormick Paints:
 - a. Top Coat: McCormick Total Advantage Zero VOC Professional Coating Eggshell 09 Series.
- H. Exposed PVC Piping:
 - 1. Benjamin Moore & Co.:
 - a. Bond Coat: STIX Waterborne Bonding Primer SXA-110; Insl-X.
 - b. First and Second Coats: Ultra Spec 500 Interior Zero VOC Latex Eggshell, 538.
 - 2. Behr Process Corporation:
 - a. Primer: Multi-Surface Interior/Exterior Primer & Sealer, 436.
 - b. First and Second Coats: Behr Pro i300 Interior Eggshell Paint, PR330.
 - 3. PPG Paints:
 - a. Bond Coat: SEAL GRIP 17-921 Interior/Exterior 100% Acrylic Universal Primer/Sealer.
 - b. First and Second Coats: Speedhide Zero Interior Eggshell Latex Enamel, 6-4310XI Series.
 - 4. Sherwin-Williams Company:
 - a. Bond Coat: PrepRite ProBlock Latex Primer/Sealer, B51W620.
 - b. First and Second Coats: ProMar 200 Zero VOC Latex Eg-Shel, B202600 Series.
 - 5. McCormick Paints:
 - a. Prime Coat: McCormick Unix Multi-Purpose Stain Blocking Interior/Exterior Primer 06460.
 - b. Top Coat: McCormick Total Advantage Zero VOC Professional Coating Eggshell 09 Series.

3.6 INTERIOR PAINTING SCHEDULE - EXISTING AREAS

- A. Wherever alterations and changes occur as a result of Work under the Contract in any room of existing building, except as specifically indicated on Drawings, paint affected ceiling and wall areas as specified under the Standard Painting Applications listed in this Section; the wall or ceiling in which the alterations occur will be painted from natural break to natural break.
- B. Generally, paint color in altered areas will match the adjoining surfaces as closely as possible.
- C. All doors and frames within "Limits of Contract" will be painted on both sides as required by the applicable Master Specifications; new Work, all required coats.
- D. When painting existing surfaces, Contractor bears the responsibility of assuring compatibility of new paint materials with existing.

END OF SECTION 09 91 23

SECTION 10 44 16 - FIRE EXTINGUISHERS**PART 1 - GENERAL****1.1 SUMMARY**

- A. Section includes portable, hand-carried fire extinguishers and mounting brackets for fire extinguishers.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher and mounting brackets.
- B. Product Schedule: For fire extinguishers. Coordinate final fire-extinguisher schedule with fire-protection cabinet schedule to ensure proper fit and function.

1.3 INFORMATIONAL SUBMITTALS

- A. Warranty: Sample of special warranty.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

1.5 COORDINATION

- A. Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.

1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Failure of hydrostatic test according to NFPA 10 when testing interval required by NFPA 10 is within the warranty period.
 - b. Faulty operation of valves or release levers.
 - 2. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS**2.1 PERFORMANCE REQUIREMENTS**

- A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."
- B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.
 - 1. Provide fire extinguishers approved, listed, and labeled by FM Global.

2.2 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

- A. Fire Extinguishers: Type, size, and capacity for each fire-protection cabinet and mounting bracket indicated.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Amerex Corporation.
 - b. Ansul by Johnson Controls Company.
 - c. Babcock-Davis.
 - d. Badger Fire Protection.
 - e. Buckeye Fire Equipment Company.
 - f. Fire End & Croker Corporation.
 - g. Guardian Fire Equipment, Inc.
 - h. JL Industries, Inc.; a division of the Activar Construction Products Group.
 - i. Kidde Residential and Commercial Division.
 - j. Larsens Manufacturing Company.
 - k. MOON American.
 - l. Nystrom.
 - m. Potter Roemer LLC; a Division of Morris Group International.
 - n. Pyro-Chem; Tyco Fire Suppression & Building Products.
 - o. Strike First Corporation of America (The).
 2. Source Limitations: Obtain fire extinguishers, fire-protection cabinets, and accessories, from single source from single manufacturer.
 3. Valves: Manufacturer's standard.
 4. Handles and Levers: Manufacturer's standard.
 5. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B.
- B. Multipurpose Dry-Chemical Type in Steel Container: UL-rated 4-A:60-B:C, 10-lb nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.

2.3 MOUNTING BRACKETS

- A. Mounting Brackets: Manufacturer's standard steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or red baked-enamel finish.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Amerex Corporation.
 - b. Ansul by Johnson Controls Company.
 - c. Babcock-Davis.
 - d. Badger Fire Protection.
 - e. Buckeye Fire Equipment Company.
 - f. Fire End & Croker Corporation.
 - g. Guardian Fire Equipment, Inc.
 - h. JL Industries, Inc.; a division of the Activar Construction Products Group.
 - i. Kidde Residential and Commercial Division.
 - j. Larsens Manufacturing Company.
 - k. Nystrom.
 - l. Potter Roemer LLC; a Division of Morris Group International.
 - m. Pyro-Chem; Tyco Fire Suppression & Building Products.
 - n. Strike First Corporation of America (The).
 2. Source Limitations: Obtain mounting brackets and fire extinguishers from single source from single manufacturer.
- B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.
1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.

PART 3 - EXECUTION**3.1 EXAMINATION**

- A. Examine fire extinguishers for proper charging and tagging.
 - 1. Remove and replace damaged, defective, or undercharged fire extinguishers.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.
 - 1. Mounting Brackets: Top of fire extinguisher to be at 42 inches above finished floor.
- B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION 10 44 16

SECTION 13 34 19 - METAL BUILDING SYSTEMS**PART 1 - GENERAL****1.1 SUMMARY**

- A. Section Includes:
1. Structural-steel framing.
 2. Metal roof panels.
 3. Foamed-insulation-core metal wall panels.
 4. Thermal insulation.
 5. Personnel doors and frames.
 6. Accessories.

1.2 DEFINITIONS

- A. Terminology Standard: See MBMA's "Metal Building Systems Manual" for definitions of terms for metal building system construction not otherwise defined in this Section or in standards referenced by this Section.

1.3 COORDINATION

- A. Coordinate sizes and locations of concrete foundations and casting of anchor-rod inserts into foundation walls and footings. Anchor rod installation, concrete, reinforcement, and formwork requirements are specified in Section 03 30 00 "Cast-in-Place Concrete."
- B. Coordinate metal panel assemblies with rain drainage work, flashing, trim, and construction of supports and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at project site.
1. Review methods and procedures related to metal building systems including, but not limited to, the following:
 - a. Condition of foundations and other preparatory work performed by other trades.
 - b. Structural load limitations.
 - c. Construction schedule. Verify availability of materials and erector's personnel, equipment, and facilities needed to make progress and avoid delays.
 - d. Required tests, inspections, and certifications.
 - e. Unfavorable weather and forecasted weather conditions and impact on construction schedule.
 2. Review methods and procedures related to metal roof panel assemblies including, but not limited to, the following:
 - a. Compliance with requirements for purlin and rafter conditions, including flatness and attachment to structural members.
 - b. Structural limitations of purlins and rafters during and after roofing.
 - c. Flashings, special roof details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect metal roof panels.
 - d. Temporary protection requirements for metal roof panel assembly during and after installation.
 - e. Roof observation and repair after metal roof panel installation.
 3. Review methods and procedures related to metal wall panel assemblies including, but not limited to, the following:
 - a. Compliance with requirements for support conditions, including alignment between and attachment to structural members.

- b. Structural limitations of girts and columns during and after wall panel installation.
- c. Flashings, special siding details, wall penetrations, openings, and condition of other construction that will affect metal wall panels.
- d. Temporary protection requirements for metal wall panel assembly during and after installation.
- e. Wall observation and repair after metal wall panel installation.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of metal building system component.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:
 - a. Metal roof panels.
 - b. Metal wall panels.
 - c. Foamed-insulation-core metal panels.
 - d. Thermal insulation and vapor-retarder facings.
 - e. Personnel doors and frames.
 - f. Roof ventilators.
- B. Shop Drawings: Indicate components by others. Include full building plan, elevations, sections, details and the following:
 - 1. Anchor-Rod Plans: Submit anchor-rod plans and templates before foundation work begins. Include location, diameter, and minimum required projection of anchor rods required to attach metal building to foundation. Indicate column reactions at each location.
 - 2. Structural-Framing Drawings: Show complete fabrication of primary and secondary framing; include provisions for openings. Indicate welds and bolted connections, distinguishing between shop and field applications. Include transverse cross-sections.
 - 3. Metal Roof and Wall Panel Layout Drawings: Show layouts of panels including methods of support. Include details of edge conditions, joints, panel profiles, corners, anchorages, clip spacing, trim, flashings, closures, and special details. Distinguish between factory- and field-assembled work; show locations of exposed fasteners.
 - a. Show roof-mounted items including roof hatches, equipment supports, pipe supports and penetrations, lighting fixtures, and items mounted on roof curbs.
 - b. Show wall-mounted items including personnel doors, vehicular doors, louvers, and lighting fixtures.
 - 4. Accessory Drawings: Include details of the following items, at a scale of not less than 1-1/2 inches per 12 inches:
 - a. Flashing and trim.
 - b. Gutters.
 - c. Downspouts.
- C. Samples for Initial Selection: For units with factory-applied finishes.
- D. Delegated Design Submittals: For metal building systems.
 - 1. Include analysis data indicating compliance with performance requirements and design data signed and sealed by the qualified professional engineer responsible for their preparation.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For erector, manufacturer and land surveyor.
- B. Welding certificates.
- C. Letter of Design Certification: Signed and sealed by a qualified professional engineer. Include the following:

1. Name and location of Project.
 2. Order number.
 3. Name of manufacturer.
 4. Name of Contractor.
 5. Building dimensions including width, length, height, and roof slope.
 6. Indicate compliance with AISC standards for hot-rolled steel and AISI standards for cold-rolled steel, including edition dates of each standard.
 7. Governing building code and year of edition.
 8. Design Loads: Include dead load, roof live load, collateral loads, roof snow load, deflection, wind loads/speeds and exposure, seismic design category or effective peak velocity-related acceleration/peak acceleration, and auxiliary loads (cranes).
 9. Load Combinations: Indicate that loads were applied acting simultaneously with concentrated loads, according to governing building code.
 10. Building-Use Category: Indicate category of building use and its effect on load importance factors.
- D. Erector Certificates: For qualified erector, from manufacturer.
- E. Material Test Reports: For each of the following products:
1. Structural steel including chemical and physical properties.
 2. Bolts, nuts, and washers including mechanical properties and chemical analysis.
 3. Tension-control, high-strength, bolt-nut-washer assemblies.
 4. Shop primers.
 5. Nonshrink grout.
- F. Source quality-control reports.
- G. Field quality-control reports.
- H. Surveys: Show final elevations and locations of major members. Indicate discrepancies between actual installation and the Contract Documents. Have surveyor who performed surveys certify their accuracy.
- I. Sample Warranties: For special warranties.
- 1.7 CLOSEOUT SUBMITTALS
- A. Maintenance Data: For metal panel finishes to include in maintenance manuals.
- 1.8 QUALITY ASSURANCE
- A. Manufacturer Qualifications: A qualified manufacturer.
1. Accreditation: Manufacturer's facility accredited according to IAS AC472, "Accreditation Criteria for Inspection Programs for Manufacturers of Metal Building Systems."
 2. Engineering Responsibility: Preparation of comprehensive engineering analysis and Shop Drawings by a professional engineer who is legally qualified to practice in jurisdiction where Project is located.
- B. Erector Qualifications: An experienced erector who specializes in erecting and installing work similar in material, design, and extent to that indicated for this Project and who is acceptable to manufacturer.
- C. Welding Qualifications: Qualify procedures and personnel according to the following:
1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 2. AWS D1.3, "Structural Welding Code - Sheet Steel."
- D. Land Surveyor Qualifications: A professional land surveyor who practices in jurisdiction where Project is located and who is experienced in providing surveying services of the kind indicated.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver components, sheets, panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.
- B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.

1.10 FIELD CONDITIONS

- A. Weather Limitations: Proceed with panel installation only when weather conditions permit metal panels to be installed according to manufacturers' written instructions and warranty requirements.

1.11 WARRANTY

- A. Special Warranty on Metal Panel Finishes: Manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Finish Warranty Period: 20 years from date of Substantial Completion.
- B. Special Weathertightness Warranty for Standing-Seam Metal Roof Panels: Manufacturer agrees to repair or replace standing-seam metal roof panel assemblies that leak or otherwise fail to remain weathertight within specified warranty period.
 - 1. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. American Eagle Buildings Inc.
 - 2. Butler Manufacturing Company.
 - 3. Ceco Buildings Systems part of the Cornerstone Building Brands.
 - 4. Star Building Systems part of Cornerstone Building Brands.
 - 5. US Buildings, LLC.
 - 6. Varco Pruden Buildings. (Basis-of-Design)
- B. Source Limitations: Obtain metal building system components, including primary and secondary framing and metal panel assemblies, from single source from single manufacturer.

2.2 SYSTEM DESCRIPTION

- A. Provide a complete, integrated set of mutually dependent components and assemblies that form a metal building system capable of withstanding structural and other loads, thermally induced movement, and exposure to weather without failure or infiltration of water into building interior.
- B. Primary-Frame Type:
 - 1. Rigid Clear Span: Solid-member, structural-framing system without interior columns.

- C. End-Wall Framing:
 - 1. Engineer end walls to be expandable. Provide primary frame, capable of supporting full-bay design loads, and end-wall columns.
- D. Secondary-Frame Type: Manufacturer's standard purlins and joists and exterior-framed (bypass) girts.
- E. Eave Height: Manufacturer's standard height, as indicated by nominal height on Drawings.
- F. Bay Spacing: As indicated on Drawings.
- G. Roof Slope: 1/4 inch per 12 inches.
- H. Roof System: Manufacturer's standard standing-seam, vertical-rib, metal roof panels.
- I. Exterior Wall System: Foamed-insulation-core metal wall panels.

2.3 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design metal building system.
- B. Structural Performance: Metal building systems to withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated according to procedures in MBMA's "Metal Building Systems Manual."
 - 1. Design Loads: As indicated on Drawings.
 - 2. Collateral Load:
 - a. Collateral load in pounds per square foot shall be applied to the entire structure to account for the weight of additional permanent materials other than the building system, such as sprinklers, mechanical systems, electrical systems, hung partitions, and ceilings.
 - b. This allowance does not include the weight of hung equipment weighing 50 pounds or more.
 - c. Equipment loads of 50 pounds or more are indicated on the Drawings and the structure shall be strengthened as required.
 - 3. Deflection and Drift Limits:
 - a. Design metal building system assemblies to withstand serviceability design loads without exceeding deflections and drift limits recommended in AISC Steel Design Guide No. 3 "Serviceability Design Considerations for Steel Buildings."
- C. Seismic Performance: Metal building system to withstand the effects of earthquake motions determined according to ASCE/SEI 7.
- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
- E. Structural Performance for Metal Roof and Wall Panels: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E1592:
 - 1. Wind Loads: As indicated on Drawings.
- F. Air Infiltration for Metal Roof Panels: Air leakage of not more than 0.06 cfm/sq. ft. when tested according to ASTM E1680 or ASTM E283 at the following test-pressure difference:
 - 1. Test-Pressure Difference: 6.24 lbf/sq. ft.
- G. Air Infiltration for Metal Wall Panels: Air leakage of not more than 0.06 cfm/sq. ft. when tested according to ASTM E283 at the following test-pressure difference:
 - 1. Test-Pressure Difference: 6.24 lbf/sq. ft.

- H. Water Penetration for Metal Roof Panels: No water penetration when tested according to ASTM E1646 or ASTM E331 at the following test-pressure difference:
 - 1. Test-Pressure Difference: 6.24 lbf/sq. ft.
- I. Water Penetration for Metal Wall Panels: No water penetration when tested according to ASTM E331 at the following test-pressure difference:
 - 1. Test-Pressure Difference: 6.24 lbf/sq. ft.
- J. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift-resistance class indicated.
 - 1. Uplift Rating: UL 90.
- K. Thermal Performance for Opaque Elements: Provide the following maximum U-factors and minimum R-values when tested according to ASTM C1363 or ASTM C518:
 - 1. Roof:
 - a. R-Value: Minimum 34.5 based on Varco-Pruden TD11 SSR (Basis-of-Design).
 - 2. Walls:
 - a. R-Value: Minimum 30.86 at 75 degreesF.

2.4 STRUCTURAL-STEEL FRAMING

- A. Structural Steel: Comply with AISC 360, "Specification for Structural Steel Buildings."
- B. Bolted Connections: Comply with RCSC's "Specification for Structural Joints Using High-Strength Bolts."
- C. Cold-Formed Steel: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" for design requirements and allowable stresses.
- D. Primary Framing: Manufacturer's standard primary-framing system, designed to withstand required loads and specified requirements. Primary framing includes transverse and lean-to frames; rafters, rake, and canopy beams; sidewall, intermediate, end-wall, and corner columns; and wind bracing.
 - 1. General: Provide frames with attachment plates, bearing plates, and splice members. Factory drill for field-bolted assembly. Provide frame span and spacing indicated.
 - a. Slight variations in span and spacing may be acceptable if necessary to comply with manufacturer's standard, as approved by Architect.
 - 2. Rigid Clear-Span Frames: I-shaped frame sections fabricated from shop-welded, built-up steel plates or structural-steel shapes. Interior columns are not permitted.
 - 3. Frame Configuration: One-directional, sloped.
 - 4. Exterior Column: Tapered.
 - 5. Rafter: Tapered.
- E. End-Wall Framing: Manufacturer's standard primary end-wall framing fabricated for field-bolted assembly to comply with the following:
 - 1. End-Wall and Corner Columns: I-shaped sections fabricated from structural-steel shapes; shop-welded, built-up steel plates; or C-shaped, cold-formed, structural-steel sheet.
- F. Secondary Framing: Manufacturer's standard secondary framing, including purlins, girts, eave struts, flange bracing, base members, gable angles, clips, headers, jambs, and other miscellaneous structural members. Unless otherwise indicated, fabricate framing from either cold-formed, structural-steel sheet or roll-formed, metallic-coated steel sheet, prepainted with coil coating, to comply with the following:
 - 1. Purlins:
 - a. C- or Z-shaped sections; fabricated from built-up steel plates, steel sheet, or structural-steel shapes; minimum 2-1/2-inch- wide flanges.

2. Girts: C- or Z-shaped sections; fabricated from built-up steel plates, steel sheet, or structural-steel shapes. Form ends of Z-sections with stiffening lips angled 40 to 50 degrees from flange, with minimum 2-1/2-inch- wide flanges.
 - a. Depth: As required to comply with system performance requirements.
 3. Eave Struts: Unequal-flange, C-shaped sections; fabricated from built-up steel plates, steel sheet, or structural-steel shapes; to provide adequate backup for metal panels.
 4. Flange Bracing: Minimum 2-by-2-by-1/8-inch structural-steel angles or 1-inch- diameter, cold-formed structural tubing to stiffen primary-frame flanges.
 5. Sag Bracing: Minimum 1-by-1-by-1/8-inch structural-steel angles.
 6. Base or Sill Angles: Manufacturer's standard base angle, minimum 3-by-2-inch, fabricated from zinc-coated (galvanized) steel sheet.
 7. Purlin and Girt Clips: Manufacturer's standard clips fabricated from steel sheet. Provide galvanized clips where clips are connected to galvanized framing members.
 8. Framing for Openings: Channel shapes; fabricated from cold-formed, structural-steel sheet or structural-steel shapes. Frame head and jamb of door openings and head, jamb, and sill of other openings.
 9. Miscellaneous Structural Members: Manufacturer's standard sections fabricated from cold-formed, structural-steel sheet; built-up steel plates; or zinc-coated (galvanized) steel sheet; designed to withstand required loads.
- G. Bracing: Provide adjustable wind bracing using any method as follows:
1. Rods: ASTM A36/A36M; ASTM A572/A572M, Grade 50; or ASTM A529/A529M, Grade 50; minimum 1/2-inch- diameter steel; threaded full length or threaded a minimum of 6 inches at each end.
 2. Cable: ASTM A475, minimum 1/4-inch- diameter, extra-high-strength grade, Class B, zinc-coated, seven-strand steel; with threaded end anchors.
 3. Angles: Fabricated from structural-steel shapes to match primary framing, of size required to withstand design loads.
 4. Rigid Portal Frames: Fabricated from shop-welded, built-up steel plates or structural-steel shapes to match primary framing; of size required to withstand design loads.
 5. Fixed-Base Columns: Fabricated from shop-welded, built-up steel plates or structural-steel shapes to match primary framing; of size required to withstand design loads.
 6. Diaphragm Action of Metal Panels: Design metal building to resist wind forces through diaphragm action of metal panels.
- H. Anchor Rods: Headed anchor rods as indicated in Anchor Rod Plan for attachment of metal building to foundation.
- I. Materials:
1. W-Shapes: ASTM A992/A992M; ASTM A572/A572M, Grade 50 or 55; or ASTM A529/A529M, Grade 50 or 55.
 2. Channels, Angles, M-Shapes, and S-Shapes: ASTM A36/A36M; ASTM A572/A572M, Grade 50 or 55; or ASTM A529/A529M, Grade 50 or 55.
 3. Plate and Bar: ASTM A36/A36M; ASTM A572/A572M, Grade 50 or 55; or ASTM A529/A529M, Grade 50 or 55.
 4. Structural-Steel Sheet: Hot-rolled, ASTM A1011/A1011M, Structural Steel (SS), Grades 30 through 55, or High-Strength Low-Alloy Steel (HSLAS) or High-Strength Low-Alloy Steel with Improved Formability (HSLAS-F), Grades 45 through 70; or cold-rolled, ASTM A1008/A1008M, Structural Steel (SS), Grades 25 through 80, or HSLAS, Grades 45 through 70.
 5. Metallic-Coated Steel Sheet: ASTM A653/A653M, SS, Grades 33 through 80, or HSLAS or HSLAS-F, Grades 50 through 80; with G60 coating designation; mill phosphatized.
 6. Metallic-Coated Steel Sheet Prepainted with Coil Coating: Steel sheet, metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A755/A755M.

- a. Zinc-Coated (Galvanized) Steel Sheet: ASTM A653/A653M, SS, Grades 33 through 80, or HSLAS or HSLAS-F, Grades 50 through 80; with G90 coating designation.
 - b. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A792/A792M, SS, Grade 50 or 80; with Class AZ50 coating.
7. Non-High-Strength Bolts, Nuts, and Washers: ASTM A307, Grade A, carbon-steel, hex-head bolts; ASTM A563 carbon-steel hex nuts; and ASTM F844 plain (flat) steel washers.
 - a. Finish: Hot-dip zinc coating, ASTM F2329, Class C.
8. High-Strength Bolts, Nuts, and Washers, Grade A325: ASTM F3125/F3125M, Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers.
 - a. Finish: Hot-dip zinc coating, ASTM F2329, Class C.
9. High-Strength Bolts, Nuts, and Washers, Grade A490: ASTM F3125/F3125M, Type 1, heavy-hex steel structural bolts or Grade F2280 tension-control, bolt-nut-washer assemblies with splined ends; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers; all with plain finish.
10. Headed Anchor Rods: ASTM F1554, Grade 36.
 - a. Configuration: Straight.
 - b. Nuts: ASTM A563 heavy-hex carbon steel.
 - c. Plate Washers: ASTM A36/A36M carbon steel.
 - d. Washers: ASTM F436 hardened carbon steel.
 - e. Finish: Hot-dip zinc coating, ASTM F2329, Class C.
11. Threaded Rods: ASTM A572/A572M, Grade 50.
 - a. Nuts: ASTM A563 heavy-hex carbon steel.
 - b. Washers: ASTM F436 hardened carbon steel.
 - c. Finish: Hot-dip zinc coating, ASTM F2329, Class C.
- J. Finish: Factory primed. Apply specified primer immediately after cleaning and pretreating.
 1. Clean and prepare in accordance with SSPC-SP2.
 2. Coat with manufacturer's standard primer. Apply primer to primary and secondary framing to a minimum dry film thickness of 1 mil.
 - a. Prime secondary framing formed from uncoated steel sheet to a minimum dry film thickness of 0.5 mil on each side.

2.5 METAL ROOF PANELS

- A. Standing-Seam, Vertical-Rib, Metal Roof Panels: Formed with vertical ribs at panel edges and intermediate stiffening ribs symmetrically spaced between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels and engaging opposite edge of adjacent panels.
 1. Basis-of-Design: Varco-Pruden SSR Standing Seam Roof.
 - a. Roof Assembly - Basis-of-Design: Varco-Pruden Thermodeck Roof System, including multi-purpose deck liner.
 2. Material: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.030-inch nominal uncoated steel thickness. Prepainted by the coil-coating process to comply with ASTM A755/A755M.
 - a. Exterior Finish: Two-coat fluoropolymer.
 - b. Color: As selected by Architect from manufacturer's full range.
 3. Clips: Two-piece floating to accommodate thermal movement.
 4. Joint Type: Mechanically seamed.
 5. Panel Coverage: 24 inches.

6. Panel Height: 3 inches.
- B. Exposed-Fastener, Metal Liner Panels: Formed with intermediate stiffening ribs symmetrically spaced between major ribs; designed to be installed by lapping side edges of adjacent panels and mechanically attaching panels to supports using exposed fasteners in side laps.
 1. Material: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.018-inch nominal uncoated steel thickness. Prepainted by the coil-coating process to comply with ASTM A755/A755M.
 - a. Exterior Finish: Siliconized polyester.
 - b. Color: As selected by Architect from manufacturer's full range.
 2. Basis-of-Design - Roof: Butler Manufacturing; ThermaLiner InsulationVarco-Pruden Thermodeck Roof System, including multi-purpose deck liner.
- C. Finishes:
 1. Exposed Coil-Coated Finish:
 - a. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - b. Siliconized Polyester: Epoxy primer and silicone-modified, polyester-enamel topcoat; with a minimum dry film thickness of 0.2 mil for primer and 0.8 mil for topcoat.
 2. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

2.6 FOAMED-INSULATION-CORE METAL WALL PANELS

- A. Concealed-Fastener, Foamed-Insulation-Core Metal Wall Panels: Formed with tongue-and-groove panel edges; designed for sequential installation by interlocking panel edges and mechanically attaching panels to supports using concealed clips or fasteners.
 1. Panel Thermal-Resistance Value (R-Value): 26.
 - a. Basis-of-Design: Metl-Span; CF Mesa Insulated Metal Wall Panel.
 2. Facing Material: Fabricate panel with exterior and interior facings of same material and thickness. Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.030-inch nominal uncoated steel thickness. Prepainted by the coil-coating process to comply with ASTM A755/A755M.
 - a. Exterior Surface: Shallow ribs.
 - b. Exterior Finish: Two-coat fluoropolymer.
 - c. Color: As selected by Architect from manufacturer's full range.
 - 1) Basis-of-Design: Metl-Span Regal Gray.
 3. Panel Coverage: 42 inches nominal.
 4. Panel Thickness: 4 inches.
 5. Insulation Core: Modified polyisocyanurate or polyurethane foam using a non-CFC blowing agent, foamed-in-place or board type, with maximum flame-spread and smoke-developed indexes of 25 and 450, respectively.
 - a. Closed-Cell Content: 90 percent when tested according to ASTM D6226.
 - b. Density: 2.0 to 2.6 lb/cu. ft. when tested according to ASTM D1622.
 - c. Compressive Strength: Minimum 20 psi when tested according to ASTM D1621.
 - d. Shear Strength: 26 psi when tested according to ASTM C273/C273M.
 6. Fire-Test-Response Characteristics: Class A according to ASTM E108.

7. Surface-Burning Characteristics: Flame-spread index of 25 or less and a smoke-developed index of 450 or less, per ASTM E84.

B. Finishes:

1. Exposed Coil-Coated Finish:

- a. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

2.7 THERMAL INSULATION

- A. Unfaced Metal Building Insulation: ASTM C991, Type I, or NAIMA 202, glass-fiber-blanket insulation; 0.5-lb/cu. ft. density; 2-inch- wide, continuous, vapor-tight edge tabs; with a flame-spread index of 25 or less.
- B. Retainer Strips: For securing insulation between supports, 0.025-inch nominal-thickness, formed, metallic-coated steel or PVC retainer clips colored to match insulation facing.
- C. Vapor-Retarder Facing: ASTM C1136, with permeance not greater than 0.02 perm when tested according to ASTM E96/E96M, Desiccant Method.
 1. Composition:
 - a. Aluminum foil facing, elastomeric barrier coating, fiberglass scrim reinforcement, and kraft-paper backing.
- D. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.

2.8 PERSONNEL DOORS AND FRAMES

A. Swinging Personnel Doors and Frames:

1. Metal building system manufacturer's standard doors and frames; prepared and reinforced at strike and at hinges to receive factory- and field-applied hardware according to BHMA A156 Series.
 - a. Steel Doors: 1-3/4 inches thick; fabricated from metallic-coated steel face sheets, 0.036-inch nominal uncoated steel thickness, of seamless, hollow-metal construction; with 0.060-inch nominal uncoated steel thickness, inverted metallic-coated steel channels welded to face sheets at top and bottom of door.
 - 1) Design: As indicated on Drawings.
 - 2) Core:
 - a) Polyurethane foam with U-factor rating of at least 0.07 Btu/sq. ft. x h x deg F.
 - b. Steel Frames: Fabricate 2-inch- wide face frames from zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.060-inch nominal uncoated steel thickness.
 - 1) Type: Factory welded.
 - c. Fabricate concealed stiffeners, reinforcement, edge channels, and moldings from either cold- or hot-rolled steel sheet.
 - d. Hardware: Refer to Drawings.
 - e. Anchors and Accessories: Manufacturer's standard units, galvanized according to ASTM A123/A123M.
 - f. Fabrication: Fabricate doors and frames to be rigid; neat in appearance; and free from defects, warp, or buckle. Provide continuous welds on exposed joints; grind, dress, and make welds smooth, flush, and invisible.

B. Materials:

1. Metallic-Coated Steel Sheet: ASTM A653/A653M, CS, Type B; with G60 zinc (galvanized) or A60 zinc-iron-alloy (galvannealed) coating designation.
- C. Finishes for Personnel Doors and Frames:
 1. Prime Finish: Factory-apply manufacturer's standard primer immediately after cleaning and pretreating.
 2. Factory-Applied Paint Finish: Manufacturer's standard, complying with SDI A250.3 for performance and acceptance criteria.
 - a. Color and Gloss: As selected by Architect from manufacturer's full range.

2.9 ACCESSORIES

- A. General: Provide accessories as standard with metal building system manufacturer and as specified. Fabricate and finish accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes. Comply with indicated profiles and with dimensional and structural requirements.
 1. Form exposed sheet metal accessories that are without excessive oil-canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
- B. Roof Panel Accessories: Provide components required for a complete metal roof panel assembly including copings, fasciae, corner units, ridge closures, clips, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal roof panels unless otherwise indicated.
 1. Closures: Provide closures at eaves and ridges, fabricated of same material as metal roof panels.
 2. Clips: Manufacturer's standard, formed from steel sheet, designed to withstand negative-load requirements.
 3. Cleats: Manufacturer's standard, mechanically seamed cleats formed from steel, stainless steel sheet or nylon-coated aluminum sheet.
 4. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
 5. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- thick, flexible closure strips; cut or premolded to match metal roof panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
 6. Thermal Spacer Blocks: Where metal panels attach directly to purlins, provide thermal spacer blocks of thickness required to provide 1-inch standoff; fabricated from extruded polystyrene.
- C. Wall Panel Accessories: Provide components required for a complete metal wall panel assembly including copings, fasciae, mullions, sills, corner units, clips, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal wall panels unless otherwise indicated.
 1. Closures: Provide closures at eaves and rakes, fabricated of same material as metal wall panels.
 2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
 3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- thick, flexible closure strips; cut or premolded to match metal wall panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
- D. Flashing and Trim: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.018-inch nominal uncoated steel thickness, prepainted with coil coating; finished to match adjacent metal panels.

1. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers.
 2. Opening Trim: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.030-inch nominal uncoated steel thickness, prepainted with coil coating. Trim head and jamb of door openings, and head, jamb, and sill of other openings.
- E. Gutters: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.018-inch nominal uncoated steel thickness, prepainted with coil coating; finished to match roof fascia and rake trim. Match profile of gable trim, complete with end pieces, outlet tubes, and other special pieces as required. Fabricate in minimum 96-inch- long sections, sized according to SMACNA's "Architectural Sheet Metal Manual."
1. Gutter Supports: Fabricated from same material and finish as gutters.
 2. Strainers: Bronze, copper, or aluminum wire ball type at outlets.
- F. Downspouts: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.018-inch nominal uncoated steel thickness, prepainted with coil coating; finished to match metal wall panels. Fabricate in minimum 10-foot- long sections, complete with formed elbows and offsets.
1. Mounting Straps: Fabricated from same material and finish as gutters.
- G. Roof Ventilators: Gravity type, complete with hardware, flashing, closures, and fittings.
1. Continuous or Sectional-Ridge Type: Factory-engineered and -fabricated, continuous unit; Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.018-inch nominal uncoated steel thickness, prepainted with coil coating; finished to match metal roof panels. Fabricated in minimum 10-foot- long sections. Provide throat size and total length indicated, complete with side baffles, ventilator assembly, end caps, splice plates, and reinforcing diaphragms.
 - a. Bird Screening: Galvanized steel, 1/2-inch- square mesh, 0.041-inch wire; or aluminum, 1/2-inch- square mesh, 0.063-inch wire.
 - b. Dampers: Manually operated, spring-loaded, vertically rising type; chain and worm gear operator; with pull chain of length required to reach within 36 inches of floor.
 - c. Throat Size: As standard with manufacturer, and as required to comply with ventilation requirements.
- H. Roof Curbs: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.048-inch nominal uncoated steel thickness prepainted with coil coating; finished to match metal roof panels; with welded top box and bottom skirt, and integral full-length cricket; capable of withstanding loads of size and height indicated.
1. Curb Subframing: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.060-inch nominal uncoated steel thickness, angle-, C-, or Z-shaped metallic-coated steel sheet.
 2. Insulation: 1-inch- thick, rigid type.
- I. Pipe Flashing: Premolded, EPDM pipe collar with flexible aluminum ring bonded to base.
- J. Materials:
1. Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide fasteners with heads matching color of materials being fastened by means of plastic caps or factory-applied coating.
 2. Fasteners for Metal Roof Panels:
 - a. Self-drilling or self-tapping, zinc-plated, hex-head carbon-steel screws, with a stainless steel cap or zinc-aluminum-alloy head and EPDM sealing washer.
 - b. Self-drilling, Type 410 stainless steel or self-tapping, Type 304 stainless steel or zinc-alloy-steel hex washer head, with EPDM washer under heads of fasteners bearing on weather side of metal panels.

3. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws with hex washer head.
4. Blind Fasteners: High-strength aluminum or stainless steel rivets.
5. Corrosion-Resistant Coating: Cold-applied asphalt mastic, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.
6. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.
7. Metal Panel Sealants:
 - a. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene-compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape of manufacturer's standard size.
 - b. Joint Sealant: ASTM C920; one part elastomeric polyurethane or polysulfide; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended by metal building system manufacturer.

2.10 FABRICATION

- A. General: Design components and field connections required for erection to permit easy assembly.
 1. Mark each piece and part of the assembly to correspond with previously prepared erection drawings, diagrams, and instruction manuals.
 2. Fabricate structural framing to produce clean, smooth cuts and bends. Punch holes of proper size, shape, and location. Members to be free of cracks, tears, and ruptures.
- B. Tolerances: Comply with MBMA's "Metal Building Systems Manual" for fabrication and erection tolerances.
- C. Primary Framing: Shop fabricate framing components to indicated size and section, with baseplates, bearing plates, stiffeners, and other items required for erection welded into place. Cut, form, punch, drill, and weld framing for bolted field assembly.
 1. Make shop connections by welding or by using high-strength bolts.
 2. Join flanges to webs of built-up members by a continuous, submerged arc-welding process.
 3. Brace compression flange of primary framing with steel angles or cold-formed structural tubing between frame web and purlin web or girt web, so flange compressive strength is within allowable limits for any combination of loadings.
 4. Weld clips to frames for attaching secondary framing if applicable, or punch for bolts.
 5. Shop Priming: Prepare surfaces for shop priming according to SSPC-SP 2. Shop prime primary framing with specified primer after fabrication.
- D. Secondary Framing: Shop fabricate framing components to indicated size and section by roll forming or break forming, with baseplates, bearing plates, stiffeners, and other plates required for erection welded into place. Cut, form, punch, drill, and weld secondary framing for bolted field connections to primary framing.
 1. Make shop connections by welding or by using non-high-strength bolts.
 2. Shop Priming: Prepare uncoated surfaces for shop priming according to SSPC-SP 2. Shop prime uncoated secondary framing with specified primer after fabrication.
- E. Metal Panels: Fabricate and finish metal panels at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements. Comply with indicated profiles and with dimensional and structural requirements.
 1. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of metal panel.

2.11 SOURCE QUALITY CONTROL

- A. Special Inspection: Engage a qualified third-party special inspector to perform source quality control inspections and to submit reports.
 - 1. Accredited Manufacturers: Special inspections will not be required if fabrication is performed by an IAS AC472-accredited manufacturer approved by authorities having jurisdiction to perform such Work without special inspection.
 - a. After fabrication, submit copy of certificate of compliance to authorities having jurisdiction, certifying that Work was performed according to Contract requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with erector present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Before erection proceeds, survey elevations and locations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments to receive structural framing, with erector present, for compliance with requirements and metal building system manufacturer's tolerances.
 - 1. Engage land surveyor to perform surveying.
- C. Proceed with erection only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition.
- B. Provide temporary shores, guys, braces, and other supports during erection to keep structural framing secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural framing, connections, and bracing are in place unless otherwise indicated.

3.3 ERECTION OF STRUCTURAL FRAMING

- A. Erect metal building system according to manufacturer's written instructions and drawings.
- B. Do not field cut, drill, or alter structural members without written approval from metal building system manufacturer's professional engineer.
- C. Set structural framing accurately in locations and to elevations indicated, according to AISC specifications referenced in this Section. Maintain structural stability of frame during erection.
- D. Base and Bearing Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
 - 1. Set plates for structural members on wedges, shims, or setting nuts as required.
 - 2. Tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
 - 3. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
- E. Align and adjust structural framing before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with framing. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
 - 1. Level and plumb individual members of structure.

2. Make allowances for difference between temperature at time of erection and mean temperature when structure will be completed and in service.
 - F. Primary Framing and End Walls: Erect framing level, plumb, rigid, secure, and true to line. Level baseplates to a true even plane with full bearing to supporting structures, set with double-nutted anchor bolts. Use grout to obtain uniform bearing and to maintain a level base-line elevation. Moist-cure grout for not less than seven days after placement.
 1. Make field connections using high-strength bolts installed according to RCSC's "Specification for Structural Joints Using High-Strength Bolts" for bolt type and joint type specified.
 - a. Joint Type: Snug tightened or pretensioned as required by manufacturer.
 - G. Secondary Framing: Erect framing level, plumb, rigid, secure, and true to line. Field bolt secondary framing to clips attached to primary framing.
 1. Provide rake or gable purlins with tight-fitting closure channels and fasciae.
 2. Locate and space wall girts to suit openings such as doors and windows.
 3. Provide supplemental framing at entire perimeter of openings, including doors, windows, louvers, ventilators, and other penetrations of roof and walls.
 - H. Bracing: Install bracing in roof and sidewalls where indicated on erection drawings.
 1. Tighten rod and cable bracing to avoid sag.
 2. Locate interior end-bay bracing only where indicated.
 - I. Framing for Openings: Provide shapes of proper design and size to reinforce openings and to carry loads and vibrations imposed, including equipment furnished under mechanical and electrical work. Securely attach to structural framing.
 - J. Erection Tolerances: Maintain erection tolerances of structural framing within AISC 303.
- 3.4 METAL PANEL INSTALLATION, GENERAL
- A. Examination: Examine primary and secondary framing to verify that structural-panel support members and anchorages have been installed within alignment tolerances required by manufacturer.
 1. Examine roughing-in for components and systems penetrating metal panels, to verify actual locations of penetrations relative to seams before metal panel installation.
 - B. General: Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.
 1. Field cut metal panels as required for doors, windows, and other openings. Cut openings as small as possible, neatly to size required, and without damage to adjacent metal panel finishes.
 - a. Field cutting of metal panels by torch is not permitted unless approved in writing by manufacturer.
 2. Install metal panels perpendicular to structural supports unless otherwise indicated.
 3. Flash and seal metal panels with weather closures at perimeter of openings and similar elements. Fasten with self-tapping screws.
 4. Locate and space fastenings in uniform vertical and horizontal alignment.
 5. Locate metal panel splices over structural supports with end laps in alignment.
 6. Lap metal flashing over metal panels to allow moisture to run over and off the material.
 - C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with corrosion-resistant coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by metal roof panel manufacturer.
 - D. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of metal panel assemblies. Provide types of gaskets, fillers, and

sealants indicated; or, if not indicated, provide types recommended by metal panel manufacturer.

1. Seal metal panel end laps with double beads of tape or sealant the full width of panel. Seal side joints where recommended by metal panel manufacturer.
2. Prepare joints and apply sealants to comply with requirements in Section 07 92 00 "Joint Sealants."

3.5 METAL ROOF PANEL INSTALLATION

- A. General: Provide metal roof panels of full length from eave to ridge unless otherwise indicated or restricted by shipping limitations.
1. Flash and seal metal roof panels with weather closures at eaves and rakes. Fasten with self-tapping screws.
- B. Standing-Seam Metal Roof Panels: Fasten metal roof panels to supports with concealed clips at each standing-seam joint, at location and spacing and with fasteners recommended by manufacturer.
1. Install clips to supports with self-drilling or self-tapping fasteners.
 2. Install pressure plates at locations indicated in manufacturer's written installation instructions.
 3. Seamed Joint: Crimp standing seams with manufacturer-approved motorized seamer tool so that clip, metal roof panel, and factory-applied sealant are completely engaged.
 4. Rigidly fasten eave end of metal roof panels and allow ridge end free movement for thermal expansion and contraction. Predrill panels for fasteners.
 5. Provide metal closures at peaks and rake walls .
- C. Metal Fascia Panels: Align bottom of metal panels and fasten with blind rivets, bolts, or self-drilling or self-tapping screws. Flash and seal metal panels with weather closures where fasciae meet soffits, along lower panel edges, and at perimeter of all openings.
- D. Metal Roof Panel Installation Tolerances: Shim and align metal roof panels within installed tolerance of 1/4 inch in 20 feet on slope and location lines and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.6 METAL WALL PANEL INSTALLATION

- A. General: Install metal wall panels in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to girts, extending full height of building, unless otherwise indicated. Anchor metal wall panels and other components of the Work securely in place, with provisions for thermal and structural movement.
1. Unless otherwise indicated, begin metal panel installation at corners with center of rib lined up with line of framing.
 2. Shim or otherwise plumb substrates receiving metal wall panels.
 3. When two rows of metal panels are required, lap panels 4 inches minimum.
 4. When building height requires two rows of metal panels at gable ends, align lap of gable panels over metal wall panels at eave height.
 5. Rigidly fasten base end of metal wall panels and allow eave end free movement for thermal expansion and contraction. Predrill panels.
 6. Flash and seal metal wall panels with weather closures at eaves and rakes, and at perimeter of all openings. Fasten with self-tapping screws.
 7. Install screw fasteners in predrilled holes.
 8. Install flashing and trim as metal wall panel work proceeds.
 9. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete, and elsewhere as indicated on Drawings; if not indicated, as necessary for waterproofing.
 10. Align bottom of metal wall panels and fasten with blind rivets, bolts, or self-drilling or self-tapping screws.
 11. Provide weatherproof escutcheons for pipe and conduit penetrating exterior walls.

- B. Insulated Metal Wall Panels: Install insulated metal wall panels on exterior side of girts. Attach panels to supports at each panel joint using concealed clip and fasteners at maximum 42 inches o.c., spaced not more than manufacturer's recommendation. Fully engage tongue and groove of adjacent insulated metal wall panels.
 - 1. Install clips to supports with self-tapping fasteners.
 - 2. Apply continuous ribbon of sealant to panel joint on concealed side of insulated metal wall panels as vapor seal; apply sealant to panel joint on exposed side of panels as weather seal.
- C. Installation Tolerances: Shim and align metal wall panels within installed tolerance of 1/4 inch in 20 feet, noncumulative; level, plumb, and on location lines; and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.7 THERMAL INSULATION INSTALLATION - ROOF

- A. General: Install insulation concurrently with metal panel installation, in thickness indicated to cover entire surface, according to manufacturer's written instructions.
 - 1. Basis-of-Design - Roof: Varco-Pruden Thermodeck Roof System, including multi-purpose deck liner.

3.8 DOOR AND FRAME INSTALLATION

- A. General: Install doors and frames plumb, rigid, properly aligned, and securely fastened in place according to manufacturers' written instructions. Coordinate installation with wall flashings and other components. Seal perimeter of each door frame with elastomeric sealant used for metal wall panels.
- B. Personnel Doors and Frames: Install doors and frames according to NAAMM-HMMA 840. Fit non-fire-rated doors accurately in their respective frames, with the following clearances:
 - 1. Between Doors and Frames at Jambs and Head: 1/8 inch.
 - 2. Between Edges of Pairs of Doors: 1/8 inch.
 - 3. At Door Sills with Threshold: 3/8 inch.
 - 4. At Door Sills without Threshold: 3/4 inch.
- C. Door Hardware:
 - 1. Install surface-mounted items after finishes have been completed at heights indicated in DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
 - 2. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
 - 3. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
 - 4. Set thresholds for exterior doors in full bed of sealant complying with requirements for concealed mastics specified in Section 07 92 00 "Joint Sealants."

3.9 ACCESSORY INSTALLATION

- A. General: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
 - 1. Install components required for a complete metal roof panel assembly, including trim, copings, ridge closures, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
 - 2. Install components for a complete metal wall panel assembly, including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
 - 3. Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with corrosion-resistant coating, by applying

rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by manufacturer.

- B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
 - 1. Install exposed flashing and trim that is without excessive oil-canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
 - 2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).
 - C. Gutters: Join sections with riveted-and-soldered or lapped-and-sealed joints. Attach gutters to eave with gutter hangers spaced as required for gutter size, but not more than 36 inches o.c. using manufacturer's standard fasteners. Provide end closures and seal watertight with sealant. Provide for thermal expansion.
 - D. Downspouts: Join sections with 1-1/2-inch telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch away from walls; locate fasteners at top and bottom and at approximately 60 inches o.c. in between.
 - 1. Provide elbows at base of downspouts to direct water away from building.
 - 2. Tie downspouts to underground drainage system indicated.
 - E. Circular Roof Ventilators: Set ventilators complete with necessary hardware, anchors, dampers, weather guards, rain caps, and equipment supports. Mount ventilators on flat level base. Install preformed filler strips at base to seal ventilator to metal roof panels.
 - F. Continuous Roof Ventilators: Set ventilators complete with necessary hardware, anchors, dampers, weather guards, rain caps, and equipment supports. Join sections with splice plates and end-cap skirt assemblies where required to achieve indicated length. Install preformed filler strips at base to seal ventilator to metal roof panels.
 - G. Louvers: Locate and place louver units level, plumb, and at indicated alignment with adjacent work.
 - 1. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.
 - 2. Provide perimeter reveals and openings of uniform width for sealants and joint fillers.
 - 3. Protect galvanized- and nonferrous-metal surfaces from corrosion or galvanic action by applying a heavy coating of corrosion-resistant paint on surfaces that will be in contact with concrete, masonry, or dissimilar metals.
 - 4. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Section 07 92 00 "Joint Sealants" for sealants applied during louver installation.
 - H. Roof Curbs: Install curbs at locations indicated on Drawings. Install flashing around bases where they meet metal roof panels.
 - I. Pipe Flashing: Form flashing around pipe penetration and metal roof panels. Fasten and seal to panel as recommended by manufacturer.
- 3.10 FIELD QUALITY CONTROL
- A. Special Inspections: Engage a qualified third-party special inspector to perform field quality control special inspections and to submit reports.

- B. Product will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

3.11 ADJUSTING

- A. Doors: After completing installation, test and adjust doors to operate easily, free of warp, twist, or distortion.
- B. Door Hardware: Adjust and check each operating item of door hardware and each door to ensure proper operation and function of every unit. Replace units that cannot be adjusted to operate as intended.
- C. Roof Ventilators: After completing installation, including work by other trades, lubricate, test, and adjust units to operate easily, free of warp, twist, or distortion as needed to provide fully functioning units.
 - 1. Adjust louver blades to be weathertight when in closed position.

3.12 CLEANING AND PROTECTION

- A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A780/A780M and manufacturer's written instructions.
- B. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.
- C. Touchup Painting:
 - 1. After erection, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted structural framing[, **bearing plates,**] and accessories.
 - a. Clean and prepare surfaces by SSPC-SP 2, "Hand Tool Cleaning," or by SSPC-SP 3, "Power Tool Cleaning."
 - b. Apply a compatible primer of same type as shop primer used on adjacent surfaces.
 - 2. Cleaning and touchup painting are specified in Section 09 91 13 "Exterior Painting" and Section 09 91 23 "Interior Painting."
- D. Metal Panels: Remove temporary protective coverings and strippable films, if any, as metal panels are installed. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.
 - 1. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 13 34 19

SECTION 22 01 00 - BASIC PLUMBING REQUIREMENTS**PART 1 - GENERAL****1.1 CONTRACT DOCUMENTS**

- A. Unless otherwise modified, provisions of General Conditions, Supplementary Conditions and Division-01 govern work under the Plumbing Divisions.
- B. Contract drawings for plumbing work are diagrammatic, intended to convey scope and general arrangement. Contractor shall review and coordinate routing of new work to clear existing piping, electrical, structure, etc. at no cost to the Owner. All dimensions of existing conditions shall be considered approximate (for information only). All dimensions shall be verified prior to construction.
- C. Contract Document Interpretation/Discrepancies:
 - 1. Should the Contractor discover any discrepancies or omissions on the drawings or in the specifications, he shall notify the Architect/Engineer (A/E) of such conditions prior to the bid date. Otherwise, it will be understood that the drawings and specifications are clear as to what is intended and shall be as interpreted by the A/E.
 - 2. In addition, should any contradiction, ambiguity, inconsistency, discrepancy or conflict appear in or between any of the Contract Documents, the Contractor, shall, before proceeding with the work in question, notify the A/E and request an interpretation. In no case shall he proceed with the affected work until advised by the A/E.
 - 3. If the Contractor fails to make a request for interpretation of discrepancies or conflicts in the drawings or specifications, no excuse will be accepted for failure to carry out the work in a satisfactory manner, as interpreted by the A/E. In all cases, the Contractor will be deemed to have estimated the most stringent materials and methods (i.e. the highest quality materials and most expensive manner of completing the work) unless he has requested and obtained written authorization as to which methods or materials will be required.
 - 4. Each and every trade or subcontractor will be deemed to have familiarized himself with all drawings of this project, including Site/Civil, Architectural, Structural, Mechanical, Electrical, Information Technology, etc. so as to avoid coordination errors, omissions, and misinterpretations. No additional compensation will be authorized for alleged errors, omissions, and misinterpretation, whether they are a result of failure to observe these requirements or not.
- D. The complete set of Architectural, Structural, Civil, Mechanical, and Electrical drawings and specifications apply to this work.

1.2 SCOPE

- A. The work in Division-22 includes furnishing and installing the plumbing systems complete and ready for satisfactory service.
- B. Requirements specified govern work in all sections of Division-22.

1.3 REFERENCES

- A. References to standards, codes, catalogs and recommendations are latest edition in effect on date of invitation to bid.
- B. Refer to applicable contract drawings, specifications and addenda pertaining to other divisions for conditions affecting work.
- C. Refer to Division-01 for description of alternates.
- D. Refer to Division-01 for description of allowance items.
- E. Refer to Division-01 for description of base bid items.

- F. Refer to Division-01 for description of demolition items.

1.4 DEFINITIONS

- A. Following are definitions of terms and expressions used in this Division:

1. "Approve" - to permit use of material, equipment or methods conditional upon compliance with contract document requirements.
2. "Concealed" - hidden from normal sight; includes work in crawl spaces, above ceilings, and in building shafts.
3. "Directed" - directed by Engineer.
4. "Equal, equivalent" - possessing the same performance qualities and characteristics and fulfilling the same utilitarian function.
5. "Exposed" - not concealed.
6. "Indicated" - indicated in Contract Documents.
7. "Piping" - includes pipe, fittings, valves, supports and accessories comprising a system.
8. "Provide" - furnish and install.
9. "Removable" - detachable from the structure or system without physical alteration of materials or equipment or disturbance to other construction.
10. "Review" - limited observation or checking to ascertain general conformance with design concepts and general compliance with contract document requirements. Such action does not constitute a waiver or alteration of the contract requirements. Verification of quantities and dimensions shall be the responsibility of the Contractor.
11. "Appurtenances" - a device or assembly installed in the referenced system which performs some useful referenced function in the operation, maintenance, servicing, economy or safety of the system. Some examples include, but are not limited to aerators, anchors, supports, gauges, backflow preventers, expansion tanks, filters, flow controls, heat exchangers, interceptors, meters, pressure reducing valves, relief valves, dampers, separators and similar devices.
12. "Record Documents" - drawings, plans and specifications that indicate the nature and location of work reported by Contractors, but not verified by Consultant. Record documents cannot be considered reliable; as they are based on information reported by the Contractor only and is not verified by the Architect or Engineer (A/E).

1.5 RIGGING REQUIREMENTS

- A. Prior to bidding, the Contractor shall verify that all equipment can be physically rigged to the proposed location without disturbance or dismantling of any existing or new physical obstacles. Should the rigging of any new equipment appear to be an issue, the Contractor shall inform the Architect or Engineer (A/E) seven (7) days prior to the bid date that the rigging of the new equipment may present a problem. Otherwise, the Contractor shall, in accordance with the manufacturer's approval and without voiding warranties and/or certifications, have the equipment "broken down" into sections as required to install the equipment in its proposed location without disturbance or dismantling of any existing or new physical obstacles.
- B. Failure to inform the Architect or Engineer (A/E) seven (7) days prior to the bid of any rigging problems will result in the Contractor accepting full responsibility for all modifications to the equipment or the physical obstacles required to install the equipment in its proposed location without additional cost to the Owner.

1.6 CONTRACTOR'S INSTALLATION DRAWINGS

- A. Prior to fabrication and installation, submit shop drawings (min. scale - 1/4" = 1' - 0") illustrating all plumbing piping, lighting fixtures, cable tray, conduit, expansion loops, supports, alignment guides and fire protection coordinated with each other and with the structure. Installation drawings shall be reviewed by Owner's representative prior to fabrication and installation of any new work and prior to the ordering of any plumbing equipment.
- B. Should the Contractor not provide the coordinated installation drawings required above, the following shall apply:

1. The Contractor shall accept full and absolute responsibility for the coordination of all project materials and equipment to be installed as indicated on the contract documents.
 2. Proposed change orders and/or time extensions will not be accepted for any additional work that results from coordination related changes.
 3. A credit shall be issued to the Owner for the value of the coordinated installation drawings; the value of the credit to the Owner shall be as determined by the A/E.
- C. Electronic files (AutoCad or Revit) of mechanical, electrical and plumbing (MEP) drawings may be made available upon receipt of a signed copy of the Engineer's Electronic Document Disclaimer (available upon request). The electronic files shall not be utilized for the preparation of coordination/installation/fabrication shop drawings. Coordination/installation/fabrication shop drawings shall be created independently from the electronic MEP files (i.e. AutoCad drawings and/or Revit model). Please note: the electronic MEP Revit model (where applicable) was created at a level of detail similar to BIM LOD 300; however, some MEP elements were modified to provide clarity and legibility to the two-dimensional construction documents. In addition, the electronic files may include delegated design elements that may differ as a result of the final delegated design to be completed by the Contractor (this may include all disciplines including architectural, structural, etc.). Modifications of the MEP systems to accommodate those delegated design elements shall be provided by the Contractor at no additional cost to the Owner.

1.7 MATERIAL, EQUIPMENT AND SUBSTITUTION REQUIREMENTS

- A. Use products of one manufacturer where two or more items of same kind of equipment are required.
- B. Materials and equipment shall have a record of two (2) years successful field use.
- C. Where a specific manufacturer is listed on the drawings, that manufacturer shall be considered the basis of design for that particular item of equipment. Only the basis of design manufacturer has been verified to meet the project requirements (i.e. dimensions, weights, service clearances, electrical requirements, etc.).
- D. Where the drawings and/or specifications indicate more than one manufacturer for a particular item of equipment, only those listed may submit products and services to be included in the work; manufacturers other than those listed will not be acceptable. Should the contractor choose to use one of the specified manufacturers other than the basis of design, it shall be the responsibility of the contractor to verify that the equipment meets all project requirements including, but not limited to, verification of all dimensions, weights, service clearances, electrical requirements, etc. All changes incurred shall be the responsibility of the contractor and shall be provided at no additional cost to the owner.
- E. Substitutions must be submitted for consideration seven (7) days prior to the original bid date. Consideration of substitutions shall be at the sole discretion of the Engineer. Substitution submittals shall include all information required in the "Submittals" paragraph of this specification section, as well as all other requirements indicated through the Division-22 specifications. Substitutions will not mitigate, in any way, the Contractor's responsibility in complying with the coordination, contract requirements or design intent. Any additional electrical, structural or special requirements, etc. shall be the responsibility of the Contractor. Also, any additional cost incurred as a result of substitution shall be the responsibility of the Contractor.
- F. Nameplate: For each piece of power operated plumbing equipment provide a permanent operational data nameplate indicating manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and similar essential data. Locate nameplates in an accessible location.
- G. Where items of equipment are indicated as Base Bid on the bid form include in the Bid price the cost of providing the equipment upon which the specification is based. In addition, submit with bid for Owner's consideration the amount to be added or deducted from the base bid for other listed manufacturers' equipment. Owner will advise Contractor within forty-five (45) days after award of contract of his selection.

1.8 MATERIAL AND EQUIPMENT LIST

- A. Within thirty (30) days after award of the contract, submit for Engineer's review a list of subcontractors' and manufacturers' names for items proposed for this project.

1.9 SUBMITTALS

- A. Where the drawings and/or specifications indicate more than one allowable manufacturer for a particular piece of equipment and/or product, only those manufacturers indicated may submit products and services to be included in the work. Unless otherwise indicated, manufacturers other than those listed will not be acceptable.
- B. Submit shop drawings, manufacturer's data and certificates for equipment, materials and finish, and pertinent details for each system where specified in each individual section, and obtain approval before procurement, fabrication, or delivery of the items to the job site. Partial submittals are not acceptable and will be returned without review.
- C. Shop Drawings: Drawings shall include floor plans, sectional views, wiring diagrams, and installation details of equipment. Include equipment spaces identifying and indicating proposed location, layout and arrangement of items of equipment, control panels, accessories, piping, ductwork, and other items that must be shown to assure a coordinated installation. Wiring diagrams shall identify circuit terminals, and indicate the internal wiring for each item of equipment and the interconnection between each item of equipment. Drawings shall indicate adequate clearance for operation, maintenance, and replacement of operating equipment devices. If equipment is disapproved, drawings shall be revised to show acceptable equipment and be resubmitted. All equipment and/or products shall be submitted by an authorized factory representative of that particular product.
- D. Manufacturer's Data: Submittals for each manufactured item shall be manufacturer's descriptive literature of cataloged products, equipment drawings, diagrams, performance and characteristic curves, and catalog cuts.
- E. Standards Compliance: When materials or equipment must conform to the standards of organizations such as the American National Standards Institute (ANSI), American Society for Testing and Materials (ASTM), National Electrical Manufacturers Association (NEMA), American Society of Mechanical Engineers (ASME), American Gas Association (AGA), American Refrigeration Institute (ARI), and Underwriters' Laboratories (UL), proof of such conformance shall be submitted to the Engineer for review. If an organization uses a label or listing to indicate compliance with a particular standard, the label or listing will be acceptable evidence, unless otherwise specified in the individual sections. In lieu of the label or listing, the Contractor shall submit a certificate from an independent testing organization, which is competent to perform acceptable testing. The certificate shall state that the item has been tested in accordance with the specified organization's test methods and that the item conforms to the specified organization's standard. For materials and equipment whose compliance with organizational standards or specifications is not regulated by an organization using its own listing or label as proof of compliance, a certificate of compliance from the manufacturer shall be submitted for review. The certificate shall identify the manufacturer, the product, and the referenced standard and shall simply state that the manufacturer certifies that the product conforms to all requirements of the project specification and of the referenced standards listed.
- F. Contractor shall thoroughly review and stamp all submittals to indicate compliance with contract requirements prior to submission and coordinate installation requirements for equipment submitted, including a) the verification of equipment weights relative to the existing and/or new structural support system and b) the verification of equipment dimensions relative to existing and/or new architectural conditions. Contractor shall be responsible for correctness of all submittals.
- G. Submittals will be checked only for general conformance with the design concept and are subject to the original contract documents, as well as any corrections and comments noted. Comments noted, if any, will not be considered a complete list of all omissions, deviations and corrections necessary to meet the requirements of the contract documents. The contractor will be responsible

to confirm that the final product and installation will be in conformance with the contract documents in their entirety, including the responsibility to fully coordinate all work with other trades and to confirm the correctness of dimensions, quantities, and capacities. Submittal review does not authorize or constitute a change to the contract requirements and does not release the contractor of responsibility to conform to the contract requirements. Requirements of the contract are not waived by review of any and all substitutions. The contractor must fulfill the terms of the contract.

- H. Compliance Review Form: Each equipment submittal must include a Compliance Review Form formatted as follows:
1. Section 1: Certify that the submittal is in complete compliance with the plans and specifications, except for the numbered and footnoted deviations and exceptions as defined herein. Deviations or exceptions taken in a cover letter or by contradiction or omission shall not constitute a release from the requirement that the equipment be in complete compliance with the plans and specifications.
 2. Section 2: Provide a detailed paragraph by paragraph annotation of the specification with an individual "C", "D", or "E" noted in the margin, as follows:
 - a. "C" shall mean compliance with no exceptions. Provide a numbered footnote (i.e. C1, C2, C3, etc.) for each comment or clarification.
 - b. "D" shall mean compliance with deviations. For each deviation, provide a numbered footnote (i.e. D1, D2, D3, etc.) with a detailed explanation of how the intent of this specification is to be satisfied.
 - c. "E" shall mean exception. The equipment offered is not in compliance with the specifications. For each exception, provide a numbered footnote (i.e. E1, E2, E3, etc.) with a detailed description of the exception.
- I. Electronic Submittals: Should the contractor elect to submit electronic shop drawings/submittals, the procedure shall be as follows:
1. Provide a transmittal with the electronic shop drawing/submittal indicating that the document was transmitted electronically. Transmittal shall also include verification of the contractor's review indicating compliance with the contract documents in accordance with paragraph 1.09.F of this section.
 2. Sequentially number all pages on the electronic shop drawing/submittal. The total number of pages shall be reflected in the transmittal.
 3. Submittal review comments shall be transmitted electronically. Large documents will be scanned with comments as necessary and returned electronically.
 4. All shop drawings such as, but not limited to: coordination drawings, ductwork shop drawings, fire alarm drawings, ductbank layouts, etc. shall be submitted in hard copy, full size format.
 5. Provide hard copy of the shop drawing/submittal for each of the Operations and Maintenance Manuals.
 6. Failure to comply with the above will result in the submittal being returned and marked "Not Reviewed".
- J. Submittals will be reviewed for general compliance with design concept in accordance with contract documents. Dimensions, quantities, weights, or other details will not be verified by the A/E; this is the responsibility of the Contractor.
- K. Acceptance will not constitute waiver of contract requirements unless deviations are specifically indicated and clearly noted.
- L. Review Period: BKM shall be allotted two (2) weeks for the processing, review and return of all submittals. It shall be incumbent upon the Contractor to include this time period in their schedule.
1. Resubmittals: BKM shall be allotted an additional two weeks (14 days) for the review of each resubmittal. Again, it shall be the Contractor's responsibility to submit the appropriate materials in a timely fashion.
 2. Contract Extension: No extension in contract time will be authorized as a result of the timeline addressed above.

M. Submittal Identifications:

1. Place a permanent label or title block on each submittal for identification.
2. Indicate name of firm or entity that prepared each submittal on label or title block.
3. Provide a space approximately 4 by 5 inches on label or beside title block to record contractor's review and approval markings and action taken by A/E.
4. Include the following information on label for processing and recording action taken:
 - a. Project name
 - b. Date
 - c. Name and address of A/E
 - d. Name and address of contractor
 - e. Name and address of subcontractor
 - f. Name and address of supplier
 - g. Name of manufacturer
 - h. Unique identifier, including revision number
 - i. Number and title of appropriate specification section
 - j. Drawing number and detail references, as appropriate
 - k. Other necessary identification
 - l. Example: 220700-01-0
 - 1) 220700 references the spec section
 - 2) 01 indicates this is the first submittal from this spec section
 - 3) 0 indicates this is the original submittal (where 1 would indicate this is the first re-submittal)

N. The engineer will provide a maximum of two (2) submittal reviews per equipment submittal; the initial review plus one (1) re-submittal. Should the re-submittal be returned "Not Acceptable" or "Revise and Resubmit", the contractor shall choose one of the following courses of action:

1. Provide the exact manufacturer and model indicated in the contract documents as the basis of design, or
2. Reimburse the engineer for all additional review time required to achieve a submittal review from the engineer of "No Exceptions Taken."
3. Should the contractor choose option 2 above, the engineer shall be reimbursed at an hourly rate of \$175 per hour with payment due prior to the return of the final submittal. In addition, the contractor shall accept complete responsibility for all delays resulting from the submittal review process extending beyond two (2) reviews per equipment submittal.

O. Resubmittals: Resubmittals shall comply with paragraph 1.09 of this section and the following additional requirements.

1. Resubmittals shall include a written response to each submittal comment. Provide a detailed comment by comment annotation of the submittal review comments with an individual "C", "D", or "E" as follows:
 - a. "C" shall mean compliance with no exceptions. Provide a numbered footnote (i.e. C1, C2, C3, etc.) for each comment or clarification.
 - b. "D" shall mean compliance with deviations. For each deviation, provide a numbered footnote (i.e. D1, D2, D3, etc.) with a detailed explanation of how the intent of this specification is to be satisfied.
 - c. "E" shall mean exception. The equipment offered is not in compliance with the specifications. For each exception, provide a numbered footnote (i.e. E1, E2, E3, etc.) with a detailed description of the exception.

1.10 MANUFACTURER'S RECOMMENDATIONS

- A. Installation procedures are required to be in accordance with the recommendations of the manufacturer of the material being installed.

1.11 ACCESSIBILITY

- A. Install equipment and materials to provide required access for servicing and maintenance. Coordinate the final location of concealed equipment and devices requiring access with final location of required access panels and doors. Allow ample space for removal of all parts that require replacement or servicing.

1.12 SAFETY REQUIREMENTS

- A. Belts, pulleys, chains, gears, couplings, projecting setscrews, keys, and other rotating parts located so that any person can come in close proximity thereto shall be fully enclosed or properly guarded in accordance with OSHA. High-temperature equipment and piping so located as to endanger personnel or create a fire hazard shall be properly guarded or covered with insulation of a type as specified herein. Items such as catwalks, ladders, and guardrails shall be provided where required for safe operation and maintenance of equipment.

1.13 WORKMANSHIP

- A. Remove and replace, at no extra cost, all work not orderly, reasonably neat, or workmanlike.
- B. Coordinate all work and cooperate with other trades to facilitate execution of work.

1.14 SITE EXAMINATION/EXISTING CONDITIONS VERIFICATION

- A. Failure to visit site and become familiar with existing conditions prior to bidding will not relieve the Contractor of responsibility for complying with the Contract documents.
- B. Contractor shall field verify existing services and direction of flow of piping prior to connection. Existing plumbing identification shall not constitute proper verification of service or direction of flow.

1.15 REGULATIONS AND PERMITS

- A. Comply with all applicable codes and regulations.
- B. All equipment provided shall be in accordance with all applicable local, state, and federal codes, guidelines and standards, as well as the authority having jurisdiction. Equipment and installation shall be in compliance with all applicable energy codes including the most current version of ASHRAE Standard 90.1.
- C. Obtain and pay for all required permits.

1.16 UTILITY CONNECTIONS

- A. Area connection charges for water and sewers will be paid by the Owner.
- B. Application for water meter will be made by the Owner.
- C. Contractor shall include an allowance as identified in Division-01 for providing water meter, vault, and connection to main by Bureau of Water Supply.

1.17 CUTTING AND PATCHING

- A. Unless otherwise directed, do all cutting and patching. Damaged work, including fireproofing and waterproofing shall be repaired by skilled mechanics of the trade involved.
- B. Do not cut walls, floors, roofs, reinforced concrete or structural steel without structural Engineer's permission. Install services without affecting reinforcing steel.
- C. In precast concrete plank drill all holes with a Carboloy tipped drill. Follow instructions of structural Engineer. Cut no reinforcing bars.

1.18 LINTELS

- A. Under this Section provide all lintels not provided elsewhere which are required for openings for the installations of mechanical and plumbing work. Lintels shall meet the requirements of the structural sections.

1.19 CLEANING UP

- A. Keep premises free from accumulation of debris.
- B. Remove tools, scaffolding, surplus material, debris, and leave premises broom clean.
- C. On discontinuance of part of the work, place all debris in containers and promptly remove them from the Owner's property.
- D. Leave all areas broom clean.
- E. Final clean-up shall be performed.

1.20 AREAS REQUIRING SPECIAL FINISHES/PAINTING

- A. In kitchens, cafeterias, dining rooms, serving pantries and utility rooms [polish chromium or nickel plate] [paint as specified under Painting] all exposed and uninsulated piping including valves, traps, strainers and appurtenant items; and exposed electrical work including conduit, boxes, switches starters and disconnects. Finish shall not be applied to nameplates, pushbuttons. Stainless steel housing and plates require no plating or paints.
- B. Provide surface preparation, priming and painting of all mechanical room floors to provide a smooth, cleanable surface. Primer and paint shall be appropriate for concrete slab surfaces. Where painting over existing surfaces or coatings, follow manufacturer's recommendations for surface preparation, priming and painting. Architectural section "Painting" shall govern the painting installation. Color shall be selected by Architect.

1.21 PROTECTION

- A. Protect mechanical and electrical material and equipment from the elements or other injury as soon as delivered on premises. Protect fixtures as soon as they are set. Board over water closets and post notices prohibiting their use.
- B. Cap or plug openings in equipment, piping and conduit systems to exclude dirt and other foreign material. Rags, wool, cotton, paper, waste or similar materials shall not be used for plugging.
- C. Contractor shall protect all existing mechanical, electrical and architectural equipment, materials, finishes, etc. located within or adjacent to the work environment. Contractor shall be responsible for restoration of all existing mechanical, electrical and architectural items to remain. All equipment to remain must be restored to its pre-existing condition prior to the start of work. Restoration and/or replacement shall be at no cost to the Owner.
- D. Contractor shall provide temporary cooling and heating as required to protect all construction materials from the potential adverse effects of high or low temperature and humidity. Upon delivery of ceiling and other finish materials to a location within the building, environmental conditions in all spaces where the materials will be either stored or installed shall be permanently maintained at 75°F (+2°F) and 50% RH (+5%). Should the HVAC include a reheat system, the reheat system shall be energized to provide temperature and humidity control whenever the HVAC system is energized. Contractor shall pay for all utility, fuel, operational, maintenance and repair costs associated with providing the environmental conditions indicated above until the owner accepts occupancy of the building.

1.22 PIPE TESTING

- A. Prior to the balancing of systems, the mechanical contractor shall air and/or hydrostatically test the following systems in accordance with the latest ASME B31 (ASME Code for Pressure Piping) and NFPA requirements.

1. Air Test:
 - a. Air, Gas and Vacuum
 2. Hydrostatic Test:
 - a. Domestic Water
 - B. Pressure tests shall also be performed prior to the installation of all insulation materials.
 - C. Hydrostatic Test: Provide temporary equipment for testing, including pump and gages. Test piping system before insulation is installed, wherever feasible and remove control devices before testing. Test each natural section of each piping system independently, but do not use piping system valves to isolate sections where test pressure exceeds valve pressure rating. Fill each section with water and pressurize for indicated pressure and time.
 1. Required test period is four (4) hours.
 2. Hydrostatically test each piping system at 150% of operating pressure indicated, but not less than 100 psi (690 kPa) test pressure.
 3. Observe each test section for leakage at end of test period. Test fails if leakage is observed or if pressure drop exceeds less than one percent (1.0%) of test pressure.
 4. Upon completion of roughing-in and before setting fixtures, the entire new domestic water system shall be tested. Where a portion of the water piping system is to be concealed before completion, this portion shall be tested separately in a manner described for the entire system.
 5. Prior to testing, verify the pressures listed above are in accordance with the latest ASME B31 code and NFPA. Should a discrepancy exist between the ASME B31 code, NFPA, and/or the pressures indicated above, contact the Engineer prior to testing.
 - D. Air Test:
 1. Air, gas and vacuum piping shall be air tested at 200 psi (1380 kPa).
 2. Prior to testing, verify the pressures listed above are in accordance with the latest ASME B31 code and NFPA. Should a discrepancy exist between the ASME B31 code, NFPA, and/or the pressures indicated above, contact the Engineer prior to testing.
 - E. Sanitary and Storm Water Piping Systems:
 1. All soil, waste, vent and storm water piping shall be tested by the Contractor and reviewed by the Architect before acceptance. All piping located underground shall be tested before backfilling. The costs of all equipment required for tests are to be included under the contract price.
 2. The entire new drainage system and venting system shall have all necessary openings plugged and filled with water to the level of the highest vent stack above the roof. The system shall hold this water for four (4) hours without showing a drop in water level. Where a portion of the system is to be tested, the test shall be conducted in the same manner as described for the entire system, except a vertical stack 10 feet (3000 mm) above the highest horizontal line to be tested may be installed and filled with water to maintain sufficient pressure, or a pump may be used to supply the required pressure.
 - F. Drain test water from piping systems after testing and repair work has been completed.
 - G. Repair piping systems sections which fail required piping test, by disassembly and re-installation, using new materials to extent required to overcome leakage. Do not use chemicals, stop-leak compounds, mastics, or other temporary repair methods.
- 1.23 CLEANING OF SYSTEMS
- A. After satisfactory completion of pressure tests and before permanently connecting fixtures, equipment, traps, strainers and other accessory items, thoroughly clean all systems. Blow out and flush piping until interiors are free of foreign matter.
 - B. Flush piping in recirculating water systems to remove all cutting oil, excess pipe joint compound and other foreign materials. Furnish necessary temporary pumping equipment to thoroughly clean

the water piping. Do not use any system pump until after cleaning and flushing has been accomplished to the satisfaction of the Engineer. Employ chemical cleaners, including a non-foaming detergent, not harmful to system components. After cleaning operation, final flushing and refilling the residual alkalinity shall not exceed 300 parts per million. Work shall be performed or supervised by a qualified water treatment service company with personnel skilled in the safe and proper use of chemicals and in testing procedures. After completion, submit a certificate of completion to Engineer stating name of the service company used.

- C. Leave strainers and dirt pockets in clean condition.
- D. Should any system become clogged with construction refuse after acceptance, the contractor shall pay for all labor and materials required to locate and remove the obstruction and replace and repair work disturbed.
- E. Thoroughly clean plumbing fixture using non-scratching cleaners. Polish chromium plated work.
- F. Leave all systems clean, and in complete running order.
- G. Disinfect potable water systems as prescribed by local code. Take precautions to avoid use of fixtures during disinfection period.
- H. Equipment that has been subjected to the elements shall be cleaned of all rust, dirt and debris and repainted to match original finish.

1.24 FUNCTIONAL PERFORMANCE TESTING AND VERIFICATION

- A. General: In addition to the tests required during and after installation of all mechanical systems, as well as any other formal commissioning requirements, the Contractor shall perform functional performance tests to verify that all systems are designed, installed, calibrated and adjusted to perform as required in the Contract.
- B. Comply with all applicable specification sections including, but not be limited to, "Basic Plumbing Requirements", "Testing, Adjusting and Balancing", "Automatic Temperature Controls" and "Commissioning", where applicable.
- C. Prior to functional performance testing, all indicating, recording and control devices shall be calibrated. A verification calibration report shall be provided with the final test report.
- D. Provide functional performance testing to verify proper operation of each and every control sequence indicated throughout the contract documents.
- E. Failure of Tests: Should any test, verification, or demonstration fail to meet the specification requirements, the component of the system causing the failure shall be repaired, replaced or readjusted. The failed test, verification, or demonstration shall then be repeated.
- F. A "Functional Performance Test Verification Form" is included at the end of Section 230900. This form (electronic version is available upon request) shall be completed for all mechanical equipment provided under this contract.
- G. Test Report: Upon satisfactory verification of calibration and functional performance tests, a copy of the final test results shall be bound in the operations and maintenance manual. The final report shall also include a full compliance statement, on company letterhead, indicating that all systems are installed and functioning per the contract requirements including drawings, specifications, control sequences and accepted submittals.
- H. The mechanical systems shall not be considered complete until all functional performance verification forms, calibration reports and compliance statement have been submitted and reviewed. Submit in accordance with the submittal requirements indicated elsewhere in these specifications.

1.25 OPERATING AND MAINTENANCE MANUAL

- A. Submit Operation and Maintenance Manuals in three-ring binders with each section separated by tab dividers. Include protective plastic sleeves for any software or folded large documents submitted.

B. At a minimum, the manual shall contain the following:

1. Title page
2. Table of contents
3. Contractor and sub-contractor contact information
4. Supplier contact information for all plumbing equipment
5. Copies of manufacturer's and contractor's warranty information (project and equipment) for all plumbing equipment.
6. Submittal log for all plumbing equipment
7. One (1) reviewed copy of each shop drawing or submittal incorporating all A/E and owner submittal review comments.
8. Copy of inspector acceptance certificates / documents.
9. Provide an 11 x 17 fold-out drawing of each floor plan and indicate locations of system shutoff valves.
10. All pipe and equipment pressure test reports complete with 11 x 17 fold-out drawing, indicating all systems tested.
11. Maintenance procedures for each item of plumbing equipment to include frequency and type of maintenance, spare parts and attic/stock list. This shall include the manufacturer's literature indicating operating and maintenance instructions, parts list, illustrations and diagrams.
12. Valve tag chart
13. Mechanical systems functional performance verification forms, calibration reports and compliance statement indicating that all systems are installed and functioning per the contract requirements.

C. The O & M Manuals shall be submitted to the A/E for review of general conformance.

1.26 TOOLS AND LUBRICANTS

- A. Furnish and turn over to the Owner, special tools not readily available commercially, that are required for disassembly or adjustment of equipment and machinery furnished.
- B. Grease Guns with Attachments for Applicable Fittings: One for each type of grease required for each motor or other equipment.
- C. Tool Containers: Hardwood or metal, permanently identified for intended service and mounted, or located, where directed by the Owner.
- D. Lubricants: A minimum of one quart (.9 L) of oil, and one pound (450 g) of grease, of equipment manufacturer's recommended grade and type, in unopened containers and properly identified as to use for each different application.

1.27 FIELD INSTRUCTION

- A. Upon completion of work, instruct Owner's representative in the proper operation and maintenance of the plumbing and electrical systems.
- B. Instruction periods specified below shall be in addition to instruction specified for certain items elsewhere in the specifications.
- C. Instructions shall be given by persons expert in the operation and maintenance and shall be for a period of not less than . . . eight hour days.
- D. Prepare statement(s) for signing by Owner's representative indicating date of completion of instructions and hours expended. Furnish copy of signed statement to Engineer.
- E. Final demonstration of all plumbing equipment shall be recorded in DVD compatible format. Provide DVD's to the Owner.

1.28 RECORD DOCUMENTS

- A. The Contractor shall maintain a record set of plumbing prints at the project site and shall indicate thereon any changes made to the contract drawings, including, but not limited to addenda, field

sketches, RFI responses, supplemental drawings, sketches, etc. Where changes are made that are reflective of supplemental instructions, revisions, RFI responses, etc., the Contractor shall make clear references to those changes.

- B. A separate set of neat, legible mechanical contract prints shall be kept at the project site at all times during the construction of the work for the express purpose of showing any and all changes indicated in paragraph A. above. The prints shall be marked up daily showing all changes to the original documents. The prints shall be marked up in a neat, legible manner using a red pen. Periodic review of the Record Documents will be conducted by the Owner's Representative or A/E. Should this review indicate that the Record Documents are deficient or not up to date, the Contractor shall immediately bring the documents into compliance and make the corrections
- C. Upon completion of the project and before final close-out, the Contractor shall be responsible for producing a final set of record documents in electronic CADD format. One (1) set of full size prints, one (1) CD of the electronic CADD drawings (in AutoCad and pdf format), along with the red-lined marked up field set shall be delivered to the owner upon completion. If requested, the electronic CADD documents shall be up-loaded to the owner's FTP site. The final CADD documents shall indicate in the title or revision block "RECORD DOCUMENTS" along with the date completed. The electronic format shall be compatible with the owner's preferred version of AutoCad. Coordinate with the owner before producing the CD or up-loading to the FTP site. Not acceptable are contractor installation drawings, shop drawings or multi-layers of work on a single drawing. The final as-built product shall mirror the contract bid documents using the project page layout, format and project title block.
- D. Computer (CADD) files of plumbing drawings will be made available to the Contractor upon receipt of a signed waiver (available upon request). One CD will be made available to the general contractor or construction manager for distribution to the trades.
- E. Should the Contractor's electronic Record Documents not be considered complete, they will be returned for completion and/or correction.

1.29 DEMOLITION

- A. All demolition of existing mechanical and electrical piping, auxiliaries and equipment, shall be as specified under the Architectural "Demolition" section, of these specifications, as shown on the drawings, and as required to complete the new and renovated installations and shall be performed by the respective mechanical and electrical contractors.
- B. This work shall include the disconnection and capping of existing services, relocation of certain equipment, and the removal of existing piping, wiring, fittings, equipment, including heat transfer units, plumbing fixtures, electrical controls and panelboxes, etc., not reused in the new work or required to complete the renovation work. Contractor shall note the drawings specify certain existing equipment to be reused.
- C. Where supports and piping are removed, holes remaining in floors, walls and ceilings must be patched and refinished to match the adjoining original surfaces and finishes.
- D. Any removed items requested by the Owner shall remain the property of the Owner. Contractor shall remove equipment and store on site as directed by the Owner. All other equipment or material shall become the property of the Contractor and shall be removed from the site. Contractor shall meet Federal EPA Laws, Regulations and Guidelines in regard to removal of asbestos insulation.
- E. The contractor shall use care when performing selective building and site demolition. The contractor shall be responsible for damage inclusive of but not limited to: building finishes, lighting (interior and exterior), furniture, structure, site, utilities (above and below ground), mechanical, plumbing, telecommunications and electrical equipment / systems. Should any damage occur or should any remedial work be required, the contractor shall be responsible to repair and or replace the damaged item(s) to the Owner's satisfaction at no additional cost. The contractor shall be responsible for surveying (including contacting Miss Utility), photo documenting and restoring the surrounding work site(s) to the original pre-demolition condition and / or to the Owner's satisfaction upon completion of the work at no additional cost.

1.30 OUTAGES

- A. All plumbing outages which will interfere with the normal use of the building in any manner shall be done at such times as shall be mutually agreed upon by the Contractor and the Owner's Representative.
- B. Unless otherwise specified, outages of any services required for the performance of this contract and affecting areas other than the immediate work area shall be scheduled at least ten (10) days in advance with the Owner's Representative. All such outages shall be performed during other than normal duty hours.
- C. The Contractor shall include in his price the cost of all premium time required for outages and other work which interferes with the normal use of the building, which will be performed, in most cases, during other than normal work time and the convenience of the using agency.

1.31 LEAD FREE COMPLIANCE

- A. Lead Free Compliance: All components associated with potable water systems (including, but not limited to, valves, end use devices/fixtures, pipe, pipe fittings, solder/flux, etc.) shall be "lead-free" in accordance with all local, state and federal codes, as well as NSF/ANSI 372 (NSF 61-G).

1.32 GUARANTEE/WARRANTY

- A. Each Contractor shall furnish a guarantee covering all labor and materials furnished by him for a period of two (2) years from the date of final acceptance of his work, and he shall agree to repair and make good at his own expense any and all defects which may appear in his work during that time if, in the judgment of the Engineer, such defects arise from defective workmanship and/or imperfect or inferior material.
- B. The above shall not in any way void or abrogate equipment manufacturer's guarantee or warranty. Certificates of guarantee shall be delivered to the Owner.
- C. Within the two (2) year warranty/guarantee period, manufacturer's recommended maintenance shall be provided by the Contractor.

1.33 PIPING LEAKAGE TEST FORMS

- A. Contractor shall submit piping leakage test results to the A/E within 72 hours of completed tests. Only test results that meet the specified leakage requirements shall be submitted. Piping test results shall be recorded on the "Piping Leakage Test Summary Form (Plumbing)" located at the end of this section; no other forms will be accepted. In addition, the pipe leakage submittals shall include 11x17 drawing(s) as required to clearly indicate the full extent of the piping test section (each piping test section shall be numbered and color coded).

PART 2 - PRODUCTS

Not Applicable

PART 3 - EXECUTION

Not Applicable

END OF SECTION 22 01 00

PIPING LEAKAGE TEST SUMMARY FORM
(PLUMBING)

Project Name: _____ Project Number: _____ Page _____ of _____

System Tested	Sections Tested (1)	System Operating Pressure	Test Pressure (PSI/FT-HD) (2)	Duration (3)	Pressure Drop (4)	Pass/Fail

Name of Testing Agency/Company: _____

Date of Test(s): _____

Test Conducted By (Print/Sign): _____

- (1) Identified by an 11 x 17 numbered and color coded test section plan. Plan shall accompany this test report.
- (2) 150% of operating pressure but not less than 100 psi , 200 psi for air-gas-vacuum, 10 ft. static head pressure or to the maximum rating of the joint. Include joint cut sheets showing their ratings.
- (3) Four (4) hours minimum.
- (4) Shall not exceed 0.0%.

SECTION 22 05 00 - BASIC PLUMBING MATERIALS AND METHODS**PART 1 - GENERAL****1.1 CONTRACT DOCUMENTS**

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specification Sections, apply to this Section.
- B. Requirements specified in all Division-22 sections apply to this Section.

1.2 SUMMARY

- A. This Section includes limited scope general construction materials and methods for application with mechanical installations as follows:
 - 1. Mechanical equipment nameplate data.
 - 2. Firestopping: Provide seals for all openings through fire-rated walls, floors, or ceilings used as passage for mechanical and electrical components such as piping, conduit, etc.
 - 3. Selective demolition including:
 - a. Nondestructive removal of materials and equipment for reuse or salvage as indicated.
 - b. Dismantling mechanical materials and equipment made obsolete by these installations.
 - 4. Excavation for underground utilities and services, including underground piping (under the building and from building to utility connection), tanks, basins, and equipment up to five (5) feet (1500 mm) outside the building.
 - 5. Miscellaneous metals for support of mechanical materials and equipment.
 - 6. Wood grounds, nailers, blocking, fasteners, and anchorage for support of mechanical materials and equipment.
 - 7. Joint sealers for sealing around mechanical materials and equipment; and for sealing penetrations in fire and smoke barriers, floors, and foundation walls.
 - 8. Access panels and doors in walls, ceilings, and floors for access to mechanical materials and equipment.

1.3 DEFINITIONS

- A. The following definitions apply to excavation operations:
 - 1. Additional Excavation: Where excavation has reached required subgrade elevations, if unsuitable bearing materials are encountered, continue excavation until suitable bearing materials are reached. The Contract Sum may be adjusted by an appropriate Contract Modification.
 - 2. Subbase: As used in this Section refers to the compacted soil layer used in pavement systems between the subgrade and the pavement base course material.
 - 3. Subgrade: As used in this Section refers to the compacted soil immediately below the slab or pavement system.
 - 4. Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations or dimensions without specific direction from the Architect.
- B. The following definitions apply to firestopping:
 - 1. Assembly: Particular arrangement of materials specific to given type of construction described or detailed in referenced documents.
 - 2. Barriers: Time rated fire walls, smoke barrier walls, time rated ceiling/floor assemblies and structural floors.

3. Firestopping: Methods and materials applied in penetrations and unprotected openings to limit spread of heat, fire, gases and smoke.
4. Penetration: Opening or foreign material passing through or into barrier or structural floor such that full thickness of rated materials is not obtained.
5. Construction Gaps: Gaps between adjacent sections of walls, exterior walls, at wall tops between top of wall and ceiling, and structural floors or roof decks; and gaps between adjacent sections of structural floors.
6. System: Specific products and applications classified and numbered by Underwriters Laboratories, Inc. to close specific barrier penetrations.
7. Sleeve: Metal fabrication or pipe section extending through thickness of barrier and used to permanently guard penetration. Sleeves are described as part of penetrating system in other sections and may or may not be required.

1.4 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division-01 Specification Sections.
- B. Product data for the following products:
 1. Access panels and doors
 2. Joint sealers
- C. Firestopping: Indicate dimensions, description of materials and finishes, general construction, specific modifications, component connections, anchorage methods, hardware, and installation procedures.
 1. Provide details of each proposed assembly identifying intended products and applicable UL system number, or UL classified devices.
 2. Provide drawings relating to non-standard applications as needed.
- D. Shop drawings detailing fabrication and installation for metal fabrications, and wood supports and anchorage for mechanical materials and equipment.
- E. Coordination drawings for access panel and door locations in accordance with Division-22 sections.
- F. Samples of joint sealer, consisting of strips of actual products showing full range of colors available for each product.
- G. Welder certificates, signed by Contractor, certifying that welders comply with requirements specified under "Quality Assurance" article of this Section.
- H. Schedules indicating proposed methods and sequence of operations for selective demolition prior to commencement of Work. Include coordination for shut-off of utility services and details for dust and noise control.
 1. Coordinate sequencing with construction phasing and Owner occupancy specified in Division-01 Section "Summary of Work."

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an Installer for the installation and application of joint sealers, access panels and doors, and firestopping materials with at least two years' experience with installations.
- B. Qualify welding processes and welding operators in accordance with AWS D1.1 "Structural Welding Code - Steel."
- C. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.
- D. Fire-Resistance Ratings: Where a fire-resistance classification is indicated, provide access door assembly with panel door, frame, hinge, and latch from manufacturer listed in the UL "Building Materials Directory" for rating shown.

1. Provide UL Label on each fire-rated access door.
 - E. Local and State Regulatory Requirements: Submit forms or acceptance for proposed assemblies not conforming to specific UL firestop system numbers, or UL classified devices.
 - F. Lead Free Compliance: All components associated with potable water systems (including, but not limited to, valves, end use devices/fixtures, pipe, pipe fittings, solder/flux, etc.) shall be "lead-free" in accordance with all local, state and federal codes, as well as NSF/ANSI 372 (NSF 61- G).
- 1.6 DELIVERY, STORAGE AND HANDLING
- A. Deliver joint sealer materials in original unopened containers or bundles with labels informing about manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multi-component materials.
 - B. Store and handle joint sealer materials in compliance with the manufacturers' recommendations to prevent their deterioration and damage.
- 1.7 PROJECT CONDITIONS
- A. Conditions Affecting Selective Demolition: The following project conditions apply:
 1. Protect adjacent materials indicated to remain. Install and maintain dust and noise barriers to keep dirt, dust, and noise from being transmitted to adjacent areas. Remove protection and barriers after demolition operations are complete.
 2. Locate, identify, and protect mechanical services passing through demolition area and serving other areas outside the demolition limits. Maintain services to areas outside demolition limits. When services must be interrupted, install temporary services for affected areas.
 - B. Conditions Affecting Excavations: The following project conditions apply:
 1. Maintain and protect existing building services which transit the area affected by selective demolition.
 2. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by excavation operations.
 3. Site Information: Subsurface conditions were investigated during the design of the Project. Reports of these investigations are available for information only; data in the reports are not intended as representations or warranties of accuracy or continuity of conditions. The Owner will not be responsible for interpretations or conclusions drawn from this information.
 4. Existing Utilities: Locate existing underground utilities in excavation areas prior to excavation. If utilities are indicated to remain, support and protect services during excavation operations.
 5. Remove existing underground utilities indicated to be removed.
 6. Uncharted or Incorrectly Charted Utilities: Contact utility owner immediately for instructions.
 7. Provide temporary utility services to affected areas. Provide minimum of 48-hour notice to Architect prior to utility interruption.
 8. Use of explosives is not permitted.
 - C. Environmental Conditions: Apply joint sealers under temperature and humidity conditions within the limits permitted by the joint sealer manufacturer. Do not apply joint sealers to wet substrates.
- 1.8 SEQUENCE AND SCHEDULING
- A. Coordinate the shut-off and disconnection of utility services with the Owner and the utility company.
 - B. Notify the Architect at least five (5) days prior to commencing demolition operations.
 - C. Perform demolition in phases as indicated.

PART 2 - PRODUCTS

2.1 MECHANICAL EQUIPMENT NAMEPLATE DATA

- A. Nameplate: For each piece of power operated mechanical equipment provide a permanent operational data nameplate indicating manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and similar essential data. Locate nameplates in an accessible location.

2.2 FIRESTOPPING

- A. All penetrations through fire barriers shall be firestopped with an approved material that is capable of maintaining the fire resistance rating of the barrier. All firestop sealants shall conform to ASTM E 814, ASTM E 119, UL 1479, UL 2079 CAN/ULC S115, and CAN/ULC S101.
- B. Firestop material shall be latex based, intumescent caulk intended for use for all thru-penetrations with piping, cable trays, conduit, and cables.
- C. When exposed to high temperatures or fires, the caulk shall expand in volume to quickly close off voids left by melting or burning construction materials. Caulk shall be applied by a standard caulk gun and remain flexible after curing.
- D. Acceptable products shall be limited to Johns Manville "Firetemp-C1;" Hilti "FS-One;" or 3M "CP25WB+." Coordinate with General Contractor such that a single manufacturer/product is utilized throughout the project for all fire and smoke stopping materials.

2.3 SMOKE STOPPING

- A. All penetrations through smoke barriers, smoke partitions, or any other surface required to resist the passage of smoke shall be provided with a smoke stop sealant and/or system that has been independently tested to provide an acceptable smoke seal that will resist the passage of smoke. Smoke stop systems (including product and installation) shall conform to all applicable standards (including but not limited to ASTM, UL and NFPA), as well as all other local, state or federal requirements.
- B. Acceptable manufacturers shall be limited to the manufacturers that may provide firestopping materials/systems (see paragraph 2.02 of this section). Coordinate with the General Contractor such that a single manufacturer/product is utilized throughout the project for all fire and smoke stopping materials.

2.4 SOIL MATERIALS

- A. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, crushed slag, or natural or crushed sand.
- B. Drainage Fill: Washed, evenly graded mixture of crushed stone, or crushed or uncrushed gravel, with 100 percent passing a 1-1/2-inch (40 mm) sieve, and not more than 5 percent passing a No. 4 sieve.
- C. Backfill and Fill Materials: Materials complying with ASTM D2487 soil classification groups GW, GP, GM, SM, SW, and SP; free of clay, rock, or gravel larger than 2 inches (150 mm) in any dimension; debris; waste; frozen materials; and vegetable and other deleterious matter.

2.5 MISCELLANEOUS METALS

- A. Steel plates, shapes, bars, and bar grating: ASTM A 36.
- B. Cold-Formed Steel Tubing: ASTM A 500.
- C. Hot-Rolled Steel Tubing: ASTM A 501.
- D. Steel Pipe: ASTM A 53, Schedule 40, welded.
- E. Non-shrink, Non-metallic Grout: Premixed, factory-packaged, non-staining, non-corrosive, non-gaseous grout, recommended for interior and exterior applications.

- F. Fasteners: Zinc-coated, type, grade, and class as required.

2.6 MISCELLANEOUS LUMBER

- A. Framing Materials: Standard Grade, light-framing-size lumber of any species. Number 3 Common or Standard Grade boards complying with WCLIB or AWPB rules, or Number 3 boards complying with SPIB rules. Lumber shall be preservative treated in accordance with AWPB LP-2, and kiln dried to a moisture content of not more than 19 percent.
- B. Construction Panels: Plywood panels; APA C-D PLUGGED INT, with exterior glue; thickness as indicated, or if not indicated, not less than 15/32 inches (12 mm).

2.7 JOINT SEALERS

- A. General: Joint sealers, joint fillers, and other related materials compatible with each other and with joint substrates under conditions of service and application.
- B. Colors: As selected by the Architect from manufacturer's standard colors.
- C. Elastomeric Joint Sealers: Provide the following types:
1. One-part, nonacid-curing, silicone sealant complying with ASTM C 920, Type S, Grade NS, Class 25, for uses in non-traffic areas for masonry, glass, aluminum, and other substrates recommended by the sealant manufacturer.
 2. One-part, mildew-resistant, silicone sealant complying with ASTM C 920, Type S, Grade NS, Class 25, for uses in non-traffic areas for glass, aluminum, and nonporous joint substrates; formulated with fungicide; intended for sealing interior joints with non-porous substrates; and subject to in-service exposure to conditions of high humidity and temperature extremes.
- D. Acrylic-Emulsion Sealants: One-part, non-sag, mildew-resistant, paintable complying with ASTM C 834 recommended for exposed applications on interior and protected exterior locations involving joint movement of not more than plus or minus 5 percent.
- E. Fire-Resistant Joint Sealers: Two-part, foamed-in-place, silicone sealant formulated for use in through-penetration fire-stopping around cables, conduit, pipes through fire rated walls and floors. Sealants and accessories shall have fire resistance ratings indicated, as established by testing identical assemblies in accordance with ASTM E 814, by Underwriters' Laboratories, Inc., or other testing and inspection agency acceptable to authorities having jurisdiction.

2.8 ACCESS DOORS

- A. Steel Access Doors and Frames: Factory-fabricated and assembled units, complete with attachment devices and fasteners ready for installation. Joints and seams shall be continuously welded steel, with welds ground smooth and flush with adjacent surfaces.
- B. Frames: 16-gage (1.6 mm) steel, with a 1-inch (25 mm) wide exposed perimeter flange for units installed in unit masonry, pre-cast, or cast-in-place concrete, ceramic tile, or wood paneling.
1. For Installation in Masonry, Concrete, Ceramic Tile, or Wood Paneling: 1-inch (25 mm) wide exposed perimeter flange and adjustable metal masonry anchors.
 2. For Gypsum Wallboard or Plaster: Perforated flanges with wallboard bead.
 3. For Full-Bed Plaster Applications: Galvanized expanded metal lath and exposed casing bead, welded to perimeter of frame.
- C. Flush Panel Doors: 14-gage (2 mm) sheet steel, with concealed spring hinges or concealed continuous piano hinge set to open 175 degrees (3.05 Radians); factory-applied prime paint.
1. Fire-Rated Units: Insulated flush panel doors, with continuous piano hinge and self-closing mechanism.
- D. Locking Devices: Flush, screwdriver-operated cam locks. [Common use]
- E. Locking Devices: Where indicated, provide 5-pin or 5-disc type cylinder locks, individually keyed; provide two (2) keys. [Secured areas only: note as such].

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 installation and application of joint sealers and access panels. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 FIRESTOP INSTALLATION

- A. Install penetration seal materials in accordance with printed instructions of the UL Fire Resistance Directory and in accordance with manufacturer's instruction.
- B. Seal holes or voids made by penetrations to ensure an effective smoke barrier.
- C. Where floor openings without penetrating items are more than four inches (100 mm) in width and subject to traffic or loading, install firestopping materials capable of supporting same loading as floor.
- D. Protect materials from damage on surface subject to traffic.
- E. Place firestopping in annular space around fire dampers before installation of damper's anchoring flanges which are installed in accordance with fire damper manufacturer's recommendations.
- F. Where large openings are created in walls or floors to permit installation of pipes, cable tray, bus duct or other items, close unused portions of opening with firestopping material tested for the application.
- G. Install smoke stopping as specified for firestopping.
- H. Where rated walls are constructed with horizontally continuous air space, double width masonry, or double stud frame construction, provide vertical, 12 inch (300 mm) wide fiber dams for full thickness and height of air cavity at maximum 15 foot (4500 mm) intervals.

3.3 PREPARATION FOR JOINT SEALERS

- A. Surface Cleaning for Joint Sealers: Clean surfaces of joints immediately before applying joint sealers to comply with recommendations of joint sealer manufacturer.
- B. Apply joint sealer primer to substrates as recommended by joint sealer manufacturer. Protect adjacent areas from spillage and migration of primers, using masking tape. Remove tape immediately after tooling without disturbing joint seal.

3.4 SELECTIVE DEMOLITION

- A. General: Demolish, remove, demount, and disconnect abandoned mechanical materials and equipment indicated to be removed and not indicated to be salvaged or saved.
- B. Materials and Equipment to be Salvaged: Remove, demount, and disconnect existing mechanical materials and equipment indicated to be removed and salvaged, and deliver materials and equipment to the location designated for storage.
- C. Disposal and Cleanup: Remove from the site and legally dispose of demolished materials and equipment not indicated to be salvaged.
- D. Mechanical Materials and Equipment: Demolish, remove, demount, and disconnect the following items:
 - 1. Inactive and obsolete piping, fittings and specialties, equipment, controls, fixtures, and insulation.
 - 2. Piping and ducts embedded in floors, walls, and ceilings may remain if such materials do not interfere with new installations. Remove materials above accessible ceilings. Drain and cap piping and ducts that are allowed to remain.

3. Perform cutting and patching required for demolition in accordance with Division-01 Section "Cutting and Patching."

3.5 EXCAVATION

- A. Slope sides of excavations to comply with local codes and ordinances. Shore and brace as required for stability of excavation.
- B. Shoring and Bracing: Establish requirements for trench shoring and bracing to comply with local codes and authorities. Maintain shoring and bracing in excavations regardless of time period excavations will be open.
 1. Remove shoring and bracing when no longer required. Where sheeting is allowed to remain, cut top of sheeting at an elevation of 30 inches (750 mm) below finished grade elevation.
- C. Install sediment and erosion control measures in accordance with local codes and ordinances.
- D. Dewatering: Prevent surface water and subsurface or ground water from flowing into excavations and from flooding project site and surrounding area.
 1. Do not allow water to accumulate in excavations. Remove water to prevent softening of bearing materials. Provide and maintain dewatering system components necessary to convey water away from excavations.
 2. Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey surface water to collecting or run-off areas. Do not use trench excavations as temporary drainage ditches.
- E. Material Storage: Stockpile satisfactory excavated materials where directed, until required for backfill or fill. Place, grade and shape stockpiles for proper drainage.
 1. Locate and retain soil materials away from edge of excavations. Do not store within drip-line of trees indicated to remain.
 2. Remove and legally dispose of excess excavated materials and materials not acceptable for use as backfill or fill.
- F. Excavation for Underground Tanks, Basins, and Mechanical Structures: Conform to elevations and dimensions shown within a tolerance of plus or minus 0.10 foot (30 mm); plus a sufficient distance to permit placing and removal of concrete formwork, installation of services, other construction, and for inspection.
 1. Excavate by hand, areas within drip-line of large trees. Protect the root system from damage and dry-out. Maintain moist conditions for root system and cover exposed roots with burlap. Paint root cuts of 1 inch (25 mm) in diameter and larger with emulsified asphalt tree paint.
 2. Take care not to disturb bottom of excavation. Excavate by hand to final grade just before concrete reinforcement is placed.
- G. Trenching: Excavate trenches for mechanical installations as follows:
 1. Excavate trenches to the uniform width, sufficiently wide to provide ample working room and a minimum of 6 to 9 inches (150 to 225 mm) clearance on both sides of pipe and equipment.
 2. Excavate trenches to depth indicated or required for piping to establish indicated slope and invert elevations. Beyond building perimeter, excavate trenches to an elevation below frost line.
 3. Limit the length of open trench to that in which pipe can be installed, tested, and the trench backfilled within the same day.
 4. Where rock is encountered, carry excavation below required elevation and backfill with a layer of crushed stone or gravel prior to installation of pipe. Provide a minimum of 6 inches (150 mm) of stone or gravel cushion between rock bearing surface and pipe.
 5. Excavate trenches for piping and equipment with bottoms of trench to accurate elevations for support of pipe and equipment on undisturbed soil.

6. For pipes or equipment 6 inches (150 mm) or larger in nominal size, shape bottom of trench to fit bottom 1/4 of the circumference. Fill unevenness with tamped sand backfill. At each pipe joint over-excavate to relieve the bell or pipe joint of the pipe of loads, and to ensure continuous bearing of the pipe barrel on the bearing surface.
- H. Cold Weather Protection: Protect excavation bottoms against freezing when atmospheric temperature is less than 35 degrees F (2 degrees C).
- I. Backfilling and Filling: Place soil materials in layers to required subgrade elevations for each area classification listed below, using materials specified in Part 2 of this Section.
 1. Under walks and pavements, use a combination of subbase materials and excavated or borrowed materials.
 2. Under building slabs, use drainage fill materials.
 3. Under piping and equipment, use subbase materials where required over rock bearing surface and for correction of unauthorized excavation.
 4. For piping less than 30 inches (750 mm) below surface of roadways, provide 4-inch (100 mm) thick concrete base slab support. After installation and testing of piping, provide a 4-inch (100 mm) thick concrete encasement (sides and top) prior to backfilling and placement of roadway subbase.
 5. In other areas, use excavated or borrowed materials.
- J. Backfill excavations as promptly as work permits, but not until completion of the following:
 1. Inspection, testing, approval, and locations of underground utilities have been recorded.
 2. Removal of concrete formwork.
 3. Removal of shoring and bracing, and backfilling of voids.
 4. Removal of trash and debris.
- K. Placement and Compaction: Place backfill and fill materials in layers of not more than 8 inches (200 mm) in loose depth for material compacted by heavy equipment, and not more than 4 inches (100 mm) in loose depth for material compacted by hand-operated tampers.
- L. Before compaction, moisten or aerate each layer as necessary to provide optimum moisture content. Compact each layer to required percentage of maximum dry density or relative dry density for each area classification specified below. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.
- M. Place backfill and fill materials evenly adjacent to structures, piping, and equipment to required elevations. Prevent displacement of piping and equipment by carrying material uniformly around them approximately to same elevation in each lift.
- N. Compaction: Control soil compaction during construction, providing minimum percentage of density specified for each area classification indicated below.
 1. Percentage of Maximum Density Requirements: Compact soil to not less than the following percentages of maximum density for soils which exhibit a well-defined moisture-density relationship (cohesive soils), determined in accordance with ASTM D 1557 and not less than the following percentages of relative density, determined in accordance with ASTM D 2049, for soils which will not exhibit a well-defined moisture-density relationship (cohesionless soils).
 2. Areas Under Structures, Building Slabs and Steps, Pavements: Compact top 12 inches (300 mm) of subgrade and each layer of backfill or fill material to 90 percent maximum density for cohesive material, or 95 percent relative density for cohesionless material.
 3. Areas Under Walkways: Compact top 6 inches (150 mm) of subgrade and each layer of backfill or fill material to 90 percent maximum density for cohesive material, or 95 percent relative density for cohesionless material.
 4. Other Areas: Compact top 6 inches (150 mm) of subgrade and each layer of backfill or fill material to 85 percent maximum density for cohesive soils, and 90 percent relative density for cohesionless soils.
 5. Moisture Control: Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water. Apply water in minimum quantity necessary to

achieve required moisture content and to prevent water appearing on surface during, or subsequent to, compaction operations.

- O. Subsidence: Where subsidence occurs at mechanical installation excavations during the period twelve (12) months after Substantial Completion, remove surface treatment (i.e., pavement, lawn, or other finish), add backfill material, compact to specified conditions, and replace surface treatment. Restore appearance, quality, and condition of surface or finish to match adjacent areas.

3.6 ERECTION OF METAL SUPPORTS AND ANCHORAGE

- A. Cut, fit, and place miscellaneous metal fabrications accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.
- B. Field Welding: Comply with AWS "Structural Welding Code."

3.7 ERECTION OF WOOD SUPPORTS AND ANCHORAGE

- A. Cut, fit, and place wood grounds, nailers, blocking, and anchorage accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.
- B. Select fastener sizes that will not penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood members.
- C. Attach to substrates as required to support applied loads.

3.8 APPLICATION OF JOINT SEALERS

- A. General: Comply with joint sealer manufacturers' printed application instructions applicable to products and applications indicated, except where more stringent requirements apply.
 - 1. Comply with recommendations of ASTM C 962 for use of elastomeric joint sealants.
 - 2. Comply with recommendations of ASTM C 790 for use of acrylic emulsion joint sealants.
- B. Tooling: Immediately after sealant application and prior to time skinning or curing begins, tool sealants to form smooth, uniform beads; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents that discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.

3.9 INSTALLATION OF ACCESS DOORS

- A. Provide access doors (minimum 18" x 18") as required to provide maintainable access to all mechanical equipment including, but not limited to, valves, etc.
- B. Set frames accurately in position and securely attached to supports, with face panels plumb and level in relation to adjacent finish surfaces.
- C. Adjust hardware and panels after installation for proper operation.

END OF SECTION 22 05 00

SECTION 22 05 10 - PLUMBING RELATED WORK**PART 1 - GENERAL****1.1 DESCRIPTION OF WORK**

- A. Extent of mechanical related work required by this section is indicated on drawings and/or specified in other Division-22 sections.
- B. Types of mechanical related work specified in this section include the following:
 - 1. Access to Mechanical Work:
 - a. Access doors in floors.
 - b. Removable cover plates in floors.
 - 2. Excavating for Mechanical Work:
 - a. Underground mechanical utilities and services.
 - b. Underground tanks, basins, and equipment enclosures.
 - c. Exterior water circulation and distribution systems.
 - d. Drainage and distribution fields.
 - 3. Concrete for Mechanical Work:
 - a. Lean concrete backfill to support mechanical work.
 - b. Encasement of mechanical work.
 - c. Underground structural concrete to accommodate mechanical work.
 - d. Tanks and vaults of mechanical work.
 - e. Basins and curbs for mechanical equipment.
 - f. Mechanical equipment foundations and housekeeping pads.
 - g. Inertia bases for isolation of mechanical work.
 - h. Rough grouting in and around mechanical work.
 - i. Patching concrete cut to accommodate mechanical work.
 - 4. Painting of Mechanical Work:
 - a. Exposed concrete provided as part of mechanical work.
 - b. Exposed piping systems.
 - c. Exposed mechanical insulation.
 - d. Exposed mechanical equipment.
 - e. Louvers.
 - f. Color-coded work.
- C. Access door requirements associated with mechanical work and mechanically related electrical components are specified in this section.
- D. Quality control testing for concrete work is required as work of this section.

1.2 QUALITY ASSURANCE

- A. Access Units Fire-Resistance Ratings: Where fire-resistance rating is indicated for construction penetrated by access units, provide UL listed-and-labeled Class B units, except for units which are smaller than minimum size requiring ratings as recognized by governing authority.
- B. Concrete Work Codes and Standards: Comply with governing regulations and, where not otherwise indicated, comply with the following industry standards, whichever is the most stringent in its application to work in each instance:
 - 1. ACI 301 "Specifications for Structural Concrete for Buildings".
 - 2. ACI 311 "Recommended Practice for Concrete Inspection".
 - 3. ACI 318 "Building Code Requirements for Reinforced Concrete".
 - 4. ACI 347 "Recommended Practice for Concrete Formwork".

5. ACI 304 "Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete".
 6. Concrete Reinforcing Steel Institute, "Manual of Standard Practice".
- C. Federal Specifications, Painting Work: In general and where applicable, comply with indicated Federal Specifications for paint quality, and use only paint from original containers which bear manufacturer's labels indicating compliance with required Federal Specifications.

1.3 SUBMITTALS

- A. Product Data, Access Units: Submit manufacturer's technical data and installation instructions for each type of access door assembly, including setting drawings, templates, instructions and directions for installation of anchorage devices.
- B. Shop Drawings, Mechanical Concrete Work: Submit shop drawings for structural type concrete work (tanks, vaults, basins, foundations and other supports), showing dimensions of formed shapes of concrete; bending, placement, sizes and spacing of reinforcing steel; location of anchors, isolation units, hangers and similar devices to be integrated with concrete work; and piping penetrations, access openings, inlets and other accessories and work to be accommodated by concrete work.
- C. Manufacturer's Data, Mechanical Concrete Work: Submit data on products, including cements, special aggregates, form-coating compound, admixtures, moisture barriers, waterstops, expansion joint fillers, sealants, and concrete curing products. Provide manufacturer's certification where indicated.
- D. Laboratory Test Reports, Mechanical Concrete Work: Submit laboratory test reports for concrete work materials, and for tested samples of placed concrete (where required as work of this section).
- E. Mixing Tickets, Mechanical Concrete Work: Submit ticket for each batch of mixed concrete used in work, indicating project identification, location where placed, date, mixing time, mix type, amount of water introduced, amount of concrete placed, and other significant or unusual data.
- F. Manufacturer's Data, Paint for Mechanical Work: Submit manufacturer's technical information, including analysis of ingredients and application instructions for products used in painting work.
- G. Samples, Paint for Mechanical Work: Submit 12" x 12" (300 mm x 300 mm) color samples of each required finish paint color (except black and white); prepared on 1/8" (3 mm) tempered hardboard, on smooth face where application is for smooth surfaces and on texture face for textured surface applications. Use actual paint materials to be applied, and label each sample to show materials and coats applied.

1.4 PROJECT CONDITIONS

- A. Existing Utilities: Locate and protect existing utilities and other underground work in manner which will ensure that no damage or service interruption will result from excavating and backfilling.
- B. Protect property from damage which might result from excavating and backfilling.
- C. Protect persons from injury at excavations, by barricades, warnings and illumination.
- D. Coordinate excavations with weather conditions, to minimize possibility of washouts, settlements and other damages and hazards.
- E. Provide temporary covering or enclosure and temporary heat as necessary to protect bottoms of excavations from freezing and frost action. Do not install mechanical work on frozen excavation bases or subbases.
- F. Environmental Conditions, Painting Work: Comply with governing regulations concerning use of and conditions for application of paint. Comply with manufacturer's recommendations and instructions. Do not apply paint in unfavorable conditions of temperature, moisture (including humidity) or ambient contamination (dust and other pollutants).

PART 2 - PRODUCTS

2.1 ACCESS TO MECHANICAL WORK

- A. Access Doors - General: Where floors must be penetrated for access to mechanical work, provide types of access doors indicated, including floor doors if any. Furnish sizes indicated or, where not otherwise indicated, furnish adequate size for intended and necessary access. Furnish manufacturer's complete units, of type recommended for application in indicated substrate construction, in each case, complete with anchorages and hardware.
- B. Floor Door Construction: Except as otherwise indicated, fabricated floor door shall be of welded steel construction, reinforced for 300 lbs. per sq. ft. (14.4 kPa) loading, with exposed welds ground smooth; 1/4" (6 mm) thick steel angle or formed steel frames, and 1/4" (6 mm) steel raised-pattern floor plate; steel strap anchors for casting in concrete; 90-degree brass/bronze hinges with stainless steel pins, and spring-type operators with hold-open arms; snap-type inside latch with removable handle, and, where applicable, inside lever latch handle and door operating handle; factory-applied rust-inhibitive prime-coat paint finish.
 - 1. Gasketed Construction: Where indicated as "Sealed", furnish manufacturer's gasketed-type door, with built-in protected cushion-type neoprene gasket, intended for reduction of noise, air and moisture penetration.
 - 2. Drained Construction: Where indicated as "Drained", or where drainage pipe connection is shown, furnish manufacturer's gutter-type or watertight-type unit, complete with drainage slots or ports at floor surface, and with gutter all around with one or more drain pipe connections.
 - 3. Double-Leaf Construction: Where opening width exceeds 3'- 0" (900 mm - 0 mm), furnish manufacturer's standard double-leaf unit construction.
 - 4. Recessed Floor-Finish Construction: Where floor doors occur in areas of floor finish other than concrete or coated-concrete, furnish manufacturer's standard recessed-panel type construction of type and recess depth recommended to receive insets of floor finish indicated.
- C. Removable Access Plates:
 - 1. General: Where valves, control devices, cleanouts and similar elements of mechanical work are located within or behind wall, ceiling or floor construction or finishes, or below grade, and are not (cannot be), provided with integral removable access plates as specified in other Division-22 sections, provide removable access plates of types and sizes needed for access requirements, as indicated. Provide manufacturer's complete unit with anchorages, fasteners and standard factory-applied finishes.
 - 2. Wall/Ceiling Unit Construction: Except as otherwise indicated, and where adaptable to substrate, provide manufacturer's standard frameless round formed stainless steel or chrome-plated brass low profile plate cover, with single exposed flush screw anchor, with bright polished finish.
 - 3. Painted Finish: Where substrate is indicated for painted finish, provide steel units with prime-coat paint finish.
 - 4. Floor Unit Construction: Except as otherwise indicated, provide manufacturer's standard round cast-iron units, with frame or body designed for casting flush in concrete; with removable plate secured with bronze screws, and surfaced with non-slip cast pattern; natural mill finish.
 - a. Sleeve-Type: Where required floor opening or hand hole extends through thickness of cast floor slab, provide unit body of same depth as slab thickness, to act as form for casting opening.
 - b. Square Units: Where square units are indicated, provide manufacturer's modular units of size which integrate as closely as possible with finish flooring unit sizes (if any).
 - c. Recessed Units: Where finish of floor is other than concrete, provide recessed-panel type construction, of type and recess depth recommended to receive insets of floor finish indicated.

- d. Finish: Provide recessed units with exposed metal (exposed after inset has been installed) of nickel bronze, manufacturer's standard finish. Provide matching fasteners.
- 5. Units Set at Grade: Except as otherwise indicated, provide manufacturer's standard round or square cast-iron units, complete cast-iron pipe extension to protect mechanical element being accessed; designed to be set slightly above finish grade, and to be either supported by compacted soil or to be encased in concrete; secure plate to body with bronze screws; natural mill finish on plate and body.

2.2 EXCAVATING FOR MECHANICAL WORK

- A. Subbase Material: Provide graded mixture of gravel, sand, crushed stone or crushed slag.
 - 1. Finely-Graded Subbase Material: Well graded sand, gravel, crushed stone or crushed slag, with 100% passing 3/8" (10 mm) sieve.
- B. Backfill Material: Soil material suitable for compacting to required densities, and complying with AASHTO Designation M145, Group A-1, A-2-4, A-2-5 or A-3.
- C. Drainage Fill Material: Washed and uniformly graded gravel, crushed stone or crushed slag, with 100% passing 1-1/2" (40 mm) sieve and not more than 5% passing No. 4 sieve.

2.3 MATERIALS OF CONCRETE WORK

- A. Forms for Exposed Concrete: Plywood, smooth metal or other smooth panel type material; sized for minimum joint exposure, and reinforced to prevent visible deflections resulting from pressure of placed concrete; sufficiently heavy for construction to prevent leakage which would be harmful to either structural or visual quality of concrete.
 - 1. Plywood "BB (Concrete Form) Plywood", Class I, Exterior Grade, mill-oiled and edge sealed.
- B. Forms for Unexposed Concrete: Smooth lumber, plywood or other easy-release material; reinforced to prevent excessive deflection or the possibility of failure during placement of concrete; sufficiently heavy for construction to prevent leakage which would be harmful to structural quality of concrete.
- C. Form Ties: For exposed concrete surfaces, provide snap-off type ties designed to snap off 1-1/2" (40 mm) below surface.
- D. Exposed-Corner Chamfer Strips: Provide wood, metal, plastic or rubber chamfer strips in forms at exposed external corners of concrete work.
- E. Form-Coating Compound: Commercially formulated compound which will prevent bond of concrete to forms. Provide compound recommended by manufacturer for application indicated, and which will not stain concrete or interfere with moisture curing of concrete or subsequent painting of exposed surfaces.
- F. Reinforcing Materials:
 - 1. Reinforcing Bars: Except as otherwise indicated, provide ANSI/ASTM A 615, deformed, Grade 40 for size numbers 3 through 18; ANSI/ASTM A 675, plain, Grade 60, for size number 2; sizes as shown.
 - 2. Steel Wire: ANSI/ASTM A 82, plain, cold-drawn.
 - 3. Welded Wire Fabric: ANSI/ASTM A 185; sizes and spacings of wires as shown; 6" x 6" (150 mm x 150 mm) x No. 10 x No. 10 where not otherwise indicated.
 - 4. Reinforcement Supports: Provide supports for reinforcement including bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcing bars and welded wire fabric in place. Provide wire bar type supports complying with CRSI recommendations, unless otherwise indicated.
 - a. For on-grade work, provide supports with sand plates or horizontal runners.

- b. At exposed surfaces, provide supports with legs that are stainless steel protected (CRSI, Class 2), or plastic protected (CRSI, Class 1).

G. Concrete Materials:

1. Portland Cement: ANSI/ASTM C 150, Type I, except as otherwise indicated.
2. Aggregates: ANSI/ASTM C 33, except as otherwise indicated.
 - a. Local aggregates not complying with ANSI/ASTM C 33, but which shown by special test or actual service to produce concrete of adequate strength and durability may be used.
 - b. For rough grouting, provide aggregate which is well graded and 100 percent passing through 3/8" (10 mm) sieve.
3. Water: Clean and free of substances harmful to concrete.
4. Air-Entraining Admixture: ANSI/ASTM C 260.
5. Water-Reducing Admixture: ANSI/ASTM C 494, Type A (normal range) and Type F (high-range, super plasticizer).
6. Set-Control Admixtures: ANSI/ASTM C 494, as follows:
 - a. Type B, Retarding.
 - b. Type C, Accelerating.
 - c. Type D, Water-reducing and Retarding.
 - d. Type E, Water-reducing and Accelerating.
 - e. Type G, High-Range Water-Reducing and Retarding (Super-plasticizer).
7. Calcium Chloride: Use not permitted.

2.4 DESIGN AND PROPORTIONING OF MIXES

- A. General: Design mechanical work concrete as follows, for each 28-day compressive strength class:
1. 4000 psi (27580 kPa) Class: 565 lbs. of cement per cu. yd. (335 kg/m³) (6.0 sacks), and 0.35 water/cement ratio.
 2. 3000 psi (20685 kPa) Class: 500 lbs. of cement per cu. yd. (296 kg/m³) (5.25 sacks), 0.46 water/cement ratio.
 3. 2500 psi (17238 kPa) Class: 450 lbs. of cement per cu. yd. (268 kg/m³) (4.75 sacks), and 0.54 water/cement ratio.
 4. Backfill Class (Lean Concrete): 375 lbs. of cement per cu. yd., (223 kg/m³) (4.0 sacks), and 0.60 water/cement ratio.
 5. Rough Grouting Class: 565 lbs. of cement per cu. yd. (335 kg/m³) (6.0 sacks), and 0.60 water/cement ratio.
- B. Admixtures: Except as otherwise indicated, use is at Contractor's option. Comply in each instance with admixture manufacturer's recommendations and suggested limitations for required quality of concrete. Use water-reducing admixture (normal or high-range in all concrete).
- C. Air Entrainment: Comply with the following limitations for resulting air entrainment:
1. Concrete Above Grade: Not less than 2%, nor more than 4%.
 2. Concrete Below Grade: Not less than 2% nor more than 4%, except up to 6% where maximum aggregate size must be 3/4" (20 mm) or less.
 3. Rough Grout Concrete: Not less than 4%, nor more than 8%.
 4. Backfill Concrete: Not more than 7%.
- D. Slump Limitations: Limit water content in design mixes to produce the following slumps at point of placement (but do not exceed specified water/cement ratios). Concrete containing high-range water-reducing admixture may have slump limit up to 8" (200 mm).

1. Reinforced Structural Concrete: For concrete which is reinforced (with more than shrinkage crack protection), or in strength class of 3000 psi (20685 kPa) and above, limit slump to range of 1" to 3" (25 mm to 75 mm).
 2. Plain Concrete: For concrete which is not reinforced or reinforced only for shrinkage crack protection, and in strength class below 3000 psi (20685 kPa), limit slump to range of 2" to 5" (50 mm to 125 mm).
 3. Rough Grout Concrete: Limit slump to range of 3" to 7" (75 mm to 175 mm).
 4. Backfill Concrete: Limit slump to 5" (125 mm).
- E. Mix for Patching: Where mechanical work requires patching of exposed concrete work which has been cut to accommodate mechanical work, provide concrete patching mix which is identical with mix of work being patched (same cement, aggregates, admixtures and proportioning).

2.5 CONCRETE MIXING

- A. Job-Site Mixing: Mix materials for concrete in drum-type batch machine mixer. For mixers of 1.0 cu. yd. (.84 m²), or smaller capacity, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after all ingredients are in mixer, before any part of batch is released. For mixers of capacity larger than 1.0 cu. yd. (.84 m²), increase mixing time by 15 seconds for each additional cu. yd., or fraction thereof.
1. Prepare and submit batch ticket for each batch discharged and used in work.
- B. Ready-Mix Concrete: Comply with requirements of ANSI/ASTM C 94, except as otherwise indicated.
1. Delete references for allowing additional water to be added to batch for material with insufficient slump. Addition of water to batch will not be permitted.
 2. During hot weather, or under conditions contributing to rapid setting of concrete, mix each load for shorter period of time than specified in ANSI/ASTM C 94. When air temperature is between 85 and 90 degrees F (29.4 and 32.2 degrees C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes, and when air temperature is above 90 degrees F (32.2 degrees C), reduce mixing and delivery time to 60 minutes.

2.6 GENERAL PAINTING PRODUCT REQUIREMENTS

- A. Pigments: Provide paint with pure, non-fading pigments, recognized to be safe, durable and environmentally acceptable, and containing not more than 0.5 percent lead (by weight in total dry film).
- B. Vehicles and Thinners: Comply with governing regulations and recognized safe practices in handling, use and drying of paint vehicles and thinners. Compatibility of paint products is the Contractor's exclusive responsibility. Select paint products to ensure freedom from problems relating to vehicles and thinners of type and within limits recommended by paint manufacturer.
- C. Undercoat Paints: Use paint produced by same manufacturer as paint to be used for finish coats.
- D. Colors: Provide colors as indicated or established by the Owner by color schedule or by other indication or, where not otherwise indicated, as selected by the Owner from manufacturer's standard (non-premium cost) colors available for type of paint to be provided in each case.
- E. Color-Coded Finishes: For finishes indicated to be color-coded for identification, provide paint complying with the color requirements of ANSI A13.1 "Scheme for the Identification of Piping Systems", except where another specific color requirement is indicated.
- F. "Paint": As used herein means coating system materials, including primers, emulsions, enamels, sealers, fillers and other applied materials whether used as prime, intermediate or finish coats.
- G. Standards: In the following designated paint systems (example: "IPS-22") the descriptions similar to "... (TT-P-55, Type II)..." refer to Federal Specifications of that number, and indicate required compliance with that publication as minimum standard of quality for paint product as named. Product of recognized higher quality can be used, provided either label indicates compliance with

required standard, or manufacturer submits proof and certification that product meets or exceeds standard in every significant measure of quality.

- H. Optional Systems: Where more than one paint system is designed for particular substrate, selection is Contractor's option except where distinct paint system is shown or scheduled for particular portion or area of that substrate.

2.7 EXTERIOR PAINT SYSTEMS

A. Concrete:

1. EPS-1: 1st Coat - Acrylic emulsion (TT-P-19).
2nd Coat - Acrylic emulsion (TT-P-19).
Not less than 2.5 mils dry-film thickness.
2. EPS-2: 1st Coat - Vinyl acrylic emulsion (TT-P-55, Type II).
2nd Coat - Vinyl acrylic emulsion (TT-P-55, Type II).
3. EPS-3: 1st Coat: Heavy-duty, textured coating (TT-C-555, Type II).
Not less than 15.0 mils dry-film thickness.

B. Cement:

1. EPS-6: 1st Coat - Primer undercoat (TT-P-25).
2nd Coat - Acrylic emulsion (TT-P-19).
3rd Coat - Acrylic emulsion (TT-P-19).
Not less than 3.5 mils dry-film thickness.

C. Ferrous Metal:

1. EPS-15: 1st Coat - Zinc-yellow iron oxide primer (TT-P-57, Type II).
2. EPS-15: 1st Coat - Red lead pigmented primer (TT-P-86, Type III).
2nd Coat - High-gloss alkyd enamel (TT-E-489, Class A).
3rd Coat - High-gloss alkyd enamel (TT-E-489, Class A).
First coat not required on items delivered shop primed.
3. EPS-16: 1st Coat - Zinc-yellow iron oxide primer (TT-P-57, Type II).
4. EPS-16: 1st Coat - Red lead pigmented primer (TT-P-86, Type III).
2nd Coat - Semi-gloss alkyd enamel (TT-E-529, Class A).
3rd Coat - Semi-gloss alkyd enamel (TT-E-529, Class A).
First coat not required on items delivered shop primed.
5. EPS-17: 1st Coat - Zinc-yellow iron oxide primer (TT-P-57, Type II).
6. EPS-17: 1st Coat - Red lead pigmented primer (TT-P-86, Type III).
2nd Coat - Lusterless alkyd enamel (TT-E-527).
3rd Coat - Lusterless alkyd enamel (TT-E-527).
First coat not required on items delivered shop primed.
7. EPS-18: 1st Coat - Zinc-yellow iron oxide primer (TT-P-57, Type II).
2nd Coat - Alkyd gloss enamel (TT-E-37).
3rd Coat - Alkyd gloss enamel (TT-E-37).
First coat not required on items delivered shop primed.
8. EPS-19: 1st Coat - Basic lead silico chromate primer (TT-P-615, Type III).
9. EPS-19: 1st Coat - Zinc chromate alkyd primer (TT-P-645).
2nd Coat - Semi-gloss silicone alkyd enamel (TT-E-490).
3rd Coat - Semi-gloss silicone alkyd enamel (TT-E-490).

D. Zinc-Coated Metal:

1. EPS-20: 1st Coat - Zinc dust-zinc oxide primer (TT-P-641).
2nd Coat - High gloss alkyd enamel (TT-E-489, Class A).
3rd Coat - High gloss alkyd enamel (TT-E-489, Class A).

E. Aluminum:

1. EPS-21: 1st Coat - Zinc chromate primer (TT-P-645).
2nd Coat - High gloss alkyd enamel (TT-E-489, Class A).
3rd Coat - High gloss alkyd enamel (TT-E-489, Class A).

2.8 INTERIOR PAINT SYSTEMS

A. Concrete:

1. IPS-1: 1st Coat - Interior latex emulsion (TT-P-29).
2nd Coat - Interior latex emulsion (TT-P-29).
2nd Coat - Interior alkyd emulsion, odorless (TT-P-30).
2. IPS-2: 1st Coat - Interior latex emulsion (TT-P-29).
2nd Coat - Interior enamel undercoat (TT-E-543).
3rd Coat - Interior enamel, semi-gloss (TT-E-509).
Not less than 3.5 mils total dry-film thickness.
3. IPS-3: 1st Coat - Acrylic emulsion (TT-P-19).
2nd Coat - Acrylic emulsion (TT-P-19).
4. IPS-4: 1st Coat - Interior latex emulsion (TT-P-29).
2nd Coat - Polyester epoxy (TT-C-5451).
3rd Coat - Polyester epoxy (TT-C-545).
Not less than 4.0 mils dry-film thickness

B. Cement:

1. IPS-9: 1st Coat - Interior latex emulsion (TT-P-29).
2nd Coat - Interior latex emulsion (TT-P-29).

C. Ferrous Metal:

1. IPS-19: 1st Coat - Red lead primer (TT-P-86).
2nd Coat - Interior latex emulsion (TT-P-29).
3rd Coat - Interior latex emulsion (TT-P-29).
First coat not required on items that are shop primed.
Not less than 2.5 mils dry-film thickness.
2. IPS-20: 1st Coat - Red lead primer (TT-P-86).
2nd Coat - Enamel undercoat (TT-E-543).
3rd Coat - Semi-gloss enamel (TT-E-509).
First coat not required on items that are shop primed.
Not less than 2.5 mils dry-film thickness.
3. IPS-21: 1st Coat - Red lead primer (TT-P-86).
2nd Coat - Enamel undercoat (TT-E-543).
3rd Coat - Gloss enamel (TT-E-506).
First coat not required on items that are shop primed.
Not less than 2.5 mils dry-film thickness.

D. Zinc-Coated Metal:

1. IPS-22: 1st Coat - Zinc dust-zinc oxide primer (TT-P-641).
2nd Coat - Interior latex emulsion (TT-P-29).
3rd Coat - Interior latex emulsion (TT-P-29).
Not less than 2.5 mils dry-film thickness.
2. IPS-23: 1st Coat - Zinc dust-zinc oxide primer (TT-P-641).
2nd Coat - Enamel undercoat (TT-E-543).
3rd Coat - Semi-gloss enamel (TT-E-509).
Not less than 2.5 mils dry-film thickness.
3. IPS-24: 1st Coat - Zinc dust-zinc oxide primer (TT-641).

2nd Coat - Enamel undercoat (TT-E-543).
3rd Coat - Gloss Enamel (TT-E-506).
Not less than 2.5 mils dry-film thickness.

E. Fabric Covering on Insulation:

1. IPS-33: 1st (Size) Coat - Interior latex emulsion (TT-P-29).
2nd Coat - Interior latex emulsion (TT-P-29).
Add fungicidal agent to render fabric mildew-proof.

PART 3 - EXECUTION

3.1 ACCESS TO MECHANICAL WORK

- A. Comply with manufacturer's instructions for installation of floor doors, and removable access plates.
- B. Set frames accurately in position and securely attach to supports with face panels plumb or level in relation to adjacent finish surfaces.
- C. Adjust hardware and panels after installation for proper operation.
- D. Remove or replace panels or frames which are warped, bowed, or otherwise damaged.

3.2 EXCAVATING FOR MECHANICAL WORK

- A. General: Do not excavate for mechanical work until work is ready to proceed without delay, so that total time lapse from excavation to completion of backfilling will be minimum.
- B. Excavate with vertical sided excavations to greatest extent possible, except where otherwise indicated. Where necessary, provide sheeting and cross-bracing to sustain sides of excavations. Remove sheeting and cross-bracing during backfilling wherever such removal would not endanger work or other property. Where not removed, cut sheeting off at sufficient distance below finished grade to not interfere with other work.
- C. Width: Excavate for piping with 6" to 9" (150 mm to 225 mm) clearance on both sides of pipe, except where otherwise shown or required for proper installation of pipe joints, fittings, valves and other work. Excavate for other mechanical work to provide minimum practical but adequate working clearances.
- D. Depth for Direct Support: For work to be supported directly on undisturbed soil, do not excavate beyond indicated depths, and hand-excavate bottom cut to accurate elevations. Except as otherwise indicated, support the following work on undisturbed soil at bottom of the excavations:
 1. Piping of 5" (125 mm) and less pipe/tube size.
 2. Cast-in-place concrete.
- E. Depth for Subbase Support: For large piping (6" pipe size and larger) (150 mm pipe size and larger) tanks, and where indicated for other mechanical work, excavate for installation of subbase material in depth indicated or, if not otherwise indicated, 6" (150 mm) below bottom of work to be supported.
- F. Depth for Unsatisfactory Soil Conditions: Where directed (because of unsatisfactory soil condition at bottom of indicated excavation), excavate additional depth as directed to reach satisfactory soil bearing condition. Backfill with subbase material, compacted as directed, to indicated excavation depth.
- G. Depth for Exterior Piping: Except as otherwise indicated, excavate for exterior water-bearing piping (water, steam condensate, drainage) so that top of piping will not be less than 2'- 6" (600 mm-150 mm) vertical distance below finished grade.
- H. Excavate near large trees (within drip line) by hand, and protect root system from damage or dryout to greatest extent possible. Maintain moist condition for root system and cover exposed roots with burlap. Paint root cuts of 1" (25 mm) diameter and larger with asphaltic tree paint.

- I. Store excavated material (temporarily) near excavation, in manner which will not interfere with or damage excavation or other work. Do not store under trees (within drip line).
 1. Retain excavated material which complies with requirements for backfill material.
 2. Dispose of excavated material which is either in excess of quantity needed for backfilling or does not comply with requirements for backfill material.
 - a. Move unused material to another location on Owner's property, at or adjacent to project site, and dispose of as directed by the Owner.
 - b. Remove unused material from project site, and dispose of in lawful manner.

3.3 DEWATERING

- A. Maintain dry excavations for mechanical work, by removing water. Protect excavations from inflow of surface water. Pump minor inflow of ground water from excavations; protect excavations from major inflow of ground water, by installing temporary sheeting and waterproofing. Provide adequate barriers which will protect other excavations and below-grade property from being damaged by water, sediment or erosion from or through mechanical work excavations.
 1. Install and operate well-point dewatering system to maintain ground water at level approximately 2'- 0" (600 mm - 0 mm) below mechanical work excavations, until backfilling is completed.

3.4 BASE PREPARATION

- A. Subbase Installation: Where indicated, install subbase material to receive mechanical work, and compact by tamping to form firm base for work. For piping, horizontal cylindrical tanks, and similar work, shape subbase to fit shape of bottom 90 degree of cylinder, for uniform continuous support.
 1. Provide finely-graded subbase material for wrapped, coated, and plastic pipe and tanks.
- B. Shape subbases and bottoms of excavations with recesses to receive pipe bells, flanged connections, valves and similar enlargements in piping systems.
- C. Concrete Encasement: Where piping under roadways is less than 2'- 6" (600 mm-150 mm) below surface of roadway, provide 4" (100 mm) base slab of concrete to support piping. After piping is installed and tested, provide 4" (100 mm) thick encasement (sides and top) of concrete before backfilling. Provide Class 2500 concrete for encasement and slab.
- D. Previous Excavations: Where piping crosses over area more than 5'- 0" (1.5 m-0 mm) wide which has been previously excavated to greater depth than required for piping installation, provide suitable subsidence-proof support for piping. Comply with details shown or, where not otherwise shown, provide one of the following support systems:
 1. Excavate to undisturbed soil, in width equal to pipe diameter plus 2'- 0" (600 mm-0 mm). Install 8" (200 mm) courses of subbase material, each compacted to 95% of maximum density, as required to fill excavation and support piping.
 2. Excavate to undisturbed soil, in width equal to pipe diameter plus 1'-0" (300 mm - 0 mm). Install lean concrete fill to required elevation for support of piping.

3.5 BACKFILLING

- A. Do not backfill until installed mechanical work has been tested and accepted, wherever testing is indicated.
- B. Install drainage fill where indicated, and tamp to uniform firm density.
- C. Backfill with finely-graded subbase material to 6" (150 mm) above wrapped, coated, and plastic piping and tanks, and to centerline of other tanks.
- D. Condition backfill material by either drying or adding water uniformly, to whatever extent may be necessary to facilitate compaction to required densities. Do not backfill with frozen soil materials.

- E. Backfill simultaneously on opposite sides of mechanical work, and compact simultaneously; do not dislocate work from installed positions.
- F. Backfill excavations in 8" (200 mm) high courses of backfill material, uniformly compacted to the following densities (% of maximum density, ASTM D 1557), using power-driven hand-operated compaction equipment.
 - 1. Lawn and Landscaped Areas: 85% for cohesive soils; 90% for cohesionless soils.
 - 2. Paved Areas, Other Than Roadways: 90% for cohesive soils; 95% for cohesionless soils.
 - 3. Roadways: 90% for cohesive soils; 95% for cohesionless soils.
- G. Backfill to elevations matching adjacent grades, at time of backfilling excavations for mechanical work.
- H. Compaction Tests: Where compaction tests indicate lower densities of backfill than specified, continue compaction (and re-excavation and backfilling where necessary) and provide additional testing as directed by the Owner. Allowable density tolerance is not more than one-test-out-of-5 falling more than 2 percentage points below specified density.

3.6 PERFORMANCE AND MAINTENANCE, EXCAVATION WORK

- A. Subsidence: Where subsidence is measurable or observable at mechanical work excavations during general project warranty period, remove surface (pavement, lawn or other finish), add backfill material, compact, and replace surface treatment. Restore appearance, quality, and condition of surface or finish to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.7 INSTALLATION OF CONCRETE WORK

- A. Formwork:
 - 1. General: Design, construct and maintain formwork to support vertical and lateral loads including pressure of cast-in-place concrete. Construct formwork so that formed concrete will be required size and shape and in required location. Construct with joints which will not leak cement paste. Form sides and bottoms of concrete work, except where clearly indicated to be cast directly in excavation or against other construction, or on grade or prepared subgrade. Design and construct forms for easy removal without damage to concrete and other work.
 - a. Install chamber strips at external corners of exposed concrete work.
 - b. Construct forms to retain equipment anchor bolts in accurate locations during placement of reinforcing steel and concrete. Use templates, if available by equipment manufacturers, to locate anchor bolts or, where not furnished, locate by accurate measure from certified setting diagrams.
 - 2. Form Coating: Coat concrete-contact surfaces of forms to be removed. Apply form-coating compound before reinforcement is placed. Apply in accordance with manufacturer's instructions and remove excess compound and spillage.
 - 3. Cleaning and Tightening: Clean forms and adjacent surfaces to receive concrete just before concrete is placed. Retighten forms promptly during concrete placement where required to eliminate leakage of cement paste.
- B. Placing Reinforcement:
 - 1. General: Comply with requirements and recommendations of specified standards, including "Placing Reinforcing Bars" by CRSI. Place bars where indicated and support to prevent displacement during concrete placement, using appropriate reinforcement supports, properly spaced and wire tied to reinforcing bars.
 - a. Place reinforcement to obtain at least minimum recommended coverage for concrete protection. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

- b. Install welded wire fabric in as long lengths as practicable. Laps adjoining pieces at least one full mesh and lace splices with 16-gage (1.6 mm) wire. Offset end laps in adjacent widths to prevent continuous laps in either direction.
- c. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials which would reduce bond with concrete.

C. Placing Concrete:

1. Wet wooden forms which have been coated with compound, immediately before concrete, and remove excess water from forms.
2. Strength-Class Applications: Comply with compressive-strength classes shown on drawings for each unit of mechanical concrete work or, if not shown, comply with the following general application requirements.
 - a. Backfill: Provide backfill class (lean concrete).
 - b. Plain Concrete Encasement: Provide 2500 psi (17238 kPa) class.
 - c. Reinforced Concrete Encasement: Provide 3000 psi (20685 kPa) class.
 - d. Underground Structural Concrete: Provide 3000 psi (20685 kPa) class.
 - e. Tanks and Vaults: Provide 4000 psi (27580 kPa) class.
 - f. Block-Type Foundations: Where least dimension is not less than 0.2 x largest dimension, provide 3000 psi (20685 kPa) class.
 - g. Beam-Type Foundations: Where least dimension is less than 0.2 x largest dimension, provide 4000 psi (27580 kPa) class.
 - h. Miscellaneous Supported Work: Provide 3000 psi (20685 kPa) class for curbs, pads, inertia blocks and similar supported work.
 - i. Concrete Fill: Provide 2500 psi (17238 kPa) class for filling structural steel foundation frames and for filling similar large-volume units.
 - j. Concrete Grout: Provide rough grouting class for filling voids to be grouted which are too small to be filled effectively with 2500 psi (17238 kPa) class concrete.
 - k. Patching General Concrete Work: Match concrete being patched.
3. Deposit concrete continuously or in layers of thickness which will result in no concrete being placed on concrete which has hardened sufficiently to cause formation of seams or planes of weakness within section. If section cannot be placed continuously, provide construction joints. Deposit concrete as nearly as practicable in its final location, so as to avoid segregation due to rehandling or flowing.
4. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding or tamping. Use equipment and procedures complying with recommended practices of ACI 309; eliminate voids in work.
5. Bring horizontal surfaces to correct level with straightedge and strike off. Use bull floats or darbies to smooth surface, free of humps and hollows.
6. Cold Weather Placement: Comply with ACI 306. Do not use frozen materials or materials containing ice and snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials. When air temperature has fallen or is expected to fall below 40 degrees F (4.4 degrees C), heat water and aggregates uniformly before mixing, as required to obtain concrete mixture temperature of not less than 50 degrees F (10 degrees C), and not more than 80 degrees F (26.7 degrees C), at time of placement. Protect concrete work from physical damage and reduced strength resulting from frost, freezing actions, or low temperatures.
7. Hot Weather Placement: Comply with ACI 305 when hot weather conditions could impair work.
 - a. Maintain concrete temperature below 90 degrees F (32.2 degrees C) at time of placement, by cooling ingredients. Mixing water may be chilled, or chopped ice may be used to control concrete temperature, provided water equivalent of ice is included in calculating compliance with water/cement ratio limitations. Cover reinforcing steel with water-soaked burlap as necessary to ensure that steel temperature will not exceed ambient air temperature immediately before embedment in concrete.

8. Finishing Horizontal Surfaces: Float and trowel horizontal (top) surfaces to level, smooth, uniform textured, dense finish, where surface is to remain exposed or receive coating, membrane or other thin-set finish. Otherwise, leave struckoff surface undisturbed; except scratch surfaces which are to receive concrete or mortar topping or setting bed, by raking with a stiff broom.
 - a. Depress top of concrete backfill sufficiently so that supported work can be set in bed of mortar or sand as indicated.
 9. Curbs: Provide monolithic finish on interior curbs by stripping forms while concrete is still green and steel-troweling surfaces to hard, dense finish with corners, intersections and terminations slightly rounded and coved.
- D. Form Removal and Surface Repairs:
1. Form Removal: Remove forms as soon as concrete has set and gained sufficient strength to ensure that neither removal of forms nor stress introduced by removal of support contributed by forms will result in damage to concrete.
 - a. Retain forms on vertical surfaces of concrete for not less than three (3) days after concrete is placed.
 - b. Retain forms supporting horizontal and angular bottom surfaces of concrete for not less than fourteen (14) days after concrete is placed, except where indicated for longer periods of support.
 2. Unexposed Surfaces: Repair significantly damaged and honeycombed areas, and remove major projections and fins where forms have been removed.
 3. Exposed Surfaces: On formed surfaces which are to be exposed, including those to be coated or covered with membrane or other thin-set applied finish, repair and patch form-tie holes and damaged and honeycombed areas, filling voids with grout and completely removing fins and other projections.

3.8 CONCRETE CURING AND PROTECTION

- A. General:
1. Protect freshly placed concrete from drying and excessively cold and hot temperatures, and maintain in moist condition at relatively constant temperature for period of time necessary for hydration of cement, proper hardening, and achievement of strength requirements as specified.
 - a. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than seventy-two (72) hours.
 - b. Begin final curing procedures immediately following initial curing and before concrete has dried. Continue curing for at least seven (7) days and in accordance with ACI 301 procedures. Avoid rapid drying at end of final curing period.
 - c. Subgrade concrete backfill may be excluded from final curing procedures where adjoining subsoil is sufficiently moist to maintain concrete in moist condition.
- B. Curing Method: Perform final curing for each area of concrete work by one of the following methods (at Contractor's option), as appropriate for location and accommodation of adjacent construction work which must continue:
1. Continuous water emersion or fog spraying.
 2. Covering with absorptive cover which is maintained in wet-to-fully saturated condition.
 3. Covering with moisture retaining cover, with sealed joints and maintained without holes or openings as non-breathing membrane.
 4. Coating with membrane-forming curing compound, applied in two (2) coats and maintained in effective condition for cure period (replaced if degraded by rain before reaching stable condition).

- a. Do not use compound curing method where surface is to be painted, dampproofed, waterproofed, or covered with other finish requiring bond to concrete.
- b. Do not use compound curing method where forms must be retained more than three (3) days.

3.9 MISCELLANEOUS CONCRETE WORK

- A. Concrete Grouting: Grout openings and recesses as indicated, in and around mechanical work and other work which penetrates or adjoins mechanical concrete work, using rough grouting class of concrete mix. Provide formwork where required, and tamp, screed and trowel surfaces. Cure grout as specified for concrete work.
- B. Refer to individual equipment sections of these specifications for fine-grouting of equipment base plates on foundations (usually with non-shrinking grout), and similar grouting requirements not defined herein as concrete work.

3.10 QUALITY CONTROL TESTING

- A. Engage testing laboratory to take samples, perform tests, and prepare and submit reports for concrete as it is placed.
 1. Backfill Concrete: Quality control testing is not required for backfill concrete (lean concrete).

3.11 SURFACE PREPARATION FOR PAINTING

- A. General: Clean surfaces before applying paint products. Remove oil and grease prior to mechanical cleaning. Comply with paint products manufacturer's instructions for surface cleaning and preparation. Remove surface-applied accessories which are not to be painted, and reinstall after completion of painting. Protect non-removable items not to be painted, by covering with paper or plastic material.
- B. Cementitious Surfaces: Remove efflorescence, chalk, dust, and glaze to ensure good bond of paint products. Clean concrete with muriatic acid (1 part diluted with 6 to 8 parts water) and flush with water, where necessary to ensure good paint bond. Perform appropriate tests to determine that both alkalinity and moisture content of concrete surfaces are below maximum allowable levels for painting, as recommended by paint manufacturer.
- C. Ferrous Metal Surfaces: Remove mill scale and loose rust on surfaces which are not zinc-coated or shop/factory prime coated.
- D. Clean shop-applied prime coats on metal surfaces, and repair (touch-up) prime coats wherever abraded or otherwise damaged, prior to application of paint system.
- E. Zinc-Coated Surfaces: Clean with non-petroleum based solvent. Wash with copper sulfate solution and flush with water, unless surface has been pretreated, or unless treatment is not recommended by manufacturer of prime coat.

3.12 PAINT SYSTEM APPLICATION

- A. Mixing: Comply with manufacturer's recommendations for mixing or stirring paint products immediately before application.
- B. Application Limitations: Except as otherwise indicated, paint every accessible surface of each unit of work indicated to be painted, regardless of whether in location recognized as "concealed" or "exposed".
 1. Omit painting on surfaces located in service shafts and tunnels and above non-removable ceilings and in similar place where space is too limited or services are too congested to allow access for painting.
 2. Omit painting of insulated piping above removable ceilings, but apply paint system to uninsulated steel piping, exposed threads of galvanized piping, pipe hangers, and similar work.

3. Omit painting on machined sliding surfaces and rotating shafts of equipment, and on nonferrous finished metals including chrome plate, stainless steel, special anodized aluminum, brass/bronze and copper, and on plastics and similar finished materials, except where specifically indicated to be color-coded by painting.
 4. Omit painting on required name plates, labels, identification tags, signs, markers, printed instructions, performance ratings, flow diagrams and similar text and graphics, located within the scope of work indicated to receive paint application.
 5. Omit specified prime coat of paint system for metal surfaces where surface has shop-applied prime coat of equivalent quality. Apply prime coat on other surfaces to be painted; comply with paint manufacturer's instructions for prime coating where not otherwise indicated. Apply additional prime coats where suction spots or unsealed areas appear.
- C. General Application Requirements: Apply paint in accordance with manufacturer's directions. Use applicators and techniques best suited for substrate, for type of material being applied, and for ambient conditions. Apply additional coats when undercoats, stains or other conditions show through final coat of paint, until paint film is of uniform finish, color and appearance. Apply paint at edges, corners, joints, welds and exposed fasteners in manner which will ensure dry-film thickness equal to that of flat surfaces. Allow sufficient time between successive coats for proper drying (comply with manufacturer's drying instructions).
- D. Number of Coats: Number indicated is minimum number; apply as many coats as are necessary to comply with dry-film thickness requirements.
- E. Coating Thickness: Apply uniform coats to produce dry-film thickness indicated or, if not otherwise indicated, apply paint without thinning in application thickness recommended by manufacturer for each coat.
- F. Smooth Finishes: Except as otherwise indicated, apply paint in smooth finish without noticeable texture, cloudiness, spotting, holidays, laps, brush marks, runs, sags, ripples, ropiness and other surface imperfections.
- G. Textured Finishes: Where indicated, roll and redistribute paint of final coat to even texture. Match adjoining textured paint finishes if any, and roll to eliminate evidence of roller or lap marks and other unevenness and imperfections.
- H. Exterior Stacks: Paint the top 18" (450 mm) of stacks black, regardless of color selected for general painting of equipment and accessories on roof.
- 3.13 CLEAN-UP AND PROTECTION, PAINTING
- A. General Clean-Up: During progress of work, remove from site discarded paint materials, rubbish, cans and rags at end of each work day. Retain paint containers from application of coatings on particular unit or area of work, until average dry-film thickness has been calculated.
- B. Spattered Surfaces: Upon completion of painting work, clean paint-spattered surfaces. Remove spattered paint by proper methods of washing and scraping, using care not to scratch or otherwise damage finished surfaces.
- C. Protection: Protect work of other trades, whether to be painted or not, against damage by painting work. Correct damage by cleaning, repairing or replacing and repainting as directed. Provide "Wet Paint" signs as required to protect newly-painted finishes. Remove temporary protective wrappings installed for protection of work not to be painted, after completion of painting operations. At completion of work by other trades, touch-up and restore damaged or defaced painted surfaces.

END OF SECTION 22 05 10

SECTION 22 05 14 - PIPE, TUBE AND FITTINGS FOR PLUMBING SYSTEMS**PART 1 - GENERAL****1.1 DESCRIPTION OF WORK**

- A. Extent of pipes and pipe fittings required by this section is indicated on drawings and/or specified in other Division-22 sections.
- B. Types of pipes and pipe fittings specified in this section include the following:
 - 1. Steel Pipes
 - 2. Copper Tube
 - 3. Cast-Iron Pressure Pipes
 - 4. Cast-Iron Soil Pipes
 - 5. Plastic Pipes
 - 6. Foundation Drainage Tile and Pipes
 - 7. Grooved Piping Products
 - 8. Miscellaneous Piping Materials/Products
- C. Pipes and pipe fittings furnished as part of factory-fabricated equipment are specified as part of the equipment assembly in other Division-22 sections.
- D. Refer to all Division-21 and -22 sections.

1.2 QUALITY ASSURANCE

- A. Codes and Standards:
 - 1. Welding: Qualify welding procedures, welders and operators in accordance with ASME B 3 1.1, or ASME B 31.9, as applicable, for shop and project site welding of piping work.
 - a. Certify welding of piping work using the Standard Procedure Specifications by, and welders tested under supervision of, National Certified Pipe Welding Bureau (NCPWB).
 - 2. Brazing: Certify brazing procedures, brazers and operators in accordance with ASME Boiler and Pressure Vessel Code, Section IX, for shop and job-site brazing of piping work.
 - 3. NSF Labels: Where plastic piping is indicated to transport potable water, provide pipes and pipe fittings bearing approval label by National Sanitation Foundation (NSF).
 - 4. Lead Free Compliance: All components associated with potable water systems (including, but not limited to, valves, end use devices/fixtures, pipe, pipe fittings, solder/flux, etc.) shall be "lead-free" in accordance with all local, state and federal codes, as well as NSF/ANSI 372 (NSF 61-G).
- B. Pipe Testing Procedures: Contractor shall pressure test all piping systems in accordance with the following:
 - 1. ASME Code for Pressure Piping B31, most current edition.
 - 2. National Fire Protection Association (NFPA), all applicable sections, most current edition.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data and installation instructions for each type of pipe and pipe fitting. In addition, submit a matrix indicating each service and the proposed pipe material and fitting.
- B. Welding Certifications: Submit reports as required for piping work.
- C. Brazing Certifications: Submit reports as required for piping work.

- D. Maintenance Data: Submit maintenance data and parts lists for each type of mechanical fitting. Include this data, product data, and certifications in maintenance manual; in accordance with requirements of Division-01.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Except for hub-and-spigot and similar units of pipe, provide factory-applied plastic end-caps on each length of pipe and tube. Maintain end-caps through shipping, storage and handling as required to prevent pipe-end damage, and eliminate dirt and moisture from inside of pipe and tube.
- B. Where possible, store pipe and tube inside and protected from weather. Where necessary to store outside, elevate above grade and enclose with durable, waterproof wrapping.
- C. Protect flanges and fittings from moisture and dirt by inside storage and enclosure, or by packaging with durable, waterproof wrapping.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Piping Materials: Provide pipe and tube of type, joint type, grade, size and weight (wall thickness or Class) indicated for each service; where type, grade or class is not indicated. Provide proper selection as determined by Installer for installation requirements, and comply with governing regulations and industry standards.
- B. Pipe/Tube Fittings: Provide factory-fabricated fittings of type, materials, grade, class and pressure rating indicated for each service and pipe size. Provide sizes and types matching pipe, tube, valve or equipment connection in each case. Where not otherwise indicated, comply with governing regulations and industry standards for selections, and with pipe manufacturer's recommendations where applicable.

2.2 CAST-IRON SOIL PIPES AND PIPE FITTINGS

- A. Hubless Cast-Iron Soil Pipe: FS WW-P-401.
- B. Cast-Iron Hub-and-Spigot Soil Pipe: ASTM A 74.
- C. Hubless Cast-Iron Soil Pipe Fittings: Neoprene gasket complying with ASTM C 564 and stainless steel clamp holding band.
- D. Cast-Iron Hub-and-Spigot Soil Pipe: Match soil pipe units; complying with same standards (ASTM A 74).
- E. Compression Gaskets: ASTM C 564.

2.3 PLASTIC PIPE AND FITTINGS

- A. Virgin Rigid Polyvinyl Chloride (PVC) Schedule 40 Pipe: Solid wall pipe with a cell class of 12454. Materials shall comply with ASTM D 1784, ASTM D 1785, ASTM D 2665 and NSF Standards 14 and 61.
- B. Virgin Rigid Polyvinyl Chloride (PVC) Schedule 80 Pipe: Solid wall pipe with a cell class of 12454. Materials shall comply with ASTM D 1784, ASTM D 1785, and NSF Standards 14 and 61.
- C. Virgin Rigid Chlorinated Polyvinyl Chloride (CPVC) Pipe: Copper Tube Size (CTS), Standard Dimensional Ratio (SDR) 11 with a cell class of 24448. Materials shall comply with ASTM D 1784, ASTM D 2846, and NSF Standards 14 and 61.
- D. Fittings for PVC Schedule 40 Pipe:
 - 1. Injection molded PVC DWV fittings: ASTM D 2665.
 - 2. Fabricated PVC DWV fittings: ASTM F 1866.
 - 3. All fittings shall conform to NSF Standard 14.

- E. Fittings for PVC Schedule 80 Pipe:
 - 1. Injection molded PVC DWV fittings: ASTM D 2467.
 - 2. Threaded PVC Schedule 80 fittings: ASTM D 2464.
 - 3. All fittings shall conform to NSF Standards 14 and 61.
- F. Fittings for CPVC Pipe: ASTM D 2846, NSF Standards 14 and 61.

2.4 MISCELLANEOUS PIPING MATERIALS/PRODUCTS

- A. Gaskets for Flanged Joints: ANSI B16.21; full-faced or cast-iron raised face for steel flanges, unless otherwise indicated.
- B. Piping Connectors for Dissimilar Non-Pressure Pipe: Elastomeric annular ring insert, or elastomeric flexible coupling secured at each end with stainless steel clamps, sized for exact fit to pipe ends and subject to approval by plumbing code.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Install pipes and pipe fittings in accordance with recognized industry practices which will achieve permanently-leakproof piping systems, capable of performing each indicated service without piping failure. Install each run with minimum joints and couplings, but with adequate and accessible unions for disassembly and maintenance/replacement of valves and equipment. Reduce sizes (where indicated) by use of reducing fittings. Align piping accurately at connections, within 1/16" (1.6 mm) misalignment tolerance.
 - 1. Comply with ANSI B31 Code for Pressure Piping.
- B. Locate piping runs, except as otherwise indicated, vertically and horizontally (pitched to drain) and avoid diagonal runs wherever possible. Where trapping is unavoidable, install drain valve with 3/4" (20 mm) hose end connection, cap and chain. Provide access panels as required. Orient horizontal runs parallel with walls and column lines. Locate runs as shown or described by diagrams, details and notations or, if not otherwise indicated, run piping in shortest route which does not obstruct usable space or block access for servicing building and its equipment. Hold piping close to walls, overhead construction, columns and other structural and permanent - enclosure elements of building; limit clearance to 1/2" (13 mm) where furring is shown for enclosure or concealment of piping, but allow for insulation thickness, if any. Where possible, locate insulated piping for 1" (25 mm) clearance outside insulation. Wherever possible in finished and occupied spaces, conceal piping from view, by locating in column enclosures, in hollow wall construction or above suspended ceilings; do not encase horizontal runs in solid partitions, except as indicated.
- C. Exposed piping in finished areas shall be covered with a 16 gauge steel cover primed and painted, secured to an adjacent structure and painted to match adjacent surfaces.
- D. Electrical Equipment Spaces: Do not run piping through transformer vaults and other electrical or electronic equipment spaces and enclosures unless unavoidable. Install drip pan under piping that must be run through electrical spaces.

3.2 PIPING SYSTEM JOINTS

- A. General: Provide joints of type indicated in each piping system.
 - 1. Thread pipe in accordance with ANSI B2.1; cut threads full and clean using sharp dies. Ream threaded ends to remove burrs and restore full inside diameter. Apply pipe joint compound, or pipe joint tape (Teflon) where recommended by pipe/fitting manufacturer, on male threads at each joint and tighten joint to leave not more than 3 threads exposed.
 - 2. Braze copper tube-and-fitting joints where indicated, in accordance with ASME B31.
 - 3. Solder copper tube-and-fitting joints where indicated, in accordance with recognized industry practice. Cut tube ends squarely, ream to full inside diameter, and clean outside of tube ends and inside of fittings. Apply solder flux to joint areas of both tubes and fittings.

Insert tube full depth into fitting, and solder in manner which will draw solder full depth and circumference of joint. Wipe excess solder from joint before it hardens.

- B. Flanged Joints: Match flanges within piping system, and at connections with valves and equipment. Clean flange faces and install gaskets. Tighten bolts to provide uniform compression of gaskets.
- C. Lead Joint Installation: Tightly pack joint with joint packing material. Do not permit packing to enter bore of finished joint. Clean joint after packing. Fill remaining joint space with one pouring of lead to indicated minimum depth measured from face of bell. After lead has cooled, caulk joint tightly by use of hammer and calking iron.
- D. Hubless Cast-Iron Joints: Comply with coupling manufacturer's installation instructions.
- E. Plastic Pipe/Tube Joints: Comply with manufacturer's instructions and recommendations, and with applicable industry standards:
 - 1. Heat Joining of Thermoplastic Pipe: ASTM D 2657.
 - 2. Making Solvent-Cemented Joints: ASTM D 2235, and ASTM F 402.
- F. Glass Pipe Joints: Comply with manufacturer's instructions and recommendations.
- G. Open Drain-Tile Joints: Except as otherwise indicated, provide 1/4" (6 mm) open joint with top 2/3 of annular space covered by joint accessory material.
- H. Grooved Pipe Joints: Comply with fitting manufacturer's instructions for making grooves in pipe ends. Remove burrs and ream pipe ends. Assemble joints in accordance with manufacturer's instructions.

3.3 PIPING INSTALLATION

- A. Install drain tile piping from lowest end of slope to highest, solidly bedded in filtering or drainage fill. Shape bed for bells of piping (if any). Place bells/hubs and grooved ends of units up-stream. Lay perforated pipe with perforations down. Refer to Division-2 specifications for filter cloth, bedding material and backfill installation requirements.
- B. Install ductile cast-iron water mains and appurtenances in accordance with-AWWA C600.

3.4 PIPE TESTING

- A. Sanitary and Storm Water Piping Systems:
 - 1. All soil, waste, vent and storm water piping shall be tested by the Contractor and reviewed by the Architect before acceptance. All piping located underground shall be tested before backfilling. The costs of all equipment required for tests are to be included under the contract price.
 - 2. The entire new drainage system and venting system shall have all necessary openings plugged and filled with water to the level of the highest vent stack above the roof or to the maximum pressure rating of the joint used. The system shall hold this water for four (4) hours without showing a drop in water level. Where a portion of the system is to be tested, the test shall be conducted in the same manner as described for the entire system, except a vertical stack 10 feet (3000 mm) above the highest horizontal line to be tested may be installed and filled with water to maintain sufficient pressure, or a pump may be used to supply the required pressure.
 - 3. Where sections are tested, overlap the sections so that all joints are subjected to the test procedures.
- B. Drain test water from piping systems after testing and repair work has been completed.
- C. Repair piping systems sections which fail required piping test, by disassembly and re-installation, using new materials to extent required to overcome leakage. Do not use chemicals, stop-leak compounds, mastics, or other temporary repair methods.

- D. Contractor shall submit pipe leakage test results to the A/E within 72 hours of completed tests. Only test results that meet the specified leakage requirements shall be submitted. Pipe test results shall be recorded on the attached "Piping Leakage Test Summary Form - Plumbing" at the end of this section; no other forms will be accepted. In addition, the pipe leakage submittals shall include 11x17 drawing(s) as required to clearly indicate the full extent of the pipe test section (each pipe test section shall be numbered and color coded).
- E. All pipe leakage test results shall be included with the final TAB report and the O&M Manual.

3.5 CLEANING, FLUSHING, INSPECTING

- A. General: Clean exterior surfaces of installed piping systems of superfluous materials, and prepare for application of specified coatings (if any). Flush out piping systems with clean water before proceeding with required tests. Inspect each run of each system for completion of joints, supports and accessory items.
 - 1. Inspect pressure piping in accordance with procedures of ASME B31.

END OF SECTION 22 05 14

PIPING LEAKAGE TEST SUMMARY FORM
(PLUMBING)

Project Name: _____ Project Number: _____ Page ____ of ____

System Tested	Sections Tested (1)	System Operating Pressure	Test Pressure (PSI/FT-HD) (2)	Duration (3)	Pressure Drop (4)	Pass/Fail

Name of Testing Agency/Company: _____
Date of Test(s): _____
Test Conducted By (Print/Sign): _____

- (1) Identified by an 11 x 17 numbered and color coded test section plan. Plan shall accompany this test report.
- (2) 150% of operating pressure but not less than 100 psi , 200 psi for air-gas-vacuum, 10 ft. static head pressure or to the maximum rating of the joint. Include joint cut sheets showing their ratings.
- (3) Four (4) hours minimum.
- (4) Shall not exceed 0.0%.

SECTION 22 05 29 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT**PART 1 - GENERAL****1.1 DESCRIPTION OF WORK**

- A. Extent of hangers and supports required by this section is indicated on drawings and/or specified in other Division-22 sections.
- B. Types of hangers and supports specified in this section include the following:
 - 1. Horizontal-Piping Hangers and Supports
 - 2. Vertical-Piping Clamps
 - 3. Hanger-Rod Attachments
 - 4. Building Attachments
 - 5. Saddles and Shields
 - 6. Spring Hangers and Supports
 - 7. Miscellaneous Materials
 - 8. Roof Equipment Supports
 - 9. Anchors
 - 10. Equipment Supports
- C. Hangers and supports furnished as part of factory-fabricated equipment are specified as part of equipment assembly in other Division-22 sections.

1.2 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of hangers and supports, of types and sizes required, whose products have been in satisfactory use in similar service for not less than five (5) years.
- B. Codes and Standards:
 - 1. Code Compliance: Comply with applicable codes pertaining to product materials and installation of hangers and supports.
 - 2. NFPA, UL, and FM Compliance: Provide products which comply with NFPA 13 listed and labeled by UL and FM where used for fire protection piping systems.
 - 3. MSS Standard Compliance:
 - a. Provide pipe hangers and supports of which materials, design, and manufacture comply with MSS SP-58.
 - b. Select and apply pipe hangers and supports, complying with MSS SP-69.
 - c. Fabricate and install pipe hangers and supports, complying with MSS SP-89.
 - d. Terminology used in this section is defined in MSS SP-90.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data, including installation instructions for each type of support and anchor. Submit pipe hanger and support schedule showing manufacturer's figure number, size, location, and features for each required pipe hanger and support.

PART 2 - PRODUCTS**2.1 HORIZONTAL-PIPING HANGERS AND SUPPORTS**

- A. General: Except as otherwise indicated, provide factory-fabricated horizontal-piping hangers and supports complying with MSS SP-58, selected by Installer to suit horizontal-piping systems in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select size of hangers and supports to exactly fit pipe size for bare piping, and to exactly fit around piping insulation with saddle or shield for

insulated piping. Provide copper-plated hangers and supports for copper-piping systems. To avoid future electrolysis or corrosion, copper plated hangers, supports, clamps, rod attachments, and building attachments shall not be in direct contact with copper piping. A separation material shall be installed between the pipe and the copper plated hanger, support, clamp, etc. The separation material shall prohibit electrical conductance and prevent galvanic action or corrosion between dissimilar metals. Separation material shall be guaranteed for a minimum of thirty (30) years.

2.2 VERTICAL-PIPING CLAMPS

- A. General: Except as otherwise indicated, provide factory-fabricated vertical-piping clamps complying with MSS SP-58, selected by Installer to suit vertical piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Select size of vertical piping clamps to exactly fit pipe size of bare pipe. Provide copper-plated hangers and supports for copper-piping systems. To avoid future electrolysis or corrosion, copper plated hangers, supports, clamps, rod attachments, and building attachments shall not be in direct contact with copper piping. A separation material shall be installed between the pipe and the copper plated hanger, support, clamp, etc. The separation material shall prohibit electrical conductance and prevent galvanic action or corrosion between dissimilar metals. Separation material shall be guaranteed for a minimum of thirty (30) years.

2.3 HANGER-ROD ATTACHMENTS

- A. General: Except as otherwise indicated, provide factory-fabricated hanger-rod attachments complying with MSS SP-58, selected by Installer to suit horizontal-piping hangers and building attachments, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select size of hanger-rod attachments to suit hanger rods. Provide copper-plated hanger-rod attachments for copper-piping systems. To avoid future electrolysis or corrosion, copper plated hangers, supports, clamps, rod attachments, and building attachments shall not be in direct contact with copper piping. A separation material shall be installed between the pipe and the copper plated hanger, support, clamp, etc. The separation material shall prohibit electrical conductance and prevent galvanic action or corrosion between dissimilar metals. Separation material shall be guaranteed for a minimum of thirty (30) years.

2.4 BUILDING ATTACHMENTS

- A. General: Except as otherwise indicated, provide factory-fabricated building attachments complying with MSS SP-58, selected by Installer to suit building substrate conditions, in accordance with MSS SP-69 and manufacturer's published product information. Select size of building attachments to suit hanger rods. Provide copper-plated building attachments for copper-piping systems. Provide copper-plated hangers and supports for copper-piping systems. To avoid future electrolysis or corrosion, copper plated hangers, supports, clamps, rod attachments, and building attachments shall not be in direct contact with copper piping. A separation material shall be installed between the pipe and the copper plated hanger, support, clamp, etc. The separation material shall prohibit electrical conductance and prevent galvanic action or corrosion between dissimilar metals. Separation material shall be guaranteed for a minimum of thirty (30) years.

2.5 SADDLES AND SHIELDS

- A. General: Except as otherwise indicated, provide saddles or shields under piping hangers and supports, factory-fabricated, for all insulated piping. Size saddles and shields for exact fit to mate with pipe insulation.

2.6 SPRING HANGERS AND SUPPORTS

- A. General: Except as otherwise indicated, provide factory-fabricated spring hangers and supports complying with MSS SP-58, selected by Installer to suit piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select spring hangers and supports to suit pipe size and loading.

2.7 MISCELLANEOUS MATERIALS

- A. Metal Framing: Provide products complying with NEMA STD ML 1.
- B. Steel Plates, Shapes and Bars: Provide products complying with ASTM A 36.
- C. Cement Grout: Portland cement (ASTM C 150, Type I or Type III) and clean uniformly graded, natural sand (ASTM C 404, Size No. 2).
- D. Heavy-Duty Steel Trapezes: Fabricate from steel shapes selected for loads required; weld steel in accordance with AWS standards.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine areas and conditions under which hangers and supports are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF BUILDING ATTACHMENTS

- A. Install attachments at required locations within concrete steel for proper piping support. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional building attachments where support is required for additional concentrated loads, including valves, flanges, guides, strainers, expansion joints, and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten insert securely to forms. Where concrete with compressive strength less than 2500 psi (17240 kPa) is indicated, install reinforcing bars through openings at top of inserts.

3.3 INSTALLATION OF HANGERS AND SUPPORTS

- A. General: Install hangers, supports, clamps and attachments to support piping properly from building structure; comply with MSS SP-69. Arrange for grouping of parallel runs of horizontal piping to be supported together on trapeze type hangers where possible. Install supports with maximum spacings complying with MSS SP-69. Where piping of various sizes is to be supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe. Do not use wire or perforated metal to support piping, and do not support piping from other piping.
- B. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers and other accessories. Except as otherwise indicated for exposed continuous pipe runs, install hangers and supports of same type and style as installed for adjacent similar piping.
- C. Support fire-water piping independently of other piping.
- D. Prevent electrolysis in support of copper tubing by use of hangers and supports which are copper plated, or by other recognized industry methods.
- E. Provisions for Movement:
 - 1. Install hangers and supports to allow controlled movement of piping systems and to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends and similar units.
- F. Load Distribution: Install hangers and supports so that piping live and dead loading and stresses from movement will not be transmitted to connected equipment.
- G. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes, and so that maximum pipe deflections allowed by ANSI B31 Pressure Piping Codes are not exceeded.
- H. Insulated Piping: Comply with the following installation requirements.
 - 1. Clamps: Attach clamps, including spacers (if any), to piping with clamps projecting through insulation; do not exceed pipe stresses allowed by ANSI B31.

2. Shields: Where low-compressive-strength insulation or vapor barriers are indicated on cold water piping, install coated protective shields.
 3. Saddles: Where insulation without vapor barrier is indicated, install protection saddles.
 4. For all insulated piping 2-1/2" (63 mm) and larger, provide insulated saddles as follows:
 - a. For domestic hot and cold water piping, provide the following:
 - b. Minimum 3.75 pcf, non-compressive, rigid, phenolic foam insulation. Fire and smoke rating shall be 25/50 or below per ASTM 84.
 - c. For cold applications below 75°F (24°C) a zero permeability, abuse resistant, vapor barrier shall be provided with matching butt strips. Apply a full coating of butyl joint sealant in addition to the butt strips for a completely sealed system.
 - d. The phenolic foam system shall have a K factor of 0.16 at a mean temperature for 75°F (24°C) and comply with ASTM Standard C1126.
 - e. Provide visible inspection sticker at the bottom of each saddle.
 - f. Pipe insulation saddles shall be Tru-Balance CoolDry Saddles as manufactured by Buckaroos, Inc. or equivalent.
 - I. Spacing: Hanger spacing for piping shall not exceed 8 feet (2400 mm) on centers for pipe 1-1/4" (32 mm) or smaller, and 10 feet (3 m) for pipe 1-1/2" (40 mm) and larger. Regardless of spacing, hangers shall be provided at or near all changes in direction, both vertical and horizontal, for all piping. For cast iron soil pipe, one hanger shall be placed at each hub or bell.
- 3.4 ADJUSTMENT OF HANGERS AND SUPPORTS
- A. Adjust hangers and supports and place grout as required under supports to bring piping to proper levels and elevations.
- 3.5 EQUIPMENT SUPPORTS
- A. Provide concrete housekeeping bases for all floor mounted equipment furnished as part of the work of Division-22. Size bases to extend minimum of 4" (100 mm) beyond equipment base in any direction; and 4" (100 mm) above finished floor elevation. Construct of reinforced concrete, roughen floor slab beneath base for bond, and provide steel rod anchors between floor and base. Locate anchor bolts using equipment manufacturer's templates. Chamfer top and edge corners.
 - B. Provide structural steel stands to support equipment not floor mounted or hung from structure. Construct of structural steel members or steel pipe and fittings. Provide factory-fabricated tank saddles for tanks mounted on steel stands.
- 3.6 PAINTING
- A. All hangers, supports, clamps and assemblies shall be primed and painted with rust inhibitors.

END OF SECTION 22 05 29

SECTION 22 14 13 - STORM WATER PIPING**PART 1 - GENERAL****1.1 DESCRIPTION OF WORK**

- A. Extent of storm water piping work is indicated on drawings and schedules, and by requirements of this section.
- B. Applications for storm water piping include the following:
 - 1. Conductor piping from roof drains and deck drains to storm water system.
 - 2. Storm water piping from conductor piping and area drains to storm sewers five feet outside of foundation wall.
 - 3. Air conditioning condensate piping.
- C. Exterior storm water piping is specified in applicable Division-2 sections, and is included as work of this section.
- D. Refer to appropriate Division-22 sections for insulation required in conjunction with storm water piping; not work of this section.
- E. Trenching and backfill required in conjunction with storm building drain piping is specified in applicable Division-22 sections, and is included as work of this section.

1.2 QUALITY ASSURANCE

- A. Specimen Joints: Before commencing pipe laying, Contractor shall form specimen joints to demonstrate that materials and methods employed will result in watertight joints.
- B. Qualification of Installers: The entire system shall be installed by trained workmen skilled in the installation of such systems for a minimum of five (5) years.
- C. Plumbing Code Compliance: Comply with applicable portions of National Standard Plumbing Code pertaining to plumbing materials, construction and installation of products.
- D. ANSI Compliance: Comply with applicable American National Standards pertaining to products and installation of soil, waste and storm water piping systems.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's data for storm water piping systems materials and products.
- B. Shop Drawings: Submit scaled layout drawings of installed storm water pipe and fittings showing interface and spatial relationship between piping and proximate equipment.

PART 2 - PRODUCTS**2.1 MANUFACTURERS**

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering cleanouts, drains and valves which may be incorporated in the Work include the following:
 - 1. Josam
 - 2. J. R. Smith
 - 3. Zurn
 - 4. Wade
 - 5. Mifab
 - 6. Watts Drainage

2.2 STORM WATER PIPING MATERIALS AND PRODUCTS

- A. General: Provide piping materials and factory-fabricated piping products of sizes, types, pressure ratings, and capacities as indicated. Where not indicated, provide proper selection as determined

by Installer to comply with installation requirements. Provide sizes and types matching piping and equipment connections; provide fittings of materials which match pipe materials used in storm water piping systems. Where more than one type of materials or products is indicated, selection is Installer's option.

2.3 BASIC IDENTIFICATION

- A. General: Provide identification complying with Division-22 Section "Identification for Plumbing Piping and Equipment".

2.4 BASIC PIPE, TUBE AND FITTINGS

- A. General: Provide pipe, tube, and fittings complying with Division-22 Section "Pipe, Tube, and Fittings for Plumbing Systems", in accordance with the following listing:
- B. Above Ground Piping Within Buildings:
 - 1. Tube Size 8" (200 mm) and Smaller: Copper tube.
 - a. Wall Thickness: Type DWV.
 - b. Fittings: Cast-bronze, drainage pattern, solder-joints.
 - 2. Pipe Size 15" (400 mm) and Smaller: Cast-iron hub-and-spigot soil pipe.
 - a. Pipe and fittings to be service weight and shall comply with ASTM A-74 and bear the collective mark of the Cast Iron Soil Pipe Institute (CISPI).
 - b. Fittings: Compression gasket joints meeting the requirements of ASTM C 564, or lead and oakum joints.
 - 3. Pipe Size 15" (400 mm) and Smaller: Hubless cast-iron soil pipe.
 - a. Pipe and fittings shall comply with CISPI 301 and bear the collective mark of the Cast Iron Soil Pipe Institute (CISPI).
 - b. Fittings: Hubless couplings shall comply with CISPI Standard 310.
 - c. For buildings less than ten (10) floors in height, provide heavy duty shielded couplings for all aboveground piping up to the second floor level.
 - d. For buildings more than ten (10), but less than twenty (20) floors in height, provide heavy duty shielded couplings for all aboveground piping up to the fourth floor level.
 - e. Provide heavy duty shielded couplings for all aboveground piping.
 - f. Heavy Duty Shielded Couplings: Heavy duty couplings shall meet the requirements of ASTM C 1540 and gaskets shall meet the requirements of ASTM 564.
 - g. Available Manufacturers: Subject to compliance with requirements, manufacturers offering couplings which may be incorporated in the Work include the following:
 - 1) Anaco/Husky
 - 2) Mission Rubber
 - 3) Tyler Coupling
 - 4) Ideal
 - 4. Pipe Size 16" (400 mm) and Smaller: PVC Schedule 40.
 - a. Pipe and fittings shall be manufactured from virgin rigid polyvinyl chloride (PVC) compound with a cell class of 12454 per ASTM D 1784 and conform with NSF International Standard 14. Pipe shall be Schedule 40, solid wall, iron pipe size (IPS) conforming to ASTM D 1785 and ASTM D 2665. Molded fittings shall conform to ASTM D 2665. Fabricated fittings shall conform to ASTM F 1866. Installation to be in accordance with manufacturer's instructions and all applicable local code requirements. Buried Pipe to be installed in accordance with ASTM D 2321 and ASTM F 1668. Solvent cements shall conform to ASTM D 2564. Primers shall conform to ASTM F 656. Installation to be in accordance with manufacturer's instructions and all applicable local code requirements. Foam core, cellular core, etc. shall not be accepted.

C. Underground Drain Piping:

1. Pipe Size 15" (400 mm) and Smaller: Cast-iron hub and spigot soil pipe.
 - a. Pipe and fittings to be service weight and shall comply with ASTM A 74 and bear the collective mark of the Cast Iron Soil Pipe Institute (CISPI).
 - b. Fittings: Compression gasket joints meeting the requirements of ASTM C 564, or lead and oakum joints.

D. Air Conditioning Condensate (above floor/roof):

1. 2" (50 mm) and Smaller: Copper.
 - a. Wall Thickness: Type M.
 - b. Fittings: Solder-joint.

2.5 BASIC PIPING SPECIALTIES

A. General: Provide piping specialties complying with Division-22 Section, "Piping Specialties for Plumbing Systems", in accordance with the following listing:

1. Pipe Escutcheons
2. Drip-Pans
3. Pipe Sleeves
4. Sleeve Seals

2.6 SUPPORTS AND ANCHORS

A. General: Provide supports and anchors complying with Division-22 Section, "Hangers and Supports for Plumbing Piping and Equipment".

2.7 CLEANOUTS

- A. General: Provide factory-fabricated cleanouts of size and type indicated. Where not indicated, provide proper selection as determined by Installer to comply with installation requirements and governing regulations.
- B. Cleanouts in Piping: Cast-iron cleanout ferrule with bronze countersunk plug, suitable for no-hub applications.
- C. Cleanouts in finished walls and partitions shall be similar to cleanouts in piping. Provide round polished stainless steel wall access cover with screw. Finish as per Architect.
- D. Cleanouts in Tiled Floor: Cast-iron internal gasketed cleanout plug and adjustable housing with secured scoriated square satin Nickel Alloy top.
- E. Cleanouts In Non-Tiled Floor: Similar to tiled floor type with a secured scoriated round satin Nickel Alloy top.

2.8 STORM WATER AREA FLOOR DRAINS

- A. General: Provide floor drains of size as indicated on drawings; and type, including features, as specified herein:
- B. Storm Water Area Floor Drain: Cast-iron body and heavy duty wide flange collar, heavy duty tractor grate (minimum 8" diameter) (minimum 205 mm diameter), with the following features:
 1. Double drainage flange with weep holes.
 2. Sediment bucket.
 3. Adjustable extension.
 4. Flat bottom strainer.
 5. Deep body.
 6. Bottom outlet, hub and spigot for underground piping.

PART 3 - EXECUTION

3.1 INSTALLATION OF BASIC IDENTIFICATION

- A. General: Install mechanical identification in accordance with Division-16 Section "Identification for Plumbing Piping and Equipment".

3.2 INSTALLATION OF STORM WATER PIPING ABOVE GROUND

- A. General: Install storm water piping in accordance with Division-22 Section, "Pipe, Tube, and Fittings for Plumbing Systems", and with National Standard Plumbing Code.

3.3 INSTALLATION OF BUILDING DRAIN PIPING

- A. General: Install storm building drains as indicated and in accordance with National Standard Plumbing Code. Lay storm building drains beginning at low point of systems, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install required gaskets in accordance with manufacturer's recommendations for use of lubricants, cements, and other special installation requirements. Clear interior of piping of dirt and other superfluous material as work progresses. Maintain swab or drag in line and pull past each joint as it is completed. Place plugs in ends of uncompleted piping at end of day or whenever work stops.
- B. Air conditioning (A/C) condensate piping shall be extended from all A/C condensate source equipment (air handling units, fan coil units, unit ventilators, split system A/C units, etc.) and connected to the nearest storm water pipe/drain location. Size per manufacturer.
- C. Install storm water piping pitched to drain at minimum slope of 1/8" per foot (10 mm per meter) (1%). Where possible, 1/4" per foot (20 mm per meter) (2%) shall be provided.

3.4 INSTALLATION OF PIPING SPECIALTIES

- A. Install piping specialties in accordance with requirements of Division-22 Section, "Piping Specialties for Plumbing Systems".

3.5 INSTALLATION OF SUPPORTS AND ANCHORS

- A. Install supports and anchors in accordance with Division-22 Section, "Hangers and Supports for Plumbing Piping and Equipment".

3.6 INSTALLATION OF SPECIAL VALVES

- A. Backwater Valves: Install in storm water piping as indicated, and as required by National Standard Plumbing Code. For interior installation, provide cleanout cover flush to floor centered over backwater valve cover, and of adequate size to remove valve cover for service. Install in such a manner to provide a maximum 1/4" (6 mm) clearance between flapper and seat for air circulation.

3.7 INSTALLATION OF SPECIAL EXPANSION COMPENSATION PRODUCTS

- A. Expansion Joints: Install expansion joints on vertical risers as indicated, or as required by National Standard Plumbing Code.

3.8 INSTALLATION OF DRAINAGE PIPING PRODUCTS

- A. Cleanouts: Install in conductor piping and storm building drain piping as indicated, as required by National Standard Plumbing Code; at each change in direction of piping greater than 45 degrees; at minimum intervals of 50 feet (15 m) for piping 4" (100 mm) and smaller and 75 feet (23 m) for larger piping; and at base of each conductor. Install floor and wall cleanout covers for concealed piping, select type to match adjacent building finish.
- B. Flashing Flanges: Install flashing flange and clamping device with each cleanout passing through waterproof membrane.

3.9 INSTALLATION OF DRAINS

- A. General: Install drains in accordance with manufacturer's written instructions and in locations indicated.
- B. Coordinate with roofing as necessary to interface roof drains with roofing work.
- C. Coordinate with storm water piping as necessary to interface drains with drainage piping systems.
 - 1. Install drains at low points of surface areas to be drained, or as indicated.
 - 2. Install drain flashing collar or flange so that no leakage occurs between drain and adjoining roofing. Maintain integrity of waterproof membranes, where penetrated.
- D. Position drains so that they are accessible and easy to maintain.

3.10 PIPING TESTS

- A. Test storm water piping system in accordance with requirements of Division-23 Section, "Testing, Adjusting and Balancing".

END OF SECTION 22 14 13

SECTION 23 01 00 - BASIC HVAC REQUIREMENTS**PART 1 - GENERAL****1.1 CONTRACT DOCUMENTS**

- A. Unless otherwise modified, provisions of General Conditions, Supplementary Conditions and Division-01 govern work under the Mechanical Divisions.
- B. Contract drawings for mechanical work are diagrammatic, intended to convey scope and general arrangement. Contractor shall review and coordinate routing of new work to clear existing piping, duct, electrical, structure, etc. at no cost to the Owner. All dimensions of existing conditions shall be considered approximate (for information only). All dimensions shall be verified prior to construction.
- C. Contract Document Interpretation/Discrepancies:
 - 1. Should the Contractor discover any discrepancies or omissions on the drawings or in the specifications, he shall notify the Architect/Engineer (A/E) of such conditions prior to the bid date. Otherwise, it will be understood that the drawings and specifications are clear as to what is intended and shall be as interpreted by the A/E.
 - 2. In addition, should any contradiction, ambiguity, inconsistency, discrepancy or conflict appear in or between any of the Contract Documents, the Contractor, shall, before proceeding with the work in question, notify the A/E and request an interpretation. In no case shall he proceed with the affected work until advised by the A/E.
 - 3. If the Contractor fails to make a request for interpretation of discrepancies or conflicts in the drawings or specifications, no excuse will be accepted for failure to carry out the work in a satisfactory manner, as interpreted by the A/E. In all cases, the Contractor will be deemed to have estimated the most stringent materials and methods (i.e. the highest quality materials and most expensive manner of completing the work) unless he has requested and obtained written authorization as to which methods or materials will be required.
 - 4. Each and every trade or subcontractor will be deemed to have familiarized himself with all drawings of this project, including Site/Civil, Architectural, Structural, Mechanical, Electrical, Plumbing, Fire Protection, Information Technology (IT), etc. so as to avoid coordination errors, omissions, and misinterpretations. No additional compensation will be authorized for alleged errors, omissions, and misinterpretation, whether they are a result of failure to observe these requirements or not.
- D. The complete set of Architectural, Structural, Civil, Mechanical, Electrical, Plumbing, Fire Protection and IT drawings, specifications, and addenda apply to this work.

1.2 SCOPE

- A. The work in Division-23 includes furnishing and installing the mechanical systems complete and ready for satisfactory service.
- B. Requirements specified govern work in all sections of Division-23.

1.3 REFERENCES

- A. References to standards, codes, catalogs and recommendations are latest edition in effect on date of invitation to bid.
- B. Refer to applicable contract drawings, specifications and addenda pertaining to other divisions for conditions affecting work.
- C. Refer to Division-01 for description of alternates.
- D. Refer to Division-01 for description of allowance items.
- E. Refer to Division-01 for description of base bid items.

- F. Refer to Division-01 for description of demolition items.

1.4 DEFINITIONS

- A. Following are definitions of terms and expressions used in this Division:

1. "Approve" - to permit use of material, equipment or methods conditional upon compliance with contract document requirements.
2. "Concealed" - hidden from normal sight; includes work in crawl spaces, above ceilings, and in building shafts.
3. "Directed" - directed by Engineer.
4. "Ductwork" - includes ducts, fittings, housings, dampers, supports and accessories comprising a system.
5. "Equal, equivalent" - possessing the same performance qualities and characteristics and fulfilling the same utilitarian function.
6. "Exposed" - not concealed.
7. "Indicated" - indicated in Contract Documents.
8. "Piping" - includes pipe, fittings, valves, supports and accessories comprising a system.
9. "Provide" - furnish and install.
10. "Removable" - detachable from the structure or system without physical alteration of materials or equipment or disturbance to other construction.
11. "Review" - limited observation or checking to ascertain general conformance with design concepts and general compliance with contract document requirements. Such action does not constitute a waiver or alteration of the contract requirements. Verification of quantities and dimensions shall be the responsibility of the Contractor.
12. "Appurtenances" - a device or assembly installed in the referenced system which performs some useful referenced function in the operation, maintenance, servicing, economy or safety of the system. Some examples include, but are not limited to aerators, anchors, supports, gauges, backflow preventers, expansion tanks, filters, flow controls, heat exchangers, interceptors, meters, pressure reducing valves, relief valves, dampers, separators and similar devices.
13. "Record Documents" - drawings, plans and specifications that indicate the nature and location of work reported by Contractors, but not verified by Consultant. Record documents cannot be considered reliable; as they are based on information reported by the Contractor only and is not verified by the Architect or Engineer (A/E).

1.5 RIGGING REQUIREMENTS

- A. Prior to bidding, the Contractor shall verify that all equipment can be physically rigged to the proposed location without disturbance or dismantling of any existing or new physical obstacles. Should the rigging of any new equipment appear to be an issue, the Contractor shall inform the Architect or Engineer (A/E) seven (7) days prior to the bid date that the rigging of the new equipment may present a problem. Otherwise, the Contractor shall, in accordance with the manufacturer's approval and without voiding warranties and/or certifications, have the equipment "broken down" into sections as required to install the equipment in its proposed location without disturbance or dismantling of any existing or new physical obstacles.
- B. Failure to inform the Architect or Engineer (A/E) seven (7) days prior to the bid of any rigging problems will result in the Contractor accepting full responsibility for all modifications to the equipment or the physical obstacles required to install the equipment in its proposed location without additional cost to the Owner.

1.6 CONTRACTOR'S INSTALLATION DRAWINGS

- A. Prior to fabrication and installation, submit shop drawings (min. scale - 1/4" = 1' - 0") illustrating all mechanical, electrical and plumbing (MEP) system elements (including but not limited to: ductwork, HVAC piping, plumbing piping, insulation, lighting fixtures, cable tray, conduit, expansion loops, supports, alignment guides, fire protection, etc.) coordinated with each other as well as the architectural and structural building elements. Installation drawings shall be based upon project specific, approved, product information for each of the MEP elements listed above

(as well as architectural, structural, etc. systems), and shall be prepared at a minimum BIM LOD 400 (Building Information Modeling Level of Development 400) level of detail. Installation drawings shall be reviewed by Owner's representative prior to fabrication and installation of any new work and prior to the ordering of any mechanical equipment.

- B. Should the Contractor not provide the coordinated installation drawings required above, the following shall apply:
 - 1. The Contractor shall accept full and absolute responsibility for the coordination of all project materials and equipment to be installed as indicated on the contract documents.
 - 2. Proposed change orders and/or time extensions will not be accepted for any additional work that results from coordination related changes.
 - 3. A credit shall be issued to the Owner for the value of the coordinated installation drawings; the value of the credit to the Owner shall be as determined by the A/E.
- C. Electronic files (AutoCad or Revit) of mechanical, electrical and plumbing (MEP) drawings may be made available upon receipt of a signed copy of the Engineer's Electronic Document Disclaimer (available upon request). The electronic files shall not be utilized for the preparation of coordination/installation/fabrication shop drawings. Coordination/installation/fabrication shop drawings shall be created independently from the electronic MEP files (i.e. AutoCad drawings and/or Revit model). Please note: the electronic MEP Revit model (where applicable) was created at a level of detail similar to BIM LOD 300; however, some MEP elements were modified to provide clarity and legibility to the two-dimensional construction documents. In addition, the electronic files may include delegated design elements that may differ as a result of the final delegated design to be completed by the Contractor (this may include all disciplines including architectural, structural, etc.). Modifications of the MEP systems to accommodate those delegated design elements shall be provided by the Contractor at no additional cost to the Owner.

1.7 MATERIAL, EQUIPMENT AND SUBSTITUTION REQUIREMENTS

- A. Use products of one manufacturer where two or more items of same kind of equipment are required.
- B. Materials and equipment shall have a record of two (2) years successful field use.
- C. Where a specific manufacturer is listed on the drawings, that manufacturer shall be considered the basis of design for that particular item of equipment. Only the basis of design manufacturer has been verified to meet the project requirements (i.e. dimensions, weights, service clearances, electrical requirements, etc.).
- D. Where the drawings and/or specifications indicate more than one manufacturer for a particular item of equipment, only those listed may submit products and services to be included in the work; manufacturers other than those listed will not be acceptable. Should the Contractor choose to use one of the specified manufacturers other than the basis of design, it shall be the responsibility of the Contractor to verify that the equipment meets all project requirements including, but not limited to, verification of all dimensions, weights, service clearances, electrical requirements, etc. All changes incurred shall be the responsibility of the Contractor and shall be provided at no additional cost to the Owner.
- E. Substitutions must be submitted for consideration seven (7) days prior to the original bid date. Consideration of substitutions shall be at the sole discretion of the Engineer. Substitution submittals shall include all information required in the "Submittals" paragraph of this specification section, as well as all other requirements indicated through the Division-23 specifications. Substitutions will not mitigate, in any way, the Contractor's responsibility in complying with the coordination, contract requirements or design intent. Any additional electrical, structural or special requirements, etc. shall be the responsibility of the Contractor. Also, any additional cost incurred as a result of substitution shall be the responsibility of the Contractor.
- F. Nameplate: For each piece of power operated mechanical equipment provide a permanent operational data nameplate indicating manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and similar essential data. Locate nameplates in an accessible location.

- G. Where items of equipment are indicated as Base Bid on the bid form include in the Bid price the cost of providing the equipment upon which the specification is based. In addition, submit with bid for Owner's consideration the amount to be added or deducted from the base bid for other listed manufacturers' equipment. Owner will advise Contractor within forty-five (45) days after award of contract of his selection.

1.8 MATERIAL AND EQUIPMENT LIST

- A. Within thirty (30) days after award of the contract, submit for Engineer's review a list of subcontractors' and manufacturers' names for items proposed for this project.

1.9 SUBMITTALS

- A. Where the drawings and/or specifications indicate more than one allowable manufacturer for a particular piece of equipment and/or product, only those manufacturers indicated may submit products and services to be included in the work. Unless otherwise indicated, manufacturers other than those listed will not be acceptable.
- B. Submit shop drawings, manufacturer's data and certificates for equipment, materials and finish, and pertinent details for each system where specified in each individual section, and obtain approval before procurement, fabrication, or delivery of the items to the job site. Partial submittals are not acceptable and will be returned without review.
- C. Shop Drawings: Drawings shall include floor plans, sectional views, wiring diagrams, and installation details of equipment. Include equipment spaces identifying and indicating proposed location, layout and arrangement of items of equipment, control panels, accessories, piping, ductwork, and other items that must be shown to assure a coordinated installation. Wiring diagrams shall identify circuit terminals, and indicate the internal wiring for each item of equipment and the interconnection between each item of equipment. Drawings shall indicate adequate clearance for operation, maintenance, and replacement of operating equipment devices. If equipment is disapproved, drawings shall be revised to show acceptable equipment and be resubmitted. All equipment and/or products shall be submitted by an authorized factory representative of that particular product.
- D. Manufacturer's Data: Submittals for each manufactured item shall be manufacturer's descriptive literature of cataloged products, equipment drawings, diagrams, performance and characteristic curves, and catalog cuts.
- E. Standards Compliance: When materials or equipment must conform to the standards of organizations such as the American National Standards Institute (ANSI), American Society for Testing and Materials (ASTM), National Electrical Manufacturers Association (NEMA), American Society of Mechanical Engineers (ASME), American Gas Association (AGA), American Refrigeration Institute (ARI), and Underwriters' Laboratories (UL), proof of such conformance shall be submitted to the Engineer for review. If an organization uses a label or listing to indicate compliance with a particular standard, the label or listing will be acceptable evidence, unless otherwise specified in the individual sections. In lieu of the label or listing, the Contractor shall submit a certificate from an independent testing organization, which is competent to perform acceptable testing. The certificate shall state that the item has been tested in accordance with the specified organization's test methods and that the item conforms to the specified organization's standard. For materials and equipment whose compliance with organizational standards or specifications is not regulated by an organization using its own listing or label as proof of compliance, a certificate of compliance from the manufacturer shall be submitted for review. The certificate shall identify the manufacturer, the product, and the referenced standard and shall simply state that the manufacturer certifies that the product conforms to all requirements of the project specification and of the referenced standards listed.
- F. Contractor shall thoroughly review and stamp all submittals to indicate compliance with contract requirements prior to submission and coordinate installation requirements for equipment submitted, including, a) the verification of equipment weights relative to the existing and/or new structural support system and b) the verification of equipment dimensions relative to existing

and/or new architectural conditions. Contractor shall be responsible for correctness of all submittals.

- G. Submittals will be checked only for general conformance with the design concept and are subject to the original contract documents, as well as any corrections and comments noted. Comments noted, if any, will not be considered a complete list of all omissions, deviations and corrections necessary to meet the requirements of the contract documents. The Contractor will be responsible to confirm that the final product and installation will be in conformance with the contract documents in their entirety, including the responsibility to fully coordinate all work with other trades and to confirm the correctness of dimensions, quantities, and capacities. Submittal review does not authorize or constitute a change to the contract requirements and does not release the Contractor of responsibility to conform to the contract requirements. Requirements of the contract are not waived by review of any and all substitutions. The Contractor must fulfill the terms of the contract.
- H. Compliance Review Form: Each equipment submittal must include a Compliance Review Form formatted as follows:
1. Section 1: Certify that the submittal is in complete compliance with the plans and specifications, except for the numbered and footnoted deviations and exceptions as defined herein. Deviations or exceptions taken in a cover letter or by contradiction or omission shall not constitute a release from the requirement that the equipment be in complete compliance with the plans and specifications.
 2. Section 2: Provide a detailed paragraph by paragraph annotation of the specification with an individual "C", "D", or "E" noted in the margin, as follows:
 - a. "C" shall mean compliance with no exceptions. Provide a numbered footnote (i.e. C1, C2, C3, etc.) for each comment or clarification.
 - b. "D" shall mean compliance with deviations. For each deviation, provide a numbered footnote (i.e. D1, D2, D3, etc.) with a detailed explanation of how the intent of this specification is to be satisfied.
 - c. "E" shall mean exception. The equipment offered is not in compliance with the specifications. For each exception, provide a numbered footnote (i.e. E1, E2, E3, etc.) with a detailed description of the exception.
- I. Electronic Submittals: Should the Contractor elect to submit electronic shop drawings/submittals, the procedure shall be as follows:
1. Provide a transmittal with the electronic shop drawing/submittal indicating that the document was transmitted electronically. Transmittal shall also include verification of the Contractor's review indicating compliance with the contract documents in accordance with paragraph 1.09.F of this section.
 2. Sequentially number all pages on the electronic shop drawing/submittal. The total number of pages shall be reflected in the transmittal.
 3. Submittal review comments shall be transmitted electronically. Large documents will be scanned with comments as necessary and returned electronically.
 4. All shop drawings such as, but not limited to: coordination drawings, ductwork shop drawings, fire alarm drawings, ductbank layouts, etc. shall be submitted in hard copy, full size format.
 5. Provide hard copy of the shop drawing/submittal for each of the Operations and Maintenance Manuals.
 6. Failure to comply with the above will result in the submittal being returned and marked "Not Reviewed".
- J. Submittals will be reviewed for general compliance with design concept in accordance with contract documents. Dimensions, quantities, weights, or other details will not be verified by the A/E; this is the responsibility of the Contractor.
- K. Acceptance will not constitute waiver of contract requirements unless deviations are specifically indicated and clearly noted.

- L. Review Period: BKM shall be allotted two (2) weeks for the processing, review and return of all submittals. It shall be incumbent upon the Contractor to include this time period in their schedule.
1. Resubmittals: BKM shall be allotted an additional two weeks (14 days) for the review of each resubmittal. Again, it shall be the Contractor's responsibility to submit the appropriate materials in a timely fashion.
 2. Contract Extension: No extension in contract time will be authorized as a result of the timeline addressed above.
- M. Submittal Identifications:
1. Place a permanent label or title block on each submittal for identification.
 2. Indicate name of firm or entity that prepared each submittal on label or title block.
 3. Provide a space approximately 4 by 5 inches on label or beside title block to record Contractor's review and approval markings and action taken by A/E.
 4. Include the following information on label for processing and recording action taken:
 - a. Project name
 - b. Date
 - c. Name and address of A/E
 - d. Name and address of Contractor
 - e. Name and address of subcontractor
 - f. Name and address of supplier
 - g. Name of manufacturer
 - h. Unique identifier, including revision number
 - i. Number and title of appropriate specification section
 - j. Drawing number and detail references, as appropriate
 - k. Other necessary identification
 - l. Example: 230700-01-0
 - 1) 230700 references the spec section
 - 2) 01 indicates this is the first submittal from this spec section
 - 3) 0 indicates this is the original submittal (where 1 would indicate this is the first re-submittal)
- N. The Engineer will provide a maximum of two (2) submittal reviews per equipment submittal; the initial review plus one (1) re-submittal. Should the re-submittal be returned "Not Acceptable" or "Revise and Resubmit", the Contractor shall choose one of the following courses of action:
1. Provide the exact manufacturer and model indicated in the contract documents as the basis of design, or
 2. Reimburse the Engineer for all additional review time required to achieve a submittal review from the Engineer of "No Exceptions Taken."
 3. Should the Contractor choose option 2 above, the Engineer shall be reimbursed at an hourly rate of \$175 per hour with payment due prior to the return of the final submittal. In addition, the Contractor shall accept complete responsibility for all delays resulting from the submittal review process extending beyond two (2) reviews per equipment submittal.
- O. Resubmittals: Resubmittals shall comply with paragraph 1.09 of this section and the following additional requirements.
1. Resubmittals shall include a written response to each submittal comment. Provide a detailed comment by comment annotation of the submittal review comments with an individual "C", "D", or "E" as follows:
 - a. "C" shall mean compliance with no exceptions. Provide a numbered footnote (i.e. C1, C2, C3, etc.) for each comment or clarification.
 - b. "D" shall mean compliance with deviations. For each deviation, provide a numbered footnote (i.e. D1, D2, D3, etc.) with a detailed explanation of how the intent of this specification is to be satisfied.

- c. "E" shall mean exception. The equipment offered is not in compliance with the specifications. For each exception, provide a numbered footnote (i.e. E1, E2, E3, etc.) with a detailed description of the exception.

1.10 MANUFACTURER'S RECOMMENDATIONS

- A. Installation procedures are required to be in accordance with the recommendations of the manufacturer of the material being installed.

1.11 ACCESSIBILITY

- A. Install equipment and materials to provide required access for servicing and maintenance. Coordinate the final location of concealed equipment and devices requiring access with final location of required access panels and doors. Allow ample space for removal of all parts that require replacement or servicing.

1.12 SAFETY REQUIREMENTS

- A. Belts, pulleys, chains, gears, couplings, projecting setscrews, keys, and other rotating parts located so that any person can come in close proximity thereto shall be fully enclosed or properly guarded in accordance with OSHA. High-temperature equipment and piping so located as to endanger personnel or create a fire hazard shall be properly guarded or covered with insulation of a type as specified herein. Items such as catwalks, ladders, and guardrails shall be provided where required for safe operation and maintenance of equipment.

1.13 WORKMANSHIP

- A. Remove and replace, at no extra cost, all work not orderly, reasonably neat, or workmanlike.
- B. Coordinate all work and cooperate with other trades to facilitate execution of work.

1.14 SITE EXAMINATION/EXISTING CONDITIONS VERIFICATION

- A. Failure to visit site and become familiar with existing conditions prior to bidding will not relieve the Contractor of responsibility for complying with the Contract documents.
- B. Contractor shall field verify existing services and direction of flow of piping and ductwork prior to connection. Existing mechanical identification shall not constitute proper verification of service or direction of flow.

1.15 REGULATIONS AND PERMITS

- A. Comply with all applicable codes and regulations.
- B. All equipment provided shall be in accordance with all applicable local, state, and federal codes, guidelines and standards, as well as the authority having jurisdiction. Equipment and installation shall be in compliance with all applicable energy codes including the most current version of ASHRAE Standard 90.1.
- C. Obtain and pay for all required permits.

1.16 CUTTING AND PATCHING

- A. Unless otherwise directed, do all cutting and patching. Damaged work, including fireproofing and waterproofing shall be repaired by skilled mechanics of the trade involved.
- B. Do not cut walls, floors, roofs, reinforced concrete or structural steel without structural Engineer's permission. Install services without affecting reinforcing steel.
- C. In precast concrete plank drill all holes with a Carboloy tipped drill. Follow instructions of structural Engineer. Cut no reinforcing bars.

1.17 LINTELS

- A. Under this Section provide all lintels not provided elsewhere which are required for openings for the installations of mechanical work. Lintels shall meet the requirements of the structural sections.

1.18 CLEANING UP

- A. Keep premises free from accumulation of debris.
- B. Remove tools, scaffolding, surplus material, debris, and leave premises broom clean.
- C. On discontinuance of part of the work, place all debris in containers and promptly remove them from the Owner's property.
- D. Leave all areas broom clean.
- E. Final clean-up shall be performed.

1.19 AREAS REQUIRING SPECIAL FINISHES/PAINTING

- A. In kitchens, cafeterias, dining rooms, serving pantries and utility rooms [polish chromium or nickel plate] [paint as specified under Painting] all exposed and uninsulated piping including valves, traps, strainers and appurtenant items; and exposed electrical work including conduit, boxes, switches starters and disconnects. Finish shall not be applied to nameplates, pushbuttons. Stainless steel housing and plates require no plating or paints.
- B. Provide surface preparation, priming and painting of all mechanical and boiler room floors to provide a smooth, cleanable surface. Primer and paint shall be appropriate for concrete slab surfaces. Where painting over existing surfaces, coatings, or where the floor is soiled, degrease and follow manufacturer's recommendations for surface preparation, priming and painting. See specification sections "Painting" and "HVAC Related Work", where applicable, for additional painting requirements. Color shall be selected by the A/E.

1.20 PROTECTION

- A. Protect mechanical and electrical material and equipment from the elements or other injury as soon as delivered on premises.
- B. Cap or plug openings in equipment, piping, duct, and conduit systems to exclude dirt and other foreign material. Rags, wool, cotton, paper, waste or similar materials shall not be used for plugging.
- C. Unless approved by Owner, HVAC equipment shall not be used for temporary heating or ventilation during construction.
- D. Contractor shall protect all existing mechanical, electrical and architectural equipment, materials, finishes, etc. located within or adjacent to the work environment. Contractor shall be responsible for restoration of all existing mechanical, electrical and architectural items to remain. All equipment to remain must be restored to its pre-existing condition prior to the start of work. Restoration and/or replacement shall be at no cost to the Owner.
- E. Contractor shall provide temporary cooling and heating as required to protect all construction materials from the potential adverse effects of high or low temperature and humidity. Upon delivery of ceiling and other finish materials to a location within the building, environmental conditions in all spaces where the materials will be either stored or installed shall be permanently maintained at 75°F (+2°F) and 50% RH (+5%). Should the HVAC include a reheat system, the reheat system shall be energized to provide temperature and humidity control whenever the HVAC system is energized. Contractor shall pay for all utility, fuel, operational, maintenance and repair costs associated with providing the environmental conditions indicated above until the Owner accepts occupancy of the building.

1.21 CLEANING OF SYSTEMS

- A. After satisfactory completion of pressure tests and before permanently connecting fixtures, equipment, traps, strainers and other accessory items, thoroughly clean all systems. Blow out and flush piping until interiors are free of foreign matter.
- B. Flush piping in recirculating water systems to remove all cutting oil, excess pipe joint compound and other foreign materials. Furnish necessary temporary pumping equipment to thoroughly clean the water piping. Do not use any system pump until after cleaning and flushing has been accomplished to the satisfaction of the Engineer. Employ chemical cleaners, including a non-foaming detergent, not harmful to system components. After cleaning operation, final flushing and refilling the residual alkalinity shall not exceed 300 parts per million. Work shall be performed or supervised by a qualified water treatment service company with personnel skilled in the safe and proper use of chemicals and in testing procedures. After completion, submit a certificate of completion to Engineer stating name of the service company used.
- C. Leave strainers and dirt pockets in clean condition.
- D. Clean fans, ductwork, enclosures, flues, registers, grilles and diffusers at completion of work. Vacuum or swab clean low pressure ducts and outlets supplying operating rooms, delivery rooms, nurseries.
- E. Permanent air systems operated for temporary heating during construction shall only be operated with filters installed of equal efficiency to those specified. Prior to acceptance and after cleaning of system, replace with clean filters as specified. Return air openings shall be equipped with filter cloth to protect against debris entering the ductwork.
 - 1. If upon periodic inspection, it is determined that the permanent ductwork has become contaminated with construction debris, then the Contractor shall be required to procure the services of a professional duct cleaning agency prior to substantial completion, at no additional cost to the Owner.
- F. Should any system become clogged with construction refuse after acceptance, the Contractor shall pay for all labor and materials required to locate and remove the obstruction and replace and repair work disturbed.
- G. Leave all systems clean, and in complete running order.
- H. Equipment that has been subjected to the elements shall be cleaned of all rust, dirt and debris and repainted to match original finish.

1.22 FUNCTIONAL PERFORMANCE TESTING AND VERIFICATION

- A. General: In addition to the tests required during and after installation of all mechanical systems, as well as any other formal commissioning requirements, the Contractor shall perform functional performance tests to verify that all systems are designed, installed, calibrated and adjusted to perform as required in the Contract.
- B. Comply with all applicable specification sections including, but not be limited to, "Basic HVAC Requirements", "Testing, Adjusting and Balancing", "Automatic Temperature Controls" and "Commissioning", where applicable.
- C. Prior to functional performance testing, all indicating, recording and control devices shall be calibrated. A verification calibration report shall be provided with the final test report.
- D. Provide functional performance testing to verify proper operation of each and every control sequence indicated throughout the contract documents.
- E. Failure of Tests: Should any test, verification, or demonstration fail to meet the specification requirements, the component of the system causing the failure shall be repaired, replaced or readjusted. The failed test, verification, or demonstration shall then be repeated.
- F. A "Functional Performance Test Verification Form" is included at the end of Section 230900. This form (electronic version is available upon request) shall be completed for all mechanical equipment provided under this contract. This shall include, but not be limited to each chiller, boiler,

air handling unit, fan, pump, VAV terminal, fan coil unit, unit ventilator, DX cooling equipment, miscellaneous heating equipment, etc.

- G. Test Report: Upon satisfactory verification of calibration and functional performance tests, a copy of the final test results shall be bound in the operations and maintenance manual. The final report shall also include a full compliance statement, on company letterhead, indicating that all systems are installed and functioning per the contract requirements including drawings, specifications, control sequences and accepted submittals.
- H. The mechanical systems shall not be considered complete until all functional performance verification forms, calibration reports and compliance statement have been submitted and reviewed. Submit in accordance with the submittal requirements indicated elsewhere in these specifications.

1.23 OPERATING AND MAINTENANCE MANUAL

- A. Submit Operation and Maintenance Manuals as follows:
 - 1. Provide an electronic version for review by the Owner and A/E, including bookmarks of all section and subsections.
 - 2. After acceptance of the electronic copy, produce hard copies in three-ring binders with each section separated by tab divider. Include protective plastic sleeves for any software or folded large documents submitted. Provide a minimum of two (2) copies to the Owner.
- B. At a minimum, the manual shall contain the following:
 - 1. Title page
 - 2. Table of contents
 - 3. Contractor and sub-contractor contact information
 - 4. Supplier contact information for all mechanical equipment
 - 5. Copies of manufacturer's and Contractor's warranty information (project and equipment) for all mechanical equipment.
 - 6. Submittal log for all mechanical equipment
 - 7. One (1) reviewed copy of each shop drawing or submittal incorporating all A/E and Owner submittal review comments.
 - 8. Copy of inspector acceptance certificates / documents.
 - 9. Provide an 11 x 17 fold-out drawing of each floor plan and indicate locations of the following:
 - a. System shutoff valves
 - b. Fire/smoke dampers
 - 10. All duct, pipe and equipment pressure test reports complete with 11 x 17 fold-out drawing, indicating all systems tested.
 - 11. Final Test and Balance (TAB) Reports. Do not include reports that have not been accepted by the A/E. Pencil or partial copies will not be acceptable.
 - 12. Maintenance procedures for each item of mechanical equipment to include frequency and type of maintenance, spare parts and attic/stock list. This shall include the manufacturer's literature indicating operating and maintenance instructions, parts list, illustrations and diagrams.
 - 13. An itemized list of all spare parts and specialty tools shall be transmitted to the Owner.
 - 14. A report of the training procedures and content provided as well as the attendance log.
 - 15. Valve tag chart
 - 16. Mechanical systems functional performance verification forms, calibration reports and compliance statement indicating that all systems are installed and functioning per the contract requirements.

1.24 TOOLS AND LUBRICANTS

- A. Furnish and turn over to the Owner, special tools not readily available commercially, that are required for disassembly or adjustment of equipment and machinery furnished.

- B. Grease Guns with Attachments for Applicable Fittings: One for each type of grease required for each motor or other equipment.
- C. Tool Containers: Hardwood or metal, permanently identified for intended service and mounted, or located, where directed by the Owner.
- D. Lubricants: A minimum of one quart (.9 L) of oil, and one pound (450 g) of grease, of equipment manufacturer's recommended grade and type, in unopened containers and properly identified as to use for each different application.

1.25 FIELD INSTRUCTION

- A. Upon completion of work, instruct Owner's representative in the proper operation and maintenance of the mechanical and electrical systems.
- B. Instruction periods specified below shall be in addition to instruction specified for certain items elsewhere in the specifications.
- C. Instructions shall be given by persons expert in the following systems and equipment and shall include descriptions and demonstration of procedures, data logging, and analysis.
 - 1. Heating Plant - including boilers, heat exchangers, fuel supply, burners, pumps, related equipment, water treatment, combustion testing, safety controls. Provide . . hours of instruction.
 - 2. Cooling Plant - Including refrigeration plant, cooling tower, pumps, related equipment, water treatment, safety controls. Provide . . hours of instruction.
 - 3. Air Systems - Including air handling units, heating and cooling coils, filters, fans, safety controls and other air handling equipment. Provide . . hours of instruction.
 - 4. Automatic Control - Including operating controls for all heating, cooling, ventilating systems, control centers, panels, compressed air system. Provide . . hours of instruction.
 - 5. General Instructions - Including review of written operating instructions and balancing report, miscellaneous instructions. Provide . . hours of instruction.
- D. Instructions shall be given by persons expert in the operation and maintenance and shall be for a period of not less than ____ eight hour days.
- E. Prepare statement(s) for signing by Owner's representative indicating date of completion of instructions and hours expended. Furnish copy of signed statement to Engineer.
- F. Final mechanical demonstration of all mechanical equipment shall be recorded in DVD compatible format. Provide DVDs to the Owner.

1.26 RECORD DOCUMENTS

- A. The Contractor shall maintain a record set of mechanical prints at the project site and shall indicate thereon any changes made to the contract drawings, including, but not limited to addenda, field sketches, RFI responses, supplemental drawings, sketches, etc. Where changes are made that are reflective of supplemental instructions, revisions, RFI responses, etc., the Contractor shall make clear references to those changes.
- B. A separate set of neat, legible mechanical contract prints shall be kept at the project site at all times during the construction of the work for the express purpose of showing any and all changes indicated in paragraph A. above. The prints shall be marked up daily showing all changes to the original documents. The prints shall be marked up in a neat, legible manner using a red pen. Periodic review of the Record Documents will be conducted by the Owner's Representative or A/E. Should this review indicate that the Record Documents are deficient or not up to date, the Contractor shall immediately bring the documents into compliance and make the corrections.
- C. Upon completion of the project and before final close-out, the Contractor shall be responsible for producing a final set of record documents in the same electronic format as the construction documents (i.e. AutoCad or Revit). One (1) set of full size prints, one (1) CD of the electronic files, along with the red-lined marked up field set shall be delivered to the Owner upon completion. If requested, the electronic files shall be uploaded to the Owner's FTP site. The final documents

shall indicate in the title or revision block "RECORD DOCUMENTS" along with the date completed. The electronic format shall be compatible with the Owner's preferred version of AutoCad or Revit. Coordinate with the Owner before producing the CD or uploading to the FTP site. Not acceptable are Contractor installation drawings, shop drawings or multi-layers of work on a single drawing. The final as-built product shall mirror the contract bid documents using the project page layout, format and project title block.

- D. Electronic files (AutoCad or Revit) of mechanical, electrical, plumbing and fire protection (MEP) drawings may be made available upon receipt of a signed copy of the Engineer's Electronic Document Disclaimer (available upon request).
- E. Should the Contractor's electronic Record Documents not be considered complete, they will be returned for completion and/or correction.

1.27 DEMOLITION

- A. All demolition of existing mechanical and electrical piping, auxiliaries and equipment, shall be as specified under the Architectural "Demolition" section, of these specifications, as shown on the drawings, and as required to complete the new and renovated installations and shall be performed by the respective mechanical and electrical contractors.
- B. This work shall include the disconnection and capping of existing services, relocation of certain equipment, and the removal of existing piping, wiring, fittings, equipment, including heat transfer units, air handling units, fans, electrical controls and panelboxes, ductwork, etc., not reused in the new work or required to complete the renovation work. Contractor shall note the drawings specify certain existing equipment to be reused.
- C. Where supports and piping are removed, holes remaining in floors, walls and ceilings must be patched and refinished to match the adjoining original surfaces and finishes.
- D. Any removed items requested by the Owner shall remain the property of the Owner. Contractor shall remove equipment and store on site as directed by the Owner. All other equipment or material shall become the property of the Contractor and shall be removed from the site. Contractor shall meet Federal EPA Laws, Regulations and Guidelines in regard to removal of asbestos insulation.
- E. The Contractor shall use care when performing selective building and site demolition. The Contractor shall be responsible for damage inclusive of but not limited to: building finishes, lighting (interior and exterior), furniture, structure, site, utilities (above and below ground), mechanical, plumbing, telecommunications and electrical equipment / systems. Should any damage occur or should any remedial work be required, the Contractor shall be responsible to repair and or replace the damaged item(s) to the Owner's satisfaction at no additional cost. The Contractor shall be responsible for surveying (including contacting Miss Utility), photo documenting and restoring the surrounding work site(s) to the original pre-demolition condition and / or to the Owner's satisfaction upon completion of the work at no additional cost.

1.28 OUTAGES

- A. All mechanical outages which will interfere with the normal use of the building in any manner shall be done at such times as shall be mutually agreed upon by the Contractor and the Owner's Representative.
- B. Unless otherwise specified, outages of any services required for the performance of this contract and affecting areas other than the immediate work area shall be scheduled at least ten (10) days in advance with the Owner's Representative. All such outages shall be performed during other than normal duty hours.
- C. The Contractor shall include in his price the cost of all premium time required for outages and other work which interferes with the normal use of the building, which will be performed, in most cases, during other than normal work time and the convenience of the using agency.

1.29 GUARANTEE/WARRANTY

- A. Each Contractor shall furnish a guarantee covering all labor and materials furnished by him for a period of two (2) years from the date of final acceptance of his work, and he shall agree to repair and make good at his own expense any and all defects which may appear in his work during that time if, in the judgment of the Engineer, such defects arise from defective workmanship and/or imperfect or inferior material.
- B. The above shall not in any way void or abrogate equipment manufacturer's guarantee or warranty. Certificates of guarantee shall be delivered to the Owner.
- C. Within the two (2) year warranty/guarantee period, manufacturer's recommended maintenance shall be provided by the Contractor.
- D. In addition to the warranties indicated above, provide a five (5) year parts and labor warranty for each of the following:
 - 1. Chillers
 - 2. All air conditioning unit related compressors (i.e. rooftop DX units, all air cooled condensing units for VRV systems, split system units, etc.).

PART 2 - PRODUCTS
Not Applicable

PART 3 - EXECUTION
Not Applicable

END OF SECTION 23 01 00

SECTION 23 05 00 - BASIC HVAC MATERIALS AND METHODS**PART 1 - GENERAL****1.1 CONTRACT DOCUMENTS**

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specification Sections, apply to this Section.
- B. Requirements specified in Division-23 Section "Basic HVAC Requirements" apply to this Section.

1.2 SUMMARY

- A. This Section includes limited scope general construction materials and methods for application with mechanical installations as follows:
 - 1. Mechanical equipment nameplate data.
 - 2. Firestopping: Provide seals for all openings (new and existing) through fire-rated walls, floors, or ceilings used as passage for mechanical and electrical components such as piping, ductwork, conduit, etc.
 - 3. Selective demolition including:
 - a. Nondestructive removal of materials and equipment for reuse or salvage as indicated.
 - b. Dismantling mechanical materials and equipment made obsolete by these installations.
 - 4. Excavation for underground utilities and services, including underground piping (under the building and from building to utility connection), tanks, basins, and equipment up to five (5) feet (1500 mm) outside the building.
 - 5. Miscellaneous metals for support of mechanical materials and equipment.
 - 6. Wood grounds, nailers, blocking, fasteners, and anchorage for support of mechanical materials and equipment.
 - 7. Joint sealers for sealing around mechanical materials and equipment; and for sealing penetrations in fire and smoke barriers, floors, and foundation walls.
 - 8. Access panels and doors in walls, ceilings, and floors for access to mechanical materials and equipment.

1.3 DEFINITIONS

- A. The following definitions apply to excavation operations:
 - 1. Additional Excavation: Where excavation has reached required subgrade elevations, if unsuitable bearing materials are encountered, continue excavation until suitable bearing materials are reached. The Contract Sum may be adjusted by an appropriate Contract Modification.
 - 2. Subbase: As used in this Section refers to the compacted soil layer used in pavement systems between the subgrade and the pavement base course material.
 - 3. Subgrade: As used in this Section refers to the compacted soil immediately below the slab or pavement system.
 - 4. Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations or dimensions without specific direction from the Architect.
- B. The following definitions apply to firestopping:
 - 1. Assembly: Particular arrangement of materials specific to given type of construction described or detailed in referenced documents.
 - 2. Barriers: Time rated fire walls, smoke barrier walls, time rated ceiling/floor assemblies and structural floors.

3. Firestopping: Methods and materials applied in penetrations and unprotected openings to limit spread of heat, fire, gases and smoke.
4. Penetration: Opening or foreign material passing through or into barrier or structural floor such that full thickness of rated materials is not obtained.
5. Construction Gaps: Gaps between adjacent sections of walls, exterior walls, at wall tops between top of wall and ceiling, and structural floors or roof decks; and gaps between adjacent sections of structural floors.
6. System: Specific products and applications classified and numbered by Underwriters Laboratories, Inc. to close specific barrier penetrations.
7. Sleeve: Metal fabrication or pipe section extending through thickness of barrier and used to permanently guard penetration. Sleeves are described as part of penetrating system in other sections and may or may not be required.

1.4 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division-01 Specification Sections.
- B. Product data for the following products:
 1. Access panels and doors
 2. Joint sealers
- C. Firestopping: Indicate dimensions, description of materials and finishes, general construction, specific modifications, component connections, anchorage methods, hardware, and installation procedures.
 1. Provide details of each proposed assembly identifying intended products and applicable UL system number, or UL classified devices.
 2. Provide drawings relating to non-standard applications as needed.
- D. Shop drawings detailing fabrication and installation for metal fabrications, and wood supports and anchorage for mechanical materials and equipment.
- E. Coordination drawings for access panel and door locations in accordance with Division-23 sections.
- F. Samples of joint sealer, consisting of strips of actual products showing full range of colors available for each product.
- G. Welder certificates, signed by Contractor, certifying that welders comply with requirements specified under "Quality Assurance" article of this Section.
- H. Schedules indicating proposed methods and sequence of operations for selective demolition prior to commencement of Work. Include coordination for shut-off of utility services and details for dust and noise control.
 1. Coordinate sequencing with construction phasing and Owner occupancy specified in Division-01 Section "Summary of Work."

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an Installer for the installation and application of joint sealers, access panels and doors, and firestopping materials with at least two years' experience with installations.
- B. Qualify welding processes and welding operators in accordance with AWS D1.1 "Structural Welding Code - Steel."
 1. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.
- C. Fire-Resistance Ratings: Where a fire-resistance classification is indicated, provide access door assembly with panel door, frame, hinge, and latch from manufacturer listed in the UL "Building Materials Directory" for rating shown.

1. Provide UL Label on each fire-rated access door.
 - D. Local and State Regulatory Requirements: Submit forms or acceptance for proposed assemblies not conforming to specific UL firestop system numbers, or UL classified devices.
- 1.6 DELIVERY, STORAGE AND HANDLING
- A. Deliver joint sealer materials in original unopened containers or bundles with labels informing about manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multi-component materials.
 - B. Store and handle joint sealer materials in compliance with the manufacturers' recommendations to prevent their deterioration and damage.
- 1.7 PROJECT CONDITIONS
- A. Conditions Affecting Selective Demolition: The following project conditions apply:
 1. Protect adjacent materials indicated to remain. Install and maintain dust and noise barriers to keep dirt, dust, and noise from being transmitted to adjacent areas. Remove protection and barriers after demolition operations are complete.
 2. Locate, identify, and protect mechanical services passing through demolition area and serving other areas outside the demolition limits. Maintain services to areas outside demolition limits. When services must be interrupted, install temporary services for affected areas.
 - B. Conditions Affecting Excavations: The following project conditions apply:
 1. Maintain and protect existing building services which transit the area affected by selective demolition.
 2. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by excavation operations.
 3. Site Information: Subsurface conditions were investigated during the design of the Project. Reports of these investigations are available for information only; data in the reports are not intended as representations or warranties of accuracy or continuity of conditions. The Owner will not be responsible for interpretations or conclusions drawn from this information.
 4. Existing Utilities: Locate existing underground utilities in excavation areas prior to excavation. If utilities are indicated to remain, support and protect services during excavation operations.
 5. Remove existing underground utilities indicated to be removed.
 6. Uncharted or Incorrectly Charted Utilities: Contact utility owner immediately for instructions.
 7. Provide temporary utility services to affected areas. Provide minimum of 48-hour notice to Architect prior to utility interruption.
 8. Use of explosives is not permitted.
 - C. Environmental Conditions: Apply joint sealers under temperature and humidity conditions within the limits permitted by the joint sealer manufacturer. Do not apply joint sealers to wet substrates.
- 1.8 SEQUENCE AND SCHEDULING
- A. Coordinate the shut-off and disconnection of utility services with the Owner and the utility company.
 - B. Notify the Architect at least five (5) days prior to commencing demolition operations.
 - C. Perform demolition in phases as indicated.

PART 2 - PRODUCTS

2.1 MECHANICAL EQUIPMENT NAMEPLATE DATA

- A. Nameplate: For each piece of power operated mechanical equipment provide a permanent operational data nameplate indicating manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and similar essential data. Locate nameplates in an accessible location.

2.2 FIRESTOPPING

- A. All penetrations through fire barriers (new and existing) shall be firestopped with an approved material that is capable of maintaining the fire resistance rating of the barrier. All firestop sealants shall conform to ASTM E 814, ASTM E 119, UL 1479, UL 2079 CAN/ULC S115, and CAN/ULC S101.
- B. Firestop material shall be latex based, intumescent caulk intended for use for all thru-penetrations with piping, ducts, cable trays, conduit, and cables.
- C. When exposed to high temperatures or fires, the caulk shall expand in volume to quickly close off voids left by melting or burning construction materials. Caulk shall be applied by a standard caulk gun and remain flexible after curing.
- D. Acceptable products shall be limited to Johns Manville "Firetemp-C1;" Hilti "FS-One;" or 3M "CP25WB+." Coordinate with General Contractor such that a single manufacturer/ product is utilized throughout the project for all fire and smoke stopping materials.

2.3 SMOKE STOPPING

- A. All penetrations through smoke barriers, smoke partitions, or any other surface required to resist the passage of smoke (new and existing) shall be provided with a smoke stop sealant and/or system that has been independently tested to provide an acceptable smoke seal that will resist the passage of smoke. Smoke stop systems (including product and installation) shall conform to all applicable standards (including but not limited to ASTM, UL and NFPA), as well as all other local, state or federal requirements.
- B. Acceptable manufacturers shall be limited to the manufacturers that may provide firestopping materials/systems (see paragraph 2.02 of this section). Coordinate with the General Contractor such that a single manufacturer/product is utilized throughout the project for all fire and smoke stopping materials.

2.4 SOIL MATERIALS

- A. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, crushed slag, or natural or crushed sand.
- B. Drainage Fill: Washed, evenly graded mixture of crushed stone, or crushed or uncrushed gravel, with 100 percent passing a 1-1/2-inch (40 mm) sieve, and not more than 5 percent passing a No. 4 sieve.
- C. Backfill and Fill Materials: Materials complying with ASTM D2487 soil classification groups GW, GP, GM, SM, SW, and SP; free of clay, rock, or gravel larger than 2 inches (150 mm) in any dimension; debris; waste; frozen materials; and vegetable and other deleterious matter.

2.5 MISCELLANEOUS METALS

- A. Steel plates, shapes, bars, and bar grating: ASTM A 36.
- B. Cold-Formed Steel Tubing: ASTM A 500.
- C. Hot-Rolled Steel Tubing: ASTM A 501.
- D. Steel Pipe: ASTM A 53, Schedule 40, welded.

- E. Non-shrink, Non-metallic Grout: Premixed, factory-packaged, non-staining, non-corrosive, non-gaseous grout, recommended for interior and exterior applications.
- F. Fasteners: Zinc-coated, type, grade, and class as required.

2.6 MISCELLANEOUS LUMBER

- A. Framing Materials: Standard Grade, light-framing-size lumber of any species. Number 3 Common or Standard Grade boards complying with WCLIB or AWPB rules, or Number 3 boards complying with SPIB rules. Lumber shall be preservative treated in accordance with AWPB LP-2, and kiln dried to a moisture content of not more than 19 percent.
- B. Construction Panels: Plywood panels; APA C-D PLUGGED INT, with exterior glue; thickness as indicated, or if not indicated, not less than 15/32 inches (12 mm).

2.7 JOINT SEALERS

- A. General: Joint sealers, joint fillers, and other related materials compatible with each other and with joint substrates under conditions of service and application.
- B. Colors: As selected by the Architect from manufacturer's standard colors.
- C. Elastomeric Joint Sealers: Provide the following types:
 - 1. One-part, nonacid-curing, silicone sealant complying with ASTM C 920, Type S, Grade NS, Class 25, for uses in non-traffic areas for masonry, glass, aluminum, and other substrates recommended by the sealant manufacturer.
 - 2. One-part, mildew-resistant, silicone sealant complying with ASTM C 920, Type S, Grade NS, Class 25, for uses in non-traffic areas for glass, aluminum, and nonporous joint substrates; formulated with fungicide; intended for sealing interior joints with non-porous substrates; and subject to in-service exposure to conditions of high humidity and temperature extremes.
- D. Acrylic-Emulsion Sealants: One-part, non-sag, mildew-resistant, paintable complying with ASTM C 834 recommended for exposed applications on interior and protected exterior locations involving joint movement of not more than plus or minus 5 percent.
- E. Fire-Resistant Joint Sealers: Two-part, foamed-in-place, silicone sealant formulated for use in through-penetration fire-stopping around cables, conduit, pipes, and duct penetrations through fire rated walls and floors. Sealants and accessories shall have fire resistance ratings indicated, as established by testing identical assemblies in accordance with ASTM E 814, by Underwriters' Laboratories, Inc., or other testing and inspection agency acceptable to authorities having jurisdiction.

2.8 ACCESS DOORS

- A. Steel Access Doors and Frames: Factory-fabricated and assembled units, complete with attachment devices and fasteners ready for installation. Joints and seams shall be continuously welded steel, with welds ground smooth and flush with adjacent surfaces.
- B. Frames: 16-gage (1.6 mm) steel, with a 1-inch (25 mm) wide exposed perimeter flange for units installed in unit masonry, pre-cast, or cast-in-place concrete, ceramic tile, or wood paneling.
 - 1. For Installation in Masonry, Concrete, Ceramic Tile, or Wood Paneling: 1-inch (25 mm) wide exposed perimeter flange and adjustable metal masonry anchors.
 - 2. For Gypsum Wallboard or Plaster: Perforated flanges with wallboard bead.
 - 3. For Full-Bed Plaster Applications: Galvanized expanded metal lath and exposed casing bead, welded to perimeter of frame.
- C. Flush Panel Doors: 14-gage (2 mm) sheet steel, with concealed spring hinges or concealed continuous piano hinge set to open 175 degrees (3.05 Radians); factory-applied prime paint.
 - 1. Fire-Rated Units: Insulated flush panel doors, with continuous piano hinge and self-closing mechanism.

- D. Locking Devices: Flush, screwdriver-operated cam locks. [Common use]
- E. Locking Devices: Where indicated, provide 5-pin or 5-disc type cylinder locks, individually keyed; provide two (2) keys. [Secured areas only: note as such].

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 installation and application of joint sealers and access panels. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 FIRESTOP INSTALLATION

- A. Install penetration seal materials in accordance with printed instructions of the UL Fire Resistance Directory and in accordance with manufacturer's instruction.
- B. Seal new and existing holes or voids made by penetrations to ensure an effective smoke barrier.
- C. Where floor openings without penetrating items are more than four inches (100 mm) in width and subject to traffic or loading, install firestopping materials capable of supporting same loading as floor.
- D. Protect materials from damage on surface subject to traffic.
- E. Place firestopping in annular space around fire dampers before installation of damper's anchoring flanges which are installed in accordance with fire damper manufacturer's recommendations.
- F. Where large openings are created in walls or floors to permit installation of pipes, ducts, cable tray, bus duct or other items, close unused portions of opening with firestopping material tested for the application.
- G. Install smoke stopping as specified for firestopping (new and existing).
- H. Where rated walls are constructed with horizontally continuous air space, double width masonry, or double stud frame construction, provide vertical, 12 inch (300 mm) wide fiber dams for full thickness and height of air cavity at maximum 15 foot (4500 mm) intervals.

3.3 PREPARATION FOR JOINT SEALERS

- A. Surface Cleaning for Joint Sealers: Clean surfaces of joints immediately before applying joint sealers to comply with recommendations of joint sealer manufacturer.
- B. Apply joint sealer primer to substrates as recommended by joint sealer manufacturer. Protect adjacent areas from spillage and migration of primers, using masking tape. Remove tape immediately after tooling without disturbing joint seal.

3.4 SELECTIVE DEMOLITION

- A. General: Demolish, remove, demount, and disconnect abandoned mechanical materials and equipment indicated to be removed and not indicated to be salvaged or saved.
- B. Materials and Equipment to be Salvaged: Remove, demount, and disconnect existing mechanical materials and equipment indicated to be removed and salvaged, and deliver materials and equipment to the location designated for storage.
- C. Disposal and Cleanup: Remove from the site and legally dispose of demolished materials and equipment not indicated to be salvaged.
- D. Mechanical Materials and Equipment: Demolish, remove, demount, and disconnect the following items:

1. Inactive and obsolete piping, fittings and specialties, equipment, ductwork, controls, fixtures, and insulation.
2. Piping and ducts embedded in floors, walls, and ceilings may remain if such materials do not interfere with new installations. Remove materials above accessible ceilings. Drain and cap piping and ducts that are allowed to remain.
3. Perform cutting and patching required for demolition in accordance with Division-1 Section "Cutting and Patching."

3.5 EXCAVATION

- A. Slope sides of excavations to comply with local codes and ordinances. Shore and brace as required for stability of excavation.
- B. Shoring and Bracing: Establish requirements for trench shoring and bracing to comply with local codes and authorities. Maintain shoring and bracing in excavations regardless of time period excavations will be open.
 1. Remove shoring and bracing when no longer required. Where sheeting is allowed to remain, cut top of sheeting at an elevation of 30 inches (750 mm) below finished grade elevation.
- C. Install sediment and erosion control measures in accordance with local codes and ordinances.
- D. Dewatering: Prevent surface water and subsurface or ground water from flowing into excavations and from flooding project site and surrounding area.
 1. Do not allow water to accumulate in excavations. Remove water to prevent softening of bearing materials. Provide and maintain dewatering system components necessary to convey water away from excavations.
 2. Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey surface water to collecting or run-off areas. Do not use trench excavations as temporary drainage ditches.
- E. Material Storage: Stockpile satisfactory excavated materials where directed, until required for backfill or fill. Place, grade and shape stockpiles for proper drainage.
 1. Locate and retain soil materials away from edge of excavations. Do not store within drip-line of trees indicated to remain.
 2. Remove and legally dispose of excess excavated materials and materials not acceptable for use as backfill or fill.
- F. Excavation for Underground Tanks, Basins, and Mechanical Structures: Conform to elevations and dimensions shown within a tolerance of plus or minus 0.10 foot (30 mm); plus a sufficient distance to permit placing and removal of concrete formwork, installation of services, other construction, and for inspection.
 1. Excavate by hand, areas within drip-line of large trees. Protect the root system from damage and dry-out. Maintain moist conditions for root system and cover exposed roots with burlap. Paint root cuts of 1 inch (25 mm) in diameter and larger with emulsified asphalt tree paint.
 2. Take care not to disturb bottom of excavation. Excavate by hand to final grade just before concrete reinforcement is placed.
- G. Trenching: Excavate trenches for mechanical installations as follows:
 1. Excavate trenches to the uniform width, sufficiently wide to provide ample working room and a minimum of 6 to 9 inches (150 to 225 mm) clearance on both sides of pipe and equipment.
 2. Excavate trenches to depth indicated or required for piping to establish indicated slope and invert elevations. Beyond building perimeter, excavate trenches to an elevation below frost line.
 3. Limit the length of open trench to that in which pipe can be installed, tested, and the trench backfilled within the same day.

4. Where rock is encountered, carry excavation below required elevation and backfill with a layer of crushed stone or gravel prior to installation of pipe. Provide a minimum of 6 inches (150 mm) of stone or gravel cushion between rock bearing surface and pipe.
 5. Excavate trenches for piping and equipment with bottoms of trench to accurate elevations for support of pipe and equipment on undisturbed soil.
 6. For pipes or equipment 6 inches (150 mm) or larger in nominal size, shape bottom of trench to fit bottom 1/4 of the circumference. Fill unevenness with tamped sand backfill. At each pipe joint over-excavate to relieve the bell or pipe joint of the pipe of loads, and to ensure continuous bearing of the pipe barrel on the bearing surface.
- H. Cold Weather Protection: Protect excavation bottoms against freezing when atmospheric temperature is less than 35 degrees F (2 degrees C).
- I. Backfilling and Filling: Place soil materials in layers to required subgrade elevations for each area classification listed below, using materials specified in Part 2 of this Section.
1. Under walks and pavements, use a combination of subbase materials and excavated or borrowed materials.
 2. Under building slabs, use drainage fill materials.
 3. Under piping and equipment, use subbase materials where required over rock bearing surface and for correction of unauthorized excavation.
 4. For piping less than 30 inches (750 mm) below surface of roadways, provide 4-inch (100 mm) thick concrete base slab support. After installation and testing of piping, provide a 4-inch (100 mm) thick concrete encasement (sides and top) prior to backfilling and placement of roadway subbase.
 5. In other areas, use excavated or borrowed materials.
- J. Backfill excavations as promptly as work permits, but not until completion of the following:
1. Inspection, testing, approval, and locations of underground utilities have been recorded.
 2. Removal of concrete formwork.
 3. Removal of shoring and bracing, and backfilling of voids.
 4. Removal of trash and debris.
- K. Placement and Compaction: Place backfill and fill materials in layers of not more than 8 inches (200 mm) in loose depth for material compacted by heavy equipment, and not more than 4 inches (100 mm) in loose depth for material compacted by hand-operated tampers.
- L. Before compaction, moisten or aerate each layer as necessary to provide optimum moisture content. Compact each layer to required percentage of maximum dry density or relative dry density for each area classification specified below. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.
- M. Place backfill and fill materials evenly adjacent to structures, piping, and equipment to required elevations. Prevent displacement of piping and equipment by carrying material uniformly around them approximately to same elevation in each lift.
- N. Compaction: Control soil compaction during construction, providing minimum percentage of density specified for each area classification indicated below.
1. Percentage of Maximum Density Requirements: Compact soil to not less than the following percentages of maximum density for soils which exhibit a well-defined moisture-density relationship (cohesive soils), determined in accordance with ASTM D 1557 and not less than the following percentages of relative density, determined in accordance with ASTM D 2049, for soils which will not exhibit a well-defined moisture-density relationship (cohesionless soils).
 2. Areas Under Structures, Building Slabs and Steps, Pavements: Compact top 12 inches (300 mm) of subgrade and each layer of backfill or fill material to 90 percent maximum density for cohesive material, or 95 percent relative density for cohesionless material.
 3. Areas Under Walkways: Compact top 6 inches (150 mm) of subgrade and each layer of backfill or fill material to 90 percent maximum density for cohesive material, or 95 percent relative density for cohesionless material.

- 4. Other Areas: Compact top 6 inches (150 mm) of subgrade and each layer of backfill or fill material to 85 percent maximum density for cohesive soils, and 90 percent relative density for cohesionless soils.
 - 5. Moisture Control: Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water. Apply water in minimum quantity necessary to achieve required moisture content and to prevent water appearing on surface during, or subsequent to, compaction operations.
 - O. Subsidence: Where subsidence occurs at mechanical installation excavations during the period twelve (12) months after Substantial Completion, remove surface treatment (i.e., pavement, lawn, or other finish), add backfill material, compact to specified conditions, and replace surface treatment. Restore appearance, quality, and condition of surface or finish to match adjacent areas.
- 3.6 ERECTION OF METAL SUPPORTS AND ANCHORAGE
- A. Cut, fit, and place miscellaneous metal fabrications accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.
 - B. Field Welding: Comply with AWS "Structural Welding Code."
- 3.7 ERECTION OF WOOD SUPPORTS AND ANCHORAGE
- A. Cut, fit, and place wood grounds, nailers, blocking, and anchorage accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.
 - B. Select fastener sizes that will not penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood members.
 - C. Attach to substrates as required to support applied loads.
- 3.8 APPLICATION OF JOINT SEALERS
- A. General: Comply with joint sealer manufacturers' printed application instructions applicable to products and applications indicated, except where more stringent requirements apply.
 - 1. Comply with recommendations of ASTM C 962 for use of elastomeric joint sealants.
 - 2. Comply with recommendations of ASTM C 790 for use of acrylic emulsion joint sealants.
 - B. Tooling: Immediately after sealant application and prior to time skinning or curing begins, tool sealants to form smooth, uniform beads; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents that discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.
- 3.9 INSTALLATION OF ACCESS DOORS
- A. Provide access doors (minimum 18" x 18") as required to provide maintainable access to all mechanical equipment including, but not limited to, valves, dampers, air terminals, etc.
 - B. Set frames accurately in position and securely attached to supports, with face panels plumb and level in relation to adjacent finish surfaces.
 - C. Adjust hardware and panels after installation for proper operation.

END OF SECTION 23 05 00

SECTION 23 05 10 - HVAC RELATED WORK**PART 1 - GENERAL****1.1 DESCRIPTION OF WORK**

- A. Extent of mechanical related work required by this section is indicated on drawings and/or specified in all other Division-23 sections.
- B. Types of mechanical related work specified in this section include the following:
 - 1. Access to Mechanical Work:
 - a. Access doors in floors.
 - b. Removable cover plates in floors.
 - 2. Excavating for Mechanical Work:
 - a. Underground mechanical utilities and services.
 - b. Underground tanks, basins, and equipment enclosures.
 - c. Exterior water circulation and distribution systems.
 - d. Drainage and distribution fields.
 - 3. Concrete for Mechanical Work:
 - a. Lean concrete backfill to support mechanical work.
 - b. Encasement of mechanical work.
 - c. Underground structural concrete to accommodate mechanical work.
 - d. Tanks and vaults of mechanical work.
 - e. Basins and curbs for mechanical equipment.
 - f. Mechanical equipment foundations and housekeeping pads.
 - g. Inertia bases for isolation of mechanical work.
 - h. Rough grouting in and around mechanical work.
 - i. Patching concrete cut to accommodate mechanical work.
 - 4. Painting of Mechanical Work:
 - a. Exposed concrete provided as part of mechanical work.
 - b. Exposed piping systems.
 - c. Exposed ductwork systems.
 - d. Exposed mechanical insulation.
 - e. Exposed mechanical equipment.
 - f. Louvers.
 - g. Color-coded work.
- C. Access door requirements associated with mechanical work and mechanically related electrical components are specified in this section.
- D. Quality control testing for concrete work is required as work of this section.

1.2 QUALITY ASSURANCE

- A. Access Units Fire-Resistance Ratings: Where fire-resistance rating is indicated for construction penetrated by access units, provide UL listed-and-labeled Class B units, except for units which are smaller than minimum size requiring ratings as recognized by governing authority.
- B. Concrete Work Codes and Standards: Comply with governing regulations and, where not otherwise indicated, comply with the following industry standards, whichever is the most stringent in its application to work in each instance:
 - 1. ACI 301 "Specifications for Structural Concrete for Buildings".
 - 2. ACI 311 "Recommended Practice for Concrete Inspection".
 - 3. ACI 318 "Building Code Requirements for Reinforced Concrete".
 - 4. ACI 347 "Recommended Practice for Concrete Formwork".

5. ACI 304 "Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete".
 6. Concrete Reinforcing Steel Institute, "Manual of Standard Practice".
- C. Federal Specifications, Painting Work: In general and where applicable, comply with indicated Federal Specifications for paint quality, and use only paint from original containers which bear manufacturer's labels indicating compliance with required Federal Specifications.

1.3 SUBMITTALS

- A. Product Data, Access Units: Submit manufacturer's technical data and installation instructions for each type of access door assembly, including setting drawings, templates, instructions and directions for installation of anchorage devices.
- B. Shop Drawings, Mechanical Concrete Work: Submit shop drawings for structural type concrete work (tanks, vaults, basins, foundations and other supports), showing dimensions of formed shapes of concrete; bending, placement, sizes and spacing of reinforcing steel; location of anchors, isolation units, hangers and similar devices to be integrated with concrete work; and piping penetrations, access openings, inlets and other accessories and work to be accommodated by concrete work.
- C. Manufacturer's Data, Mechanical Concrete Work: Submit data on products, including cements, special aggregates, form-coating compound, admixtures, moisture barriers, waterstops, expansion joint fillers, sealants, and concrete curing products. Provide manufacturer's certification where indicated.
- D. Laboratory Test Reports, Mechanical Concrete Work: Submit laboratory test reports for concrete work materials, and for tested samples of placed concrete (where required as work of this section).
- E. Mixing Tickets, Mechanical Concrete Work: Submit ticket for each batch of mixed concrete used in work, indicating project identification, location where placed, date, mixing time, mix type, amount of water introduced, amount of concrete placed, and other significant or unusual data.
- F. Manufacturer's Data, Paint for Mechanical Work: Submit manufacturer's technical information, including analysis of ingredients and application instructions for products used in painting work.
- G. Samples, Paint for Mechanical Work: Submit 12" x 12" (300 mm x 300 mm) color samples of each required finish paint color (except black and white); prepared on 1/8" (3 mm) tempered hardboard, on smooth face where application is for smooth surfaces and on texture face for textured surface applications. Use actual paint materials to be applied, and label each sample to show materials and coats applied.

1.4 PROJECT CONDITIONS

- A. Existing Utilities: Locate and protect existing utilities and other underground work in manner which will ensure that no damage or service interruption will result from excavating and backfilling.
- B. Protect property from damage which might result from excavating and backfilling.
- C. Protect persons from injury at excavations, by barricades, warnings and illumination.
- D. Coordinate excavations with weather conditions, to minimize possibility of washouts, settlements and other damages and hazards.
- E. Provide temporary covering or enclosure and temporary heat as necessary to protect bottoms of excavations from freezing and frost action. Do not install mechanical work on frozen excavation bases or subbases.
- F. Environmental Conditions, Painting Work: Comply with governing regulations concerning use of and conditions for application of paint. Comply with manufacturer's recommendations and instructions. Do not apply paint in unfavorable conditions of temperature, moisture (including humidity) or ambient contamination (dust and other pollutants).

PART 2 - PRODUCTS

2.1 ACCESS TO MECHANICAL WORK

- A. Access Doors - General: Where floors must be penetrated for access to mechanical work, provide types of access doors indicated, including floor doors if any. Furnish sizes indicated or, where not otherwise indicated, furnish adequate size for intended and necessary access. Furnish manufacturer's complete units, of type recommended for application in indicated substrate construction, in each case, complete with anchorages and hardware.
- B. Floor Door Construction: Except as otherwise indicated, fabricated floor door shall be of welded steel construction, reinforced for 300 lbs. per sq. ft. (14.4 kPa) loading, with exposed welds ground smooth; 1/4" (6 mm) thick steel angle or formed steel frames, and 1/4" (6 mm) steel raised-pattern floor plate; steel strap anchors for casting in concrete; 90-degree brass/bronze hinges with stainless steel pins, and spring-type operators with hold-open arms; snap-type inside latch with removable handle, and, where applicable, inside lever latch handle and door operating handle; factory-applied rust-inhibitive prime-coat paint finish.
 - 1. Gasketed Construction: Where indicated as "Sealed", furnish manufacturer's gasketed-type door, with built-in protected cushion-type neoprene gasket, intended for reduction of noise, air and moisture penetration.
 - 2. Drained Construction: Where indicated as "Drained", or where drainage pipe connection is shown, furnish manufacturer's gutter-type or watertight-type unit, complete with drainage slots or ports at floor surface, and with gutter all around with one or more drain pipe connections.
 - 3. Double-Leaf Construction: Where opening width exceeds 3'- 0" (900 mm - 0 mm), furnish manufacturer's standard double-leaf unit construction.
 - 4. Recessed Floor-Finish Construction: Where floor doors occur in areas of floor finish other than concrete or coated-concrete, furnish manufacturer's standard recessed-panel type construction of type and recess depth recommended to receive insets of floor finish indicated.
- C. Removable Access Plates:
 - 1. General: Where valves, control devices, cleanouts and similar elements of mechanical work are located within or behind wall, ceiling or floor construction or finishes, or below grade, and are not (cannot be), provided with integral removable access plates as specified in other Division-23 sections, provide removable access plates of types and sizes needed for access requirements, as indicated. Provide manufacturer's complete unit with anchorages, fasteners and standard factory-applied finishes.
 - 2. Wall/Ceiling Unit Construction: Except as otherwise indicated, and where adaptable to substrate, provide manufacturer's standard frameless round formed stainless steel or chrome-plated brass low profile plate cover, with single exposed flush screw anchor, with bright polished finish.
 - 3. Painted Finish: Where substrate is indicated for painted finish, provide steel units with prime-coat paint finish.
 - 4. Floor Unit Construction: Except as otherwise indicated, provide manufacturer's standard round cast-iron units, with frame or body designed for casting flush in concrete; with removable plate secured with bronze screws, and surfaced with non-slip cast pattern; natural mill finish.
 - a. Sleeve-Type: Where required floor opening or hand hole extends through thickness of cast floor slab, provide unit body of same depth as slab thickness, to act as form for casting opening.
 - b. Square Units: Where square units are indicated, provide manufacturer's modular units of size which integrate as closely as possible with finish flooring unit sizes (if any).
 - c. Recessed Units: Where finish of floor is other than concrete, provide recessed-panel type construction, of type and recess depth recommended to receive insets of floor finish indicated.

- d. Finish: Provide recessed units with exposed metal (exposed after inset has been installed) of nickel bronze, manufacturer's standard finish. Provide matching fasteners.
5. Units Set at Grade: Except as otherwise indicated, provide manufacturer's standard round or square cast-iron units, complete cast-iron pipe extension to protect mechanical element being accessed; designed to be set slightly above finish grade, and to be either supported by compacted soil or to be encased in concrete; secure plate to body with bronze screws; natural mill finish on plate and body.

2.2 EXCAVATING FOR MECHANICAL WORK

- A. Subbase Material: Provide graded mixture of gravel, sand, crushed stone or crushed slag.
 1. Finely-Graded Subbase Material: Well graded sand, gravel, crushed stone or crushed slag, with 100% passing 3/8" (10 mm) sieve.
- B. Backfill Material: Soil material suitable for compacting to required densities, and complying with AASHTO Designation M145, Group A-1, A-2-4, A-2-5 or A-3.
- C. Drainage Fill Material: Washed and uniformly graded gravel, crushed stone or crushed slag, with 100% passing 1-1/2" (40 mm) sieve and not more than 5% passing No. 4 sieve.

2.3 MATERIALS OF CONCRETE WORK

- A. Forms for Exposed Concrete: Plywood, smooth metal or other smooth panel type material; sized for minimum joint exposure, and reinforced to prevent visible deflections resulting from pressure of placed concrete; sufficiently heavy for construction to prevent leakage which would be harmful to either structural or visual quality of concrete.
 1. Plywood "BB (Concrete Form) Plywood", Class I, Exterior Grade, mill-oiled and edge sealed.
- B. Forms for Unexposed Concrete: Smooth lumber, plywood or other easy-release material; reinforced to prevent excessive deflection or the possibility of failure during placement of concrete; sufficiently heavy for construction to prevent leakage which would be harmful to structural quality of concrete.
- C. Form Ties: For exposed concrete surfaces, provide snap-off type ties designed to snap off 1-1/2" (40 mm) below surface.
- D. Exposed-Corner Chamfer Strips: Provide wood, metal, plastic or rubber chamfer strips in forms at exposed external corners of concrete work.
- E. Form-Coating Compound: Commercially formulated compound which will prevent bond of concrete to forms. Provide compound recommended by manufacturer for application indicated, and which will not stain concrete or interfere with moisture curing of concrete or subsequent painting of exposed surfaces.
- F. Reinforcing Materials:
 1. Reinforcing Bars: Except as otherwise indicated, provide ANSI/ASTM A 615, deformed, Grade 40 for size numbers 3 through 18; ANSI/ASTM A 675, plain, Grade 60, for size number 2; sizes as shown.
 2. Steel Wire: ANSI/ASTM A 82, plain, cold-drawn.
 3. Welded Wire Fabric: ANSI/ASTM A 185; sizes and spacings of wires as shown; 6" x 6" (150 mm x 150 mm) x No. 10 x No. 10 where not otherwise indicated.
 4. Reinforcement Supports: Provide supports for reinforcement including bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcing bars and welded wire fabric in place. Provide wire bar type supports complying with CRSI recommendations, unless otherwise indicated.
 - a. For on-grade work, provide supports with sand plates or horizontal runners.

- b. At exposed surfaces, provide supports with legs that are stainless steel protected (CRSI, Class 2), or plastic protected (CRSI, Class 1).

G. Concrete Materials:

1. Portland Cement: ANSI/ASTM C 150, Type I, except as otherwise indicated.
2. Aggregates: ANSI/ASTM C 33, except as otherwise indicated.
 - a. Local aggregates not complying with ANSI/ASTM C 33, but which shown by special test or actual service to produce concrete of adequate strength and durability may be used.
 - b. For rough grouting, provide aggregate which is well graded and 100 percent passing through 3/8" (10 mm) sieve.
3. Water: Clean and free of substances harmful to concrete.
4. Air-Entraining Admixture: ANSI/ASTM C 260.
5. Water-Reducing Admixture: ANSI/ASTM C 494, Type A (normal range) and Type F (high-range, super plasticizer).
6. Set-Control Admixtures: ANSI/ASTM C 494, as follows:
 - a. Type B, Retarding.
 - b. Type C, Accelerating.
 - c. Type D, Water-reducing and Retarding.
 - d. Type E, Water-reducing and Accelerating.
 - e. Type G, High-Range Water-Reducing and Retarding (Super-plasticizer).
7. Calcium Chloride: Use not permitted.

2.4 DESIGN AND PROPORTIONING OF MIXES

- A. General: Design mechanical work concrete as follows, for each 28-day compressive strength class:
1. 4000 psi (27580 kPa) Class: 565 lbs. of cement per cu. yd. (335 kg/m³) (6.0 sacks), and 0.35 water/cement ratio.
 2. 3000 psi (20685 kPa) Class: 500 lbs. of cement per cu. yd. (296 kg/m³) (5.25 sacks), 0.46 water/cement ratio.
 3. 2500 psi (17238 kPa) Class: 450 lbs. of cement per cu. yd. (268 kg/m³) (4.75 sacks), and 0.54 water/cement ratio.
 4. Backfill Class (Lean Concrete): 375 lbs. of cement per cu. yd., (223 kg/m³) (4.0 sacks), and 0.60 water/cement ratio.
 5. Rough Grouting Class: 565 lbs. of cement per cu. yd. (335 kg/m³) (6.0 sacks), and 0.60 water/cement ratio.
- B. Admixtures: Except as otherwise indicated, use is at Contractor's option. Comply in each instance with admixture manufacturer's recommendations and suggested limitations for required quality of concrete. Use water-reducing admixture (normal or high-range in all concrete).
- C. Air Entrainment: Comply with the following limitations for resulting air entrainment:
1. Concrete Above Grade: Not less than 2%, nor more than 4%.
 2. Concrete Below Grade: Not less than 2% nor more than 4%, except up to 6% where maximum aggregate size must be 3/4" (20 mm) or less.
 3. Rough Grout Concrete: Not less than 4%, nor more than 8%.
 4. Backfill Concrete: Not more than 7%.
- D. Slump Limitations: Limit water content in design mixes to produce the following slumps at point of placement (but do not exceed specified water/cement ratios). Concrete containing high-range water-reducing admixture may have slump limit up to 8" (200 mm).

1. Reinforced Structural Concrete: For concrete which is reinforced (with more than shrinkage crack protection), or in strength class of 3000 psi (20685 kPa) and above, limit slump to range of 1" to 3" (25 mm to 75 mm).
 2. Plain Concrete: For concrete which is not reinforced or reinforced only for shrinkage crack protection, and in strength class below 3000 psi (20685 kPa), limit slump to range of 2" to 5" (50 mm to 125 mm).
 3. Rough Grout Concrete: Limit slump to range of 3" to 7" (75 mm to 175 mm).
 4. Backfill Concrete: Limit slump to 5" (125 mm).
- E. Mix for Patching: Where mechanical work requires patching of exposed concrete work which has been cut to accommodate mechanical work, provide concrete patching mix which is identical with mix of work being patched (same cement, aggregates, admixtures and proportioning).

2.5 CONCRETE MIXING

- A. Job-Site Mixing: Mix materials for concrete in drum-type batch machine mixer. For mixers of 1.0 cu. yd. (.84 m²), or smaller capacity, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after all ingredients are in mixer, before any part of batch is released. For mixers of capacity larger than 1.0 cu. yd. (.84 m²), increase mixing time by 15 seconds for each additional cu. yd., or fraction thereof.
1. Prepare and submit batch ticket for each batch discharged and used in work.
- B. Ready-Mix Concrete: Comply with requirements of ANSI/ASTM C 94, except as otherwise indicated.
1. Delete references for allowing additional water to be added to batch for material with insufficient slump. Addition of water to batch will not be permitted.
 2. During hot weather, or under conditions contributing to rapid setting of concrete, mix each load for shorter period of time than specified in ANSI/ASTM C 94. When air temperature is between 85 and 90 degrees F (29.4 and 32.2 degrees C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes, and when air temperature is above 90 degrees F (32.2 degrees C), reduce mixing and delivery time to 60 minutes.

2.6 GENERAL PAINTING PRODUCT REQUIREMENTS

- A. Pigments: Provide paint with pure, non-fading pigments, recognized to be safe, durable and environmentally acceptable, and containing not more than 0.5 percent lead (by weight in total dry film).
- B. Vehicles and Thinners: Comply with governing regulations and recognized safe practices in handling, use and drying of paint vehicles and thinners. Compatibility of paint products is the Contractor's exclusive responsibility. Select paint products to ensure freedom from problems relating to vehicles and thinners of type and within limits recommended by paint manufacturer.
- C. Undercoat Paints: Use paint produced by same manufacturer as paint to be used for finish coats.
- D. Colors: Provide colors as indicated or established by the Owner by color schedule or by other indication or, where not otherwise indicated, as selected by the Owner from manufacturer's standard (non-premium cost) colors available for type of paint to be provided in each case.
- E. Color-Coded Finishes: For finishes indicated to be color-coded for identification, provide paint complying with the color requirements of ANSI A13.1 "Scheme for the Identification of Piping Systems", except where another specific color requirement is indicated.
- F. "Paint": As used herein means coating system materials, including primers, emulsions, enamels, sealers, fillers and other applied materials whether used as prime, intermediate or finish coats.
- G. Standards: In the following designated paint systems (example: "IPS-22") the descriptions similar to "... (TT-P-55, Type II)..." refer to Federal Specifications of that number, and indicate required compliance with that publication as minimum standard of quality for paint product as named. Product of recognized higher quality can be used, provided either label indicates compliance with

required standard, or manufacturer submits proof and certification that product meets or exceeds standard in every significant measure of quality.

- H. Optional Systems: Where more than one paint system is designed for particular substrate, selection is Contractor's option except where distinct paint system is shown or scheduled for particular portion or area of that substrate.

2.7 EXTERIOR PAINT SYSTEMS

A. Concrete:

1. EPS-1: 1st Coat - Acrylic emulsion (TT-P-19).
2nd Coat - Acrylic emulsion (TT-P-19).
Not less than 2.5 mils dry-film thickness.
2. EPS-2: 1st Coat - Vinyl acrylic emulsion (TT-P-55, Type II).
2nd Coat - Vinyl acrylic emulsion (TT-P-55, Type II).
3. EPS-3: 1st Coat: Heavy-duty, textured coating (TT-C-555, Type II).
Not less than 15.0 mils dry-film thickness.

B. Cement:

1. EPS-6: 1st Coat - Primer undercoat (TT-P-25).
2nd Coat - Acrylic emulsion (TT-P-19).
3rd Coat - Acrylic emulsion (TT-P-19).
Not less than 3.5 mils dry-film thickness.

C. Ferrous Metal:

1. EPS-15: 1st Coat - Zinc-yellow iron oxide primer (TT-P-57, Type II).
2. EPS-15: 1st Coat - Red lead pigmented primer (TT-P-86, Type III).
2nd Coat - High-gloss alkyd enamel (TT-E-489, Class A).
3rd Coat - High-gloss alkyd enamel (TT-E-489, Class A).
First coat not required on items delivered shop primed.
3. EPS-16: 1st Coat - Zinc-yellow iron oxide primer (TT-P-57, Type II).
4. EPS-16: 1st Coat - Red lead pigmented primer (TT-P-86, Type III).
2nd Coat - Semi-gloss alkyd enamel (TT-E-529, Class A).
3rd Coat - Semi-gloss alkyd enamel (TT-E-529, Class A).
First coat not required on items delivered shop primed.
5. EPS-17: 1st Coat - Zinc-yellow iron oxide primer (TT-P-57, Type II).
6. EPS-17: 1st Coat - Red lead pigmented primer (TT-P-86, Type III).
2nd Coat - Lusterless alkyd enamel (TT-E-527).
3rd Coat - Lusterless alkyd enamel (TT-E-527).
First coat not required on items delivered shop primed.
7. EPS-18: 1st Coat - Zinc-yellow iron oxide primer (TT-P-57, Type II).
2nd Coat - Alkyd gloss enamel (TT-E-37).
3rd Coat - Alkyd gloss enamel (TT-E-37).
First coat not required on items delivered shop primed.
8. EPS-19: 1st Coat - Basic lead silico chromate primer (TT-P-615, Type III).
9. EPS-19: 1st Coat - Zinc chromate alkyd primer (TT-P-645).
2nd Coat - Semi-gloss silicone alkyd enamel (TT-E-490).
3rd Coat - Semi-gloss silicone alkyd enamel (TT-E-490).

D. Zinc-Coated Metal:

1. EPS-20: 1st Coat - Zinc dust-zinc oxide primer (TT-P-641).
2nd Coat - High gloss alkyd enamel (TT-E-489, Class A).

3rd Coat - High gloss alkyd enamel (TT-E-489, Class A).

E. Aluminum:

1. EPS-21: 1st Coat - Zinc chromate primer (TT-P-645).
2nd Coat - High gloss alkyd enamel (TT-E-489, Class A).
3rd Coat - High gloss alkyd enamel (TT-E-489, Class A).

2.8 INTERIOR PAINT SYSTEMS

A. Concrete:

1. IPS-1: 1st Coat - Interior latex emulsion (TT-P-29).
2nd Coat - Interior latex emulsion (TT-P-29).
2nd Coat - Interior alkyd emulsion, odorless (TT-P-30).
2. IPS-2: 1st Coat - Interior latex emulsion (TT-P-29).
2nd Coat - Interior enamel undercoat (TT-E-543).
3rd Coat - Interior enamel, semi-gloss (TT-E-509).
Not less than 3.5 mils total dry-film thickness.
3. IPS-3: 1st Coat - Acrylic emulsion (TT-P-19).
2nd Coat - Acrylic emulsion (TT-P-19).
4. IPS-4: 1st Coat - Interior latex emulsion (TT-P-29).
2nd Coat - Polyester epoxy (TT-C-5451).
3rd Coat - Polyester epoxy (TT-C-545).
Not less than 4.0 mils dry-film thickness.

B. Cement:

1. IPS-9: 1st Coat - Interior latex emulsion (TT-P-29).
2nd Coat - Interior latex emulsion (TT-P-29).

C. Ferrous Metal:

1. IPS-19: 1st Coat - Red lead primer (TT-P-86).
2nd Coat - Interior latex emulsion (TT-P-29).
3rd Coat - Interior latex emulsion (TT-P-29).
First coat not required on items that are shop primed.
Not less than 2.5 mils dry-film thickness.
2. IPS-20: 1st Coat - Red lead primer (TT-P-86).
2nd Coat - Enamel undercoat (TT-E-543).
3rd Coat - Semi-gloss enamel (TT-E-509).
First coat not required on items that are shop primed.
Not less than 2.5 mils dry-film thickness.
3. IPS-21: 1st Coat - Red lead primer (TT-P-86).
2nd Coat - Enamel undercoat (TT-E-543).
3rd Coat - Gloss enamel (TT-E-506).
First coat not required on items that are shop primed.
Not less than 2.5 mils dry-film thickness.

D. Zinc-Coated Metal:

1. IPS-22: 1st Coat - Zinc dust-zinc oxide primer (TT-P-641).
2nd Coat - Interior latex emulsion (TT-P-29).
3rd Coat - Interior latex emulsion (TT-P-29).
Not less than 2.5 mils dry-film thickness.
2. IPS-23: 1st Coat - Zinc dust-zinc oxide primer (TT-P-641).
2nd Coat - Enamel undercoat (TT-E-543).
3rd Coat - Semi-gloss enamel (TT-E-509).
Not less than 2.5 mils dry-film thickness.

3. IPS-24: 1st Coat - Zinc dust-zinc oxide primer (TT-641).
2nd Coat - Enamel undercoat (TT-E-543).
3rd Coat - Gloss Enamel (TT-E-506).
Not less than 2.5 mils dry-film thickness.
- E. Fabric Covering on Insulation:
 1. IPS-33: 1st (Size) Coat - Interior latex emulsion (TT-P-29).
2nd Coat - Interior latex emulsion (TT-P-29).
Add fungicidal agent to render fabric mildew-proof.

PART 3 - EXECUTION

3.1 ACCESS TO MECHANICAL WORK

- A. Comply with manufacturer's instructions for installation of floor doors, and removable access plates.
- B. Set frames accurately in position and securely attach to supports with face panels plumb or level in relation to adjacent finish surfaces.
- C. Adjust hardware and panels after installation for proper operation.
- D. Remove or replace panels or frames which are warped, bowed, or otherwise damaged.

3.2 EXCAVATING FOR MECHANICAL WORK

- A. General: Do not excavate for mechanical work until work is ready to proceed without delay, so that total time lapse from excavation to completion of backfilling will be minimum.
- B. Excavate with vertical sided excavations to greatest extent possible, except where otherwise indicated. Where necessary, provide sheeting and cross-bracing to sustain sides of excavations. Remove sheeting and cross-bracing during backfilling wherever such removal would not endanger work or other property. Where not removed, cut sheeting off at sufficient distance below finished grade to not interfere with other work.
- C. Width: Excavate for piping with 6" to 9" (150 mm to 225 mm) clearance on both sides of pipe, except where otherwise shown or required for proper installation of pipe joints, fittings, valves and other work. Excavate for other mechanical work to provide minimum practical but adequate working clearances.
- D. Depth for Direct Support: For work to be supported directly on undisturbed soil, do not excavate beyond indicated depths, and hand-excavate bottom cut to accurate elevations. Except as otherwise indicated, support the following work on undisturbed soil at bottom of the excavations:
 1. Piping of 5" (125 mm) and less pipe/tube size.
 2. Cast-in-place concrete.
- E. Depth for Subbase Support: For large piping (6" pipe size and larger) (150 mm pipe size and larger) tanks, and where indicated for other mechanical work, excavate for installation of subbase material in depth indicated or, if not otherwise indicated, 6" (150 mm) below bottom of work to be supported.
- F. Depth for Unsatisfactory Soil Conditions: Where directed (because of unsatisfactory soil condition at bottom of indicated excavation), excavate additional depth as directed to reach satisfactory soil bearing condition. Backfill with subbase material, compacted as directed, to indicated excavation depth.
- G. Depth for Exterior Piping: Except as otherwise indicated, excavate for exterior water-bearing piping (water, steam condensate, drainage) so that top of piping will not be less than 2'- 6" (600 mm-150 mm) vertical distance below finished grade.
- H. Excavate near large trees (within drip line) by hand, and protect root system from damage or dryout to greatest extent possible. Maintain moist condition for root system and cover exposed roots with burlap. Paint root cuts of 1" (25 mm) diameter and larger with asphaltic tree paint.

- I. Store excavated material (temporarily) near excavation, in manner which will not interfere with or damage excavation or other work. Do not store under trees (within drip line).
 1. Retain excavated material which complies with requirements for backfill material.
 2. Dispose of excavated material which is either in excess of quantity needed for backfilling or does not comply with requirements for backfill material.
 - a. Move unused material to another location on Owner's property, at or adjacent to project site, and dispose of as directed by the Owner.
 - b. Remove unused material from project site, and dispose of in lawful manner.

3.3 DEWATERING

- A. Maintain dry excavations for mechanical work, by removing water. Protect excavations from inflow of surface water. Pump minor inflow of ground water from excavations; protect excavations from major inflow of ground water, by installing temporary sheeting and waterproofing. Provide adequate barriers which will protect other excavations and below-grade property from being damaged by water, sediment or erosion from or through mechanical work excavations.
 1. Install and operate well-point dewatering system to maintain ground water at level approximately 2'- 0" (600 mm - 0 mm) below mechanical work excavations, until backfilling is completed.

3.4 BASE PREPARATION

- A. Subbase Installation: Where indicated, install subbase material to receive mechanical work, and compact by tamping to form firm base for work. For piping, horizontal cylindrical tanks, and similar work, shape subbase to fit shape of bottom 90 degree of cylinder, for uniform continuous support.
 1. Provide finely-graded subbase material for wrapped, coated, and plastic pipe and tanks.
- B. Shape subbases and bottoms of excavations with recesses to receive pipe bells, flanged connections, valves and similar enlargements in piping systems.
- C. Concrete Encasement: Where piping under roadways is less than 2'- 6" (600 mm-150 mm) below surface of roadway, provide 4" (100 mm) base slab of concrete to support piping. After piping is installed and tested, provide 4" (100 mm) thick encasement (sides and top) of concrete before backfilling. Provide Class 2500 concrete for encasement and slab.
- D. Previous Excavations: Where piping crosses over area more than 5'- 0" (1.5 m-0 mm) wide which has been previously excavated to greater depth than required for piping installation, provide suitable subsidence-proof support for piping. Comply with details shown or, where not otherwise shown, provide one of the following support systems:
 1. Excavate to undisturbed soil, in width equal to pipe diameter plus 2'- 0" (600 mm-0 mm). Install 8" (200 mm) courses of subbase material, each compacted to 95% of maximum density, as required to fill excavation and support piping.
 2. Excavate to undisturbed soil, in width equal to pipe diameter plus 1'-0" (300 mm - 0 mm). Install lean concrete fill to required elevation for support of piping.

3.5 BACKFILLING

- A. Do not backfill until installed mechanical work has been tested and accepted, wherever testing is indicated.
- B. Install drainage fill where indicated, and tamp to uniform firm density.
- C. Backfill with finely-graded subbase material to 6" (150 mm) above wrapped, coated, and plastic piping and tanks, and to centerline of other tanks.
- D. Condition backfill material by either drying or adding water uniformly, to whatever extent may be necessary to facilitate compaction to required densities. Do not backfill with frozen soil materials.

- E. Backfill simultaneously on opposite sides of mechanical work, and compact simultaneously; do not dislocate work from installed positions.
- F. Backfill excavations in 8" (200 mm) high courses of backfill material, uniformly compacted to the following densities (% of maximum density, ASTM D 1557), using power-driven hand-operated compaction equipment.
 - 1. Lawn and Landscaped Areas: 85% for cohesive soils; 90% for cohesionless soils.
 - 2. Paved Areas, Other Than Roadways: 90% for cohesive soils; 95% for cohesionless soils.
 - 3. Roadways: 90% for cohesive soils; 95% for cohesionless soils.
- G. Backfill to elevations matching adjacent grades, at time of backfilling excavations for mechanical work.
- H. Compaction Tests: Where compaction tests indicate lower densities of backfill than specified, continue compaction (and re-excavation and backfilling where necessary) and provide additional testing as directed by the Owner. Allowable density tolerance is not more than one-test-out-of-5 falling more than 2 percentage points below specified density.

3.6 PERFORMANCE AND MAINTENANCE, EXCAVATION WORK

- A. Subsidence: Where subsidence is measurable or observable at mechanical work excavations during general project warranty period, remove surface (pavement, lawn or other finish), add backfill material, compact, and replace surface treatment. Restore appearance, quality, and condition of surface or finish to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.7 INSTALLATION OF CONCRETE WORK

- A. Formwork:
 - 1. General: Design, construct and maintain formwork to support vertical and lateral loads including pressure of cast-in-place concrete. Construct formwork so that formed concrete will be required size and shape and in required location. Construct with joints which will not leak cement paste. Form sides and bottoms of concrete work, except where clearly indicated to be cast directly in excavation or against other construction, or on grade or prepared subgrade. Design and construct forms for easy removal without damage to concrete and other work.
 - a. Install chamfer strips at external corners of exposed concrete work.
 - b. Construct forms to retain equipment anchor bolts in accurate locations during placement of reinforcing steel and concrete. Use templates, if available by equipment manufacturers, to locate anchor bolts or, where not furnished, locate by accurate measure from certified setting diagrams.
 - 2. Form Coating: Coat concrete-contact surfaces of forms to be removed. Apply form-coating compound before reinforcement is placed. Apply in accordance with manufacturer's instructions and remove excess compound and spillage.
 - 3. Cleaning and Tightening: Clean forms and adjacent surfaces to receive concrete just before concrete is placed. Retighten forms promptly during concrete placement where required to eliminate leakage of cement paste.
- B. Placing Reinforcement:
 - 1. General: Comply with requirements and recommendations of specified standards, including "Placing Reinforcing Bars" by CRSI. Place bars where indicated and support to prevent displacement during concrete placement, using appropriate reinforcement supports, properly spaced and wire tied to reinforcing bars.
 - a. Place reinforcement to obtain at least minimum recommended coverage for concrete protection. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

- b. Install welded wire fabric in as long lengths as practicable. Laps adjoining pieces at least one full mesh and lace splices with 16-gage (1.6 mm) wire. Offset end laps in adjacent widths to prevent continuous laps in either direction.
- c. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials which would reduce bond with concrete.

C. Placing Concrete:

- 1. Wet wooden forms which have been coated with compound, immediately before concrete, and remove excess water from forms.
- 2. Strength-Class Applications: Comply with compressive-strength classes shown on drawings for each unit of mechanical concrete work or, if not shown, comply with the following general application requirements.
 - a. Backfill: Provide backfill class (lean concrete).
 - b. Plain Concrete Encasement: Provide 2500 psi (17238 kPa) class.
 - c. Reinforced Concrete Encasement: Provide 3000 psi (20685 kPa) class.
 - d. Underground Structural Concrete: Provide 3000 psi (20685 kPa) class.
 - e. Tanks and Vaults: Provide 4000 psi (27580 kPa) class.
 - f. Block-Type Foundations: Where least dimension is not less than 0.2 x largest dimension, provide 3000 psi (20685 kPa) class.
 - g. Beam-Type Foundations: Where least dimension is less than 0.2 x largest dimension, provide 4000 psi (27580 kPa) class.
 - h. Miscellaneous Supported Work: Provide 3000 psi (20685 kPa) class for curbs, pads, inertia blocks and similar supported work.
 - i. Concrete Fill: Provide 2500 psi (17238 kPa) class for filling structural steel foundation frames and for filling similar large-volume units.
 - j. Concrete Grout: Provide rough grouting class for filling voids to be grouted which are too small to be filled effectively with 2500 psi (17238 kPa) class concrete.
 - k. Patching General Concrete Work: Match concrete being patched.
- 3. Deposit concrete continuously or in layers of thickness which will result in no concrete being placed on concrete which has hardened sufficiently to cause formation of seams or planes of weakness within section. If section cannot be placed continuously, provide construction joints. Deposit concrete as nearly as practicable in its final location, so as to avoid segregation due to rehandling or flowing.
- 4. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding or tamping. Use equipment and procedures complying with recommended practices of ACI 309; eliminate voids in work. Mechanical vibrators shall not be used when placing concrete around underground ductwork.
- 5. Bring horizontal surfaces to correct level with straightedge and strike off. Use bull floats or darbies to smooth surface, free of humps and hollows.
- 6. Cold Weather Placement: Comply with ACI 306. Do not use frozen materials or materials containing ice and snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials. When air temperature has fallen or is expected to fall below 40 degrees F (4.4 degrees C), heat water and aggregates uniformly before mixing, as required to obtain concrete mixture temperature of not less than 50 degrees F (10 degrees C), and not more than 80 degrees F (26.7 degrees C), at time of placement. Protect concrete work from physical damage and reduced strength resulting from frost, freezing actions, or low temperatures.
- 7. Hot Weather Placement: Comply with ACI 305 when hot weather conditions could impair work. Maintain concrete temperature below 90 degrees F (32.2 degrees C) at time of placement, by cooling ingredients. Mixing water may be chilled, or chopped ice may be used to control concrete temperature, provided water equivalent of ice is included in calculating compliance with water/cement ratio limitations. Cover reinforcing steel with water-soaked burlap as necessary to ensure that steel temperature will not exceed ambient air temperature immediately before embedment in concrete.

8. Finishing Horizontal Surfaces: Float and trowel horizontal (top) surfaces to level, smooth, uniform textured, dense finish, where surface is to remain exposed or receive coating, membrane or other thin-set finish. Otherwise, leave struckoff surface undisturbed; except scratch surfaces which are to receive concrete or mortar topping or setting bed, by raking with a stiff broom.
 - a. Depress top of concrete backfill sufficiently so that supported work can be set in bed of mortar or sand as indicated.
 9. Curbs: Provide monolithic finish on interior curbs by stripping forms while concrete is still green and steel-troweling surfaces to hard, dense finish with corners, intersections and terminations slightly rounded and coved.
- D. Form Removal and Surface Repairs:
1. Form Removal: Remove forms as soon as concrete has set and gained sufficient strength to ensure that neither removal of forms nor stress introduced by removal of support contributed by forms will result in damage to concrete.
 - a. Retain forms on vertical surfaces of concrete for not less than three (3) days after concrete is placed.
 - b. Retain forms supporting horizontal and angular bottom surfaces of concrete for not less than fourteen (14) days after concrete is placed, except where indicated for longer periods of support.
 2. Unexposed Surfaces: Repair significantly damaged and honeycombed areas, and remove major projections and fins where forms have been removed.
 3. Exposed Surfaces: On formed surfaces which are to be exposed, including those to be coated or covered with membrane or other thin-set applied finish, repair and patch form-tie holes and damaged and honeycombed areas, filling voids with grout and completely removing fins and other projections.

3.8 CONCRETE CURING AND PROTECTION

- A. General:
1. Protect freshly placed concrete from drying and excessively cold and hot temperatures, and maintain in moist condition at relatively constant temperature for period of time necessary for hydration of cement, proper hardening, and achievement of strength requirements as specified.
 - a. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than seventy-two (72) hours.
 - b. Begin final curing procedures immediately following initial curing and before concrete has dried. Continue curing for at least seven (7) days and in accordance with ACI 301 procedures. Avoid rapid drying at end of final curing period.
 - c. Subgrade concrete backfill may be excluded from final curing procedures where adjoining subsoil is sufficiently moist to maintain concrete in moist condition.
- B. Curing Method: Perform final curing for each area of concrete work by one of the following methods (at Contractor's option), as appropriate for location and accommodation of adjacent construction work which must continue:
1. Continuous water emersion or fog spraying.
 2. Covering with absorptive cover which is maintained in wet-to-fully saturated condition.
 3. Covering with moisture retaining cover, with sealed joints and maintained without holes or openings as non-breathing membrane.
 4. Coating with membrane-forming curing compound, applied in two (2) coats and maintained in effective condition for cure period (replaced if degraded by rain before reaching stable condition).

- a. Do not use compound curing method where surface is to be painted, dampproofed, waterproofed, or covered with other finish requiring bond to concrete.
- b. Do not use compound curing method where forms must be retained more than three (3) days.

3.9 MISCELLANEOUS CONCRETE WORK

- A. Concrete Grouting: Grout openings and recesses as indicated, in and around mechanical work and other work which penetrates or adjoins mechanical concrete work, using rough grouting class of concrete mix. Provide formwork where required, and tamp, screed and trowel surfaces. Cure grout as specified for concrete work.
- B. Refer to individual equipment sections of these specifications for fine-grouting of equipment base plates on foundations (usually with non-shrinking grout), and similar grouting requirements not defined herein as concrete work.

3.10 QUALITY CONTROL TESTING

- A. Engage testing laboratory to take samples, perform tests, and prepare and submit reports for concrete as it is placed.
 1. Backfill Concrete: Quality control testing is not required for backfill concrete (lean concrete).

3.11 SURFACE PREPARATION FOR PAINTING

- A. General: Clean surfaces before applying paint products. Remove oil and grease prior to mechanical cleaning. Comply with paint products manufacturer's instructions for surface cleaning and preparation. Remove surface-applied accessories which are not to be painted, and reinstall after completion of painting. Protect non-removable items not to be painted, by covering with paper or plastic material.
- B. Cementitious Surfaces: Remove efflorescence, chalk, dust, and glaze to ensure good bond of paint products. Clean concrete with muriatic acid (1 part diluted with 6 to 8 parts water) and flush with water, where necessary to ensure good paint bond. Perform appropriate tests to determine that both alkalinity and moisture content of concrete surfaces are below maximum allowable levels for painting, as recommended by paint manufacturer.
- C. Ferrous Metal Surfaces: Remove mill scale and loose rust on surfaces which are not zinc-coated or shop/factory prime coated.
- D. Clean shop-applied prime coats on metal surfaces, and repair (touch-up) prime coats wherever abraded or otherwise damaged, prior to application of paint system.
- E. Zinc-Coated Surfaces: Clean with non-petroleum based solvent. Wash with copper sulfate solution and flush with water, unless surface has been pretreated, or unless treatment is not recommended by manufacturer of prime coat.

3.12 PAINT SYSTEM APPLICATION

- A. Mixing: Comply with manufacturer's recommendations for mixing or stirring paint products immediately before application.
- B. Application Limitations: Except as otherwise indicated, paint every accessible surface of each unit of work indicated to be painted, regardless of whether in location recognized as "concealed" or "exposed".
 1. Omit painting on surfaces located in service shafts and tunnels and above non-removable ceilings and in similar place where space is too limited or services are too congested to allow access for painting.
 2. Omit painting of ductwork and insulated piping above removable ceilings, but apply paint system to uninsulated steel piping, exposed threads of galvanized piping, pipe hangers, duct hangers, exposed ductwork, and similar work.

3. Omit painting on machined sliding surfaces and rotating shafts of equipment, and on nonferrous finished metals including chrome plate, stainless steel, special anodized aluminum, brass/bronze and copper, and on plastics and similar finished materials, except where specifically indicated to be color-coded by painting.
 4. Omit painting on required name plates, labels, identification tags, signs, markers, printed instructions, performance ratings, flow diagrams and similar text and graphics, located within the scope of work indicated to receive paint application.
 5. Omit specified prime coat of paint system for metal surfaces where surface has shop-applied prime coat of equivalent quality. Apply prime coat on other surfaces to be painted; comply with paint manufacturer's instructions for prime coating where not otherwise indicated. Apply additional prime coats where suction spots or unsealed areas appear.
- C. General Application Requirements: Apply paint in accordance with manufacturer's directions. Use applicators and techniques best suited for substrate, for type of material being applied, and for ambient conditions. Apply additional coats when undercoats, stains or other conditions show through final coat of paint, until paint film is of uniform finish, color and appearance. Apply paint at edges, corners, joints, welds and exposed fasteners in manner which will ensure dry-film thickness equal to that of flat surfaces. Allow sufficient time between successive coats for proper drying (comply with manufacturer's drying instructions).
- D. Number of Coats: Number indicated is minimum number; apply as many coats as are necessary to comply with dry-film thickness requirements.
- E. Coating Thickness: Apply uniform coats to produce dry-film thickness indicated or, if not otherwise indicated, apply paint without thinning in application thickness recommended by manufacturer for each coat.
- F. Smooth Finishes: Except as otherwise indicated, apply paint in smooth finish without noticeable texture, cloudiness, spotting, holidays, laps, brush marks, runs, sags, ripples, ropiness and other surface imperfections.
- G. Textured Finishes: Where indicated, roll and redistribute paint of final coat to even texture. Match adjoining textured paint finishes if any, and roll to eliminate evidence of roller or lap marks and other unevenness and imperfections.
- H. Exterior Stacks: Paint the top 18" (450 mm) of stacks black, regardless of color selected for general painting of equipment and accessories on roof.
- 3.13 CLEAN-UP AND PROTECTION, PAINTING
- A. General Clean-Up: During progress of work, remove from site discarded paint materials, rubbish, cans and rags at end of each work day. Retain paint containers from application of coatings on particular unit or area of work, until average dry-film thickness has been calculated.
- B. Spattered Surfaces: Upon completion of painting work, clean paint-spattered surfaces. Remove spattered paint by proper methods of washing and scraping, using care not to scratch or otherwise damage finished surfaces.
- C. Protection: Protect work of other trades, whether to be painted or not, against damage by painting work. Correct damage by cleaning, repairing or replacing and repainting as directed. Provide "Wet Paint" signs as required to protect newly-painted finishes. Remove temporary protective wrappings installed for protection of work not to be painted, after completion of painting operations. At completion of work by other trades, touch-up and restore damaged or defaced painted surfaces.

END OF SECTION 23 05 10

SECTION 23 05 48 - VIBRATION ISOLATION FOR HVAC PIPING AND EQUIPMENT**PART 1 - GENERAL****1.1 SUMMARY**

- A. Scope: The extent of vibration isolation work to be provided under this Contract is covered by the requirements of this Section, all other Division-23 sections and the Contract Drawings including structural, architectural, mechanical and electrical which identify equipment and systems requiring vibration isolation treatment.
- B. Types: Types of vibration isolation equipment and systems specified in this Section include:
- | <u>TYPE</u> | <u>DESCRIPTION</u> |
|-------------|--------------------------------------|
| 3H Hanger | Combination Spring and Neoprene Type |
- C. Selection of Isolators: Provide isolators selected by a vibration isolator equipment specialist.
1. Conform to isolator types herein specified.
 2. Examine the contract drawings for sizes, horsepowers, rotational speeds, equipment location, length of span between columns and beams and construction type to determine the isolator selection type and deflection required for each piece of mechanical equipment.
 3. Conform to the requirements of the most current edition of American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) Handbook, "HVAC Applications", Sound and Vibration Control.

1.2 QUALITY ASSURANCE

- A. Codes: At a minimum, conform to the most current edition of ASHRAE Handbook, "HVAC Applications".
- B. Manufacturer: Isolators of the same type shall be the product of the same manufacturer. The manufacturer shall publish and maintain a full line of materials, engineering and application data and operating and maintenance instructions.

1.3 SUBMITTALS

- A. Contractor's Certification: Vibration isolator submittals shall include a certification, signed by an officer representing the Contractor and stipulating that the submittal prepared by the manufacturer has been reviewed, and checked on an item by item basis against each piece of mechanical equipment, shown or specified in the Contract Documents, which requires vibration isolation.
- B. Manufacturer's Certification: The manufacturer or manufacturers (if there are more than one) shall each certify that the selections of vibration isolation equipment are based upon the drawings and specifications, and that each piece of mechanical equipment has been examined for rotational speed, equipment type, mounting location, and supporting span between column centers, and that an appropriate isolator has been selected.
- C. Product Data: Furnish manufacturer's product data covering each isolator type for style, characteristic, and finish.
1. Isolator quantities, dimensions, deflections, capacities and types shall remain the responsibility of the manufacturer and the Contractor.
- D. Shop Drawings: Where coordinated shop drawings are required, provide layout drawings, drawn to a scale of not less than 1/4-inch to 1-foot (6 mm to 300 mm), showing the proposed layout of equipment and piping systems and the location and type of each vibration isolation device.
1. Carefully examine other sections requiring coordinated shop drawings and prepare isolation shop drawings to the same scale showing the location of each vibration isolation equipment base, pipe hanger, flexible connection, and isolator.

1.4 STORAGE AND PROTECTION

- A. Storage: Store vibration isolation equipment indoors in the manufacturer's original shipping containers. Preclude the entrance of construction dirt and debris.
 - 1. Vibration isolation equipment and bases, which show signs of rust, cement or concrete fouling, dirt and construction debris shall be disassembled and cleaned, approved or removed from the project site and replaced with new.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include the following:
 - 1. Mason
 - 2. Vibration Eliminator Co.
 - 3. Kinetics Noise Control

2.2 EQUIPMENT

- A. Dimensions: The schedule shows dimensions for deflection and sizes all in inches.
- B. Spans: Where referenced, the schedule shows spans of the longest bay dimension for slabs or beams supported between columns. Dimensions are in feet.
- C. Selection: Exact mounting sizes, dimensions and quantity of isolators and static deflection required shall be determined by the isolator manufacturer based upon equipment that will be furnished and installed by the Contractor under this Contract.
 - 1. Vibration isolation specialist shall coordinate his work with that of other trades to verify that equipment speeds, in revolutions per minute (rpm), are based upon actual equipment installed at the project site.
 - 2. Verify that equipment rpm and spring deflection selected are arranged so that resonance is avoided.

2.3 ISOLATOR TYPES

- A. Type 3H Hangers: Provide combination spring and elastomer hangers consisting of a formed steel frame with coil spring and elastomer insert in compression.
 - 1. Design hangers to be capable of supporting a 200 percent overload without noticeable deformation or failure.
 - 2. Design hangers to allow a 30 degree misalignment without binding or a reduction in hanger efficiency.
 - 3. Design hangers for connection to equipment and supporting rods.
 - 4. Restraints shall have the same deflection as isolators installed under the fans.

2.4 PIPING AND DUCTWORK

- A. General: All ductwork and piping in mechanical equipment rooms and within fifty feet (15 m) of the vibration source (i.e. mechanical equipment such as air handling units, chillers, pumps, cooling towers, air compressors, etc.) shall be isolated from the building structure with flexible vibration isolators. Air handling units with less than two inches (500 Pa) of external static pressure shall be excluded from this requirement.
 - 1. Suspend ductwork on Type 3H hangers.
 - 2. Suspend piping on Type 3H hangers.
 - 3. Floor-mounted ductwork and piping shall be supported with Type 4 spring isolators with deflections the same as the equipment to which the piping is attached.
- B. Reciprocating Equipment: Provide spring type hangers with deflections equal to that of reciprocating equipment, with piping arranged with offset elbows to absorb vibration.

- C. Risers: Pipe and duct risers within 100 feet (30 m) of mechanical equipment rooms shall be resiliently anchored to the building structure with Type 1 vibration isolators, near the midpoint of the risers.
1. Risers shall be isolated and supported at each second floor with pairs of Type 3H hangers, having deflections a minimum of five times the anticipated thermal movement at the support point.
 2. Risers shall be guided as required with four (4) sets of Type 2I vibration isolators.
 3. Provide flexible neoprene or canvas connectors as specified in sheet metal ductwork at the connection point to all air moving equipment.
 4. Support ductwork with an internal pressure exceeding 3 inches (750 Pa) water with Type 3H hangers on maximum 10 foot (3 m) centers with deflections equal to the equipment isolators.

2.5 VIBRATION ISOLATION SYSTEM SELECTION

- A. General: The following selections of vibration isolation equipment systems shall be considered as a minimum. For the equipment below, the following code applies:

Letter (i.e. A, B, C) = Base type

Number (i.e. 1, 2, 3, 4) = Isolator type

Decimal number (i.e. 0.25, 1.5, etc.) = Minimum deflection

- B. Air Moving Device Locations:

Vibration isolation provisions apply to housed or unhoused freestanding fans of any pressure rating, located in field-erected central-station units or in unhoused return air or supply air service.

TYPE EQUIPMENT	BASEMENT BELOW GRADE	20 FOOT (6M) FLOOR SPAN	30 FOOT (9 M) FLOOR SPAN	40 FOOT (12 M) FLOOR SPAN
Up to 5 hp (Up to 3.7 kW)	A or B 2 0.25	B 3 1.0	B 3 1.0	B 3 1.5
5 thru 40 hp (3.7 thru 29.8 kW) 200 to 500 rpm (21 to 52 Rad/s)	B 3 1.5	B 3 1.5	B 3 1.5	B 3 2.5
500 rpm (52 Rad/s) & over)	B or C 3 0.75	C 3 0.75	C 3 1.5	C 3 2.5
Over 40 hp (Over 29.8 kW) 250 to 500 rpm (26 to 52 Rad/s)	B 3 0.75	C 2 1.5	C 3 2.5	C 3 2.5
500 rpm and over (52 Rad/s and over	B 3 0.75	C 3 1.5	C 3 1.5	C 3 2.5
Fan powered boxes and fan coil units	A 3 0.75	A 3 0.75	A 3 0.75	A 3 0.75

PART 3 - EXECUTION**3.1 INSTALLATION**

- A. Manufacturer: All vibration isolation equipment shall be installed in accordance with the manufacturer's recommendations.
- B. Manufacturer's Representative: The vibration isolation installation and deflection testing after equipment start-up shall be conducted by a representative of the manufacturer.

3.2 TESTS AND REPORTS

- A. Testing: Each vibration isolation device shall be deflection tested. Two (2) copies of a bound report shall be submitted prior to final acceptance. The certification shall include the following:
 - 1. Certify that equipment has been isolated in accordance with Contract Drawings, specifications and submittals.
 - 2. Certify that all minimum specified deflections have been equaled or exceeded.

3.3 ANCHORING

- A. Installation: Installation shall comply with manufacturer's published recommendations and shall be installed so that isolators are plumb and are operating at a manner for which they were designed.
 - 1. Unless otherwise specified, all equipment shall be securely bolted to isolators, steel bases or concrete inertia bases.
 - 2. Indoor vibration isolators need not be attached to the structure unless required by local codes.
 - 3. Isolators installed outdoors shall be attached to building structure.

3.4 CLEANING

- A. Debris: Remove all debris from under equipment, and thoroughly clean steel bases, inertia bases and check for free movement.
- B. Adjustment: Adjust isolators as required for proper operation prior to starting equipment. Testing of vibration isolators shall be performed by a certified representative of the manufacturer as specified.

3.5 GENERAL

- A. All exterior structural steel and/or steel housings of exterior vibration isolation materials shall be hot dipped galvanized.

END OF SECTION 23 05 48

SECTION 23 05 53 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT**PART 1 - GENERAL****1.1 DESCRIPTION OF WORK**

- A. Extent of mechanical identification work required by this section is indicated on drawings and/or specified in other Division-23 sections.
- B. Types of identification devices specified in this section include the following:
 - 1. Pipe and Duct Markers
 - 2. Painted Identification Materials
 - 3. Engraved Plastic-Laminate Signs
 - 4. Plastic Equipment Markers
 - 5. Plasticized Tags
- C. Refer to requirements of Division-26.

1.2 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacturer of identification devices of types and sizes required, whose products have been in satisfactory use in similar service for not less than five (5) years.
- B. Codes and Standards:
 - 1. ANSI Standards: Comply with ANSI A13.1 or Owner standards for lettering size, length of color field, colors, and viewing angles of identification devices.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data and installation instructions for each identification material and device required.
- B. Schedules: Submit valve schedule for each piping system, typewritten and reproduced on 8-1/2" x 11" (213 mm x 275 mm) bond paper. Tabulate valve number, piping system, system abbreviation (as shown on tag), location of valve (room or space), and variations for identification (if any). Mark valves which are intended for emergency shut-off and similar special uses, by special "flags", in margin of schedule. In addition to mounted copies, furnish extra copies for maintenance manuals.
- C. Maintenance Data: Include product data and schedules in maintenance manuals.

PART 2 - PRODUCTS**2.1 MANUFACTURERS**

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers' products which may be incorporated in the work include the following:
 - 1. Brady
 - 2. Seton
 - 3. Bunting
 - 4. Brimar

2.2 MECHANICAL IDENTIFICATION MATERIALS

- A. General: Provide manufacturer's standard products of categories and types required for each application as referenced in other Division-23 sections. Where more than single type is specified for application, selection is Installer's option but provide single selection for each product category.

2.3 PIPE AND DUCT MARKERS

- A. Snap-on Type: Provide pre-printed, semi-rigid, snap-on color coded identification sleeves complying with ANSI A13.1. This type shall be used for insulated pipe sizes 2" and smaller.
- B. Pressure Sensitive Type: Provide pre-printed, permanent adhesive, color coded, pressure sensitive, vinyl markers conforming to ANSI A13.1. This style marker shall be applied to all uninsulated piping; insulated piping 2-1/2" and larger, and all ductwork.
- C. Flow Direction: Provide flow directional arrows either as part of markers, or separately attached to pipes and ducts.

2.4 PAINTED IDENTIFICATION MATERIALS

- A. Piping and Equipment Systems: Continuous color coded painting of piping and equipment shall be provided in all mechanical rooms in compliance with ANSI A13.1.
- B. All natural gas piping shall be painted yellow and labeled with the pressure of gas in piping (i.e. 14" wc, 2 PSI, etc.).

2.5 ENGRAVED PLASTIC-LAMINATE SIGNS

- A. General: Provide engraving stock melamine plastic laminate, complying with FS L-P-387, in the sizes and thicknesses indicated, engraved with engraver's standard letter style of the sizes and wording indicated, black with white core (letter color) except as otherwise indicated, punched for mechanical fastening except where adhesive mounting is necessary because of substrate.
 - 1. Thickness: 1/16" (1.6 mm) for units up to 20 sq. in. (12900 mm²) or 8" (200 mm) length; 1/8" for larger units.
- B. Fasteners: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate the substrate.
- C. Duty: Accident-prevention tags with appropriate wording including large-size primary wording (as examples; DANGER, CAUTION, DO NOT OPERATE).

2.6 PLASTIC EQUIPMENT MARKERS

- A. General: Provide manufacturer's standard laminated plastic, color coded equipment markers.
- B. Nomenclature: Include the following, matching terminology on schedules as closely as possible:
 - 1. Name and schedule number
 - 2. Equipment service

2.7 LETTERING AND GRAPHICS

- A. General: Coordinate names, abbreviations and other designations used in mechanical identification work with corresponding designations shown on plans. Provide numbers, lettering and wording as indicated or, if not otherwise indicated, as recommended by manufacturers or as required for proper identification and operation/maintenance of mechanical systems and equipment.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

- A. Coordination: Where identification is to be applied to surfaces which require insulation, painting or other covering or finish including valve tags in finished mechanical spaces, install identification after completion of covering and painting. Install identification prior to installation of acoustical ceilings and similar removable concealment.

3.2 DUCTWORK IDENTIFICATION

- A. General: Identify air supply, return, exhaust, intake and relief ductwork with pressure sensitive markers and arrows, showing ductwork service and direction of flow.
- B. Location: In each space where ductwork is exposed, or concealed only by removable ceiling system, locate signs near points where ductwork originates or continues into concealed enclosures (shaft, underground or similar concealment), and at 25 foot (7500 mm) spacings.
- C. Access Doors: Provide duct markers on each access door in ductwork and housings, indicating purpose of access (to what equipment) and other maintenance and operating instructions, and appropriate safety and procedural information.

3.3 MECHANICAL EQUIPMENT IDENTIFICATION

- A. General: Install engraved plastic laminate sign on or near each major item of mechanical equipment and each operational device, as specified herein if not otherwise specified for each item or device. Provide signs for the following general categories of equipment and operational devices:
 - 1. Fans and blowers.
- B. Lettering Size: Minimum 1/4" (6 mm) lettering for name of unit where viewing distance is less than 2'- 0" (600 mm - 0 mm), 1/2" (13 mm) high for distances up to 6'- 0" (1800 mm - 0 mm), and proportionately larger lettering for greater distances. Provide secondary lettering 2/3 to 3/4 of size of principal lettering.
- C. Text of Signs: In addition to name of identified unit, provide lettering to distinguish between multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.

3.4 ADJUSTING AND CLEANING

- A. Adjusting: Relocate any mechanical identification device which has become visually blocked by work of this division or other divisions.
- B. Cleaning: Clean face of identification devices, and glass frames of valve charts.

3.5 EXTRA STOCK

- A. Furnish minimum of 5% extra stock of each mechanical identification material required, including additional numbered valve tags (not less than 3) for each piping system, additional piping system identification markers, and additional plastic laminate engraving blanks of assorted sizes.

END OF SECTION 23 05 53

SECTION 23 05 93 - TESTING, ADJUSTING AND BALANCING**PART 1 - GENERAL****1.1 DESCRIPTION OF WORK**

- A. Extent of testing, adjusting, and balancing (TAB) work required by this section is indicated on drawings and schedules, and by requirements of this section, and is defined to include, but is not necessarily limited to, air distribution systems, hydronic distribution systems, and associated equipment and apparatus of mechanical work. The work consists of setting speed and volume (flow), adjusting facilities provided for systems, recording data, conducting tests, preparing and submitting reports to achieve the capacities or setpoints indicated on the contract documents, and recommending modifications to work as required to achieve the capacities or setpoints indicated on the contract documents.
- B. Component types of testing, adjusting, and balancing specified in this section shall include, but not be limited to, the following as applied to mechanical equipment:
 - 1. Building automated systems
 - 2. Fans
 - 3. Ductwork systems
- C. Refer to requirements of Division-26.

1.2 QUALITY ASSURANCE

- A. Tester's Qualifications: A firm certified by Associated Air Balance Council (AABC) who is not Installer of system to be tested.
 - 1. AABC Compliance: Comply with the current AABC's Manual "AABC National Standards", as applicable to mechanical air and hydronic distribution systems, and associated equipment and apparatus.
 - 2. Industry Standards: Comply with AABC recommendations pertaining to measurements, instruments, and testing, adjusting, and balancing, except as otherwise indicated.
 - 3. ASHRAE Standard 111: Comply with current edition of ASHRAE 111, "Measurement, Testing, Adjusting and Balancing of HVAC Systems".
 - 4. Independence: TAB contractor shall be independently owned and operated with no affiliation with the general contractor, mechanical contractor, sheet metal contractor, design engineer, etc.
 - 5. Experience: Each technician shall demonstrate a minimum of three years of actual test and balance field experience.

1.3 SUBMITTALS

- A. Qualification: TAB contractor qualifications shall be provided as a formal submittal for review to demonstrate conformance with all qualifications indicated throughout the contract documents.
- B. Submit certified test reports, signed by the AABC Test and Balance technician who performed the TAB work. In addition, the report shall be certified by an AABC certified Test and Balance Engineer (T.B.E.) who is familiar with the project.
 - 1. Include identification and types of instruments used, and their most recent calibration date with submission of final test report.
- C. The Contractor shall maintain a copy of AABC standards on the site during all TAB work. Said document(s) shall be made available to Owner representatives for reference as to minimum requirements.
- D. Maintenance Data: Include in maintenance manuals, copies of certified test reports, identification of instruments.

1.4 JOB CONDITIONS

- A. Do not proceed with testing, adjusting, and balancing work until work has been completed, tested, operable, and all balancing devices indicated on the contract documents have been installed. Ensure that there is no residual work still to be completed on the equipment to be tested.
- B. Do not proceed until work scheduled for testing, adjusting, and balancing is clean and free from debris, dirt and discarded building materials.

PART 2 - PRODUCTS

2.1 PATCHING MATERIALS

- A. Except as otherwise indicated, use same products as used by original Installer for patching holes in insulation, ductwork and housings which have been cut or drilled for test purposes, including access for test instruments, attaching jigs, and similar purposes.
 - 1. Factory fabricated plastic plugs shall be used to patch drilled holes in ductwork and housings.

2.2 TEST INSTRUMENTS

- A. Utilize test instruments and equipment for TAB work required, of type, precision, and capacity as recommended in the following TAB standards:
 - 1. AABC's Manual "AABC National Standards".
 - 2. Wherever permanently installed measuring equipment is provided, such as air volume monitors, flow meters, temperature and pressure gages, etc., these shall be used in addition to TAB instrumentation. Any discrepancies in accuracy shall be brought to the attention of the Owner. Where permanently installed instrumentation meets accuracy requirements for TAB work, they may be used provided TAB Contractor can verify calibration of installed instruments.
- B. The Contractor shall employ manufactured enclosure type cones, capable of air volume direct readings, for all diffuser air flow measurements.

PART 3 - EXECUTION

3.1 FIELD WORK

- A. Prior to the mechanical installation, the mechanical and TAB contractors shall review the design documents for "balanceability" to confirm that all devices required to properly balance each system are to be provided under this contract. Recommended modifications and/or additions shall be made directly to the engineer and a minimum of 30 days prior to the installation of mechanical equipment.
- B. Examine installed work and conditions under which testing is to be done to ensure that work has been completed, cleaned, operable and accessible. Do not proceed with TAB work until unsatisfactory conditions have been corrected.
- C. Test, adjust and balance environmental systems and components, as indicated, in accordance with procedures outlined in applicable AABC standards. All systems and components shall be balanced within $\pm 5\%$ of design air and water flows.
- D. Test, adjust and balance system during summer season for cooling and during winter season for heating systems, including operation at outside conditions within 3°F (2°C) wet bulb temperature of maximum summer design condition, and within 10°F (6°C) dry bulb temperature of minimum winter design condition. When seasonal operation does not permit measuring final temperatures, then take final temperature readings when seasonal operation does permit.
- E. For fan systems, provide sheave replacements where required to achieve specified air flows.
- F. Patch holes in insulation, ductwork and housings, which have been cut or drilled for test purposes, in manner recommended by original Installer.

3.2 REPORTS

- A. Prepare report of test results, including instrumentation calibration reports, in format recommended by AABC standards. Provide a System Summary page(s) at the front of the report.
- B. An interim/preliminary handwritten report shall be submitted to the Engineer for review prior to the formal submission of the report.
- C. Test reports shall include, but not be limited to, the following information:
 - 1. Air Handling Equipment Test:
 - a. Air handling equipment shall include, but not be limited to, all fans (supply, exhaust, return, relief, make-up, ventilation, etc.), air handling units, fan coil units, unit ventilators, VRF terminals, chilled beams. etc.).
 - b. Design Conditions: CFM, static pressure, motor h.p., outside air CFM (where applicable), fan and motor RPM and fan motor h.p. for each fan.
 - c. Installed Equipment: Manufacturer, size, arrangement, class, motor h.p., volts, phase, cycles, and full load amps.
 - d. Field Test Results: Fan CFM, fan RPM, fan motor voltage, fan motor operating amps, fan motor operating b.h.p., total static pressure for each fan. In addition, where applicable provide external static pressure, air pressure drop across each coil, filter bank, attenuator, etc. (ie. provide total static pressure profile of each system), as well as leaving air temperature, outside air conditions (dry bulb/wet bulb) at time of test, coil flow data (GPM), coil entering and leaving air temperatures, coil entering and leaving water temperatures, coil water pressure drop, VFD settings at final test conditions, and duct static pressure setpoint. Air temperature difference measurements will not be acceptable.
 - 2. Air Distribution Test: Main and major branch ducts and individual supply, return and exhaust terminals (VAV terminals, terminal reheat units, diffusers, registers and grilles):
 - a. Design Conditions: Ductwork: CFM, duct size. Air terminals, diffusers, registers, grilles: CFM, module size and inlet size.
 - b. Field Test Results: Ductwork: CFM, duct size, number of velocity readings, average velocity reading. Air terminals, diffusers, registers, grilles: CFM, module size and inlet size.
- D. Prepare report of recommendations for correcting unsatisfactory mechanical performances when system cannot be successfully balanced; including, where necessary, modifications which exceed requirements of contract documents for mechanical work.
- E. Record outdoor air temperature (dry bulb and wet bulb) at the time of testing air handling units, chillers, cooling towers, boilers and any other equipment where performance is affected by outdoor air conditions.
- F. Report shall include results of piping and ductwork tests indicated in paragraphs 3.03 and 3.04 of this section.

3.3 TESTS - PIPING

- A. Sanitary and Storm Water Piping Systems:
 - 1. All soil, waste, vent and storm water piping shall be tested by the Contractor and reviewed by the Architect before acceptance. All piping located underground shall be tested before backfilling. The costs of all equipment required for tests are to be included under the contract price.
 - 2. The entire new drainage system and venting system shall have all necessary openings plugged and filled with water to the level of the highest vent stack above the roof. The system shall hold this water for four (4) hours without showing a drop in water level. Where a portion of the system is to be tested, the test shall be conducted in the same manner as described for the entire system, except a vertical stack 10 feet (3000 mm) above the

highest horizontal line to be tested may be installed and filled with water to maintain sufficient pressure, or a pump may be used to supply the required pressure.

- B. Drain test water from piping systems after testing and repair work has been completed.
- C. Repair piping systems sections which fail required piping test, by disassembly and re-installation, using new materials to extent required to overcome leakage. Do not use chemicals, stop-leak compounds, mastics, or other temporary repair methods.
- D. Contractor shall submit piping leakage test results to the A/E within 72 hours of completed tests. Only test results that meet the specified leakage requirements shall be submitted. Piping test results shall be recorded on the "Piping Leakage Test Summary Form (Hydronic and Air)" and "Piping Leakage Test Summary Form (Plumbing)" located at the end of this section; no other forms will be accepted. In addition, the pipe leakage submittals shall include 11x17 drawing(s) as required to clearly indicate the full extent of the piping test section (each piping test section shall be numbered and color coded).

3.4 TESTS - DUCTWORK

- A. Prior to the balancing of systems by the AABC certified balancing contractor, all high and low pressure systems shall be tested by the mechanical contractor for duct leakage. Duct leakage shall not exceed 1%. In addition, current SMACNA and AABC Standards shall apply, where applicable, to meet the maximum 1% leakage. Duct leakage shall not exceed 1% of design cfm for a duration of ten (10) minutes. Test pressures shall be not less than the following:
 - Ductwork systems less than 2.0 in. wg E.S.P.:
 - (Duct Pressure Class 2): Test to 2 in. wg
 - Ductwork systems between 2.0 in. wg and 5.0 in. wg E.S.P.:
 - (Duct Pressure Class 6): Test to 6 in. wg
 - Ductwork systems greater than 5.0 in. wg E.S.P.:
 - (Duct Pressure Class 10): Test to 10 in. wg
- B. Insulation materials shall not be applied until systems have been witnessed, documented, and submitted to meet the above testing requirements.
- C. The balance contractor shall witness and certify all duct pressure tests.
- D. Contractor shall submit duct leakage test results to the A/E within 72 hours of completed tests. Only test results that meet the specified leakage requirements shall be submitted. Duct test results shall be recorded on the attached "Air Duct Leakage Test Summary Form" at the end of this section; no other forms will be accepted. In addition, the duct leakage submittals shall include 11x17 drawing(s) as required to clearly indicate the full extent of the duct test section (each duct test section shall be numbered and color coded).
- E. All duct leakage test results shall be included with the final TAB report and the O&M manual. The orifice tube calibration chart shall also be included with the final duct leakage test report information.

3.5 TESTS - EQUIPMENT

- A. The contractor shall verify calibration of all indicating, recording, controlling and controlled devices throughout the mechanical system. Verify the proper function of all installed equipment and devices and the interlocking of all new systems as required by the contract documents.
- B. A report including successful calibration and function performance verification of all items indicated above shall be included in the Operations and Maintenance Manual.

3.6 FUNCTIONAL PERFORMANCE TESTING AND VERIFICATION

- A. General: In addition to the tests required during and after installation of all mechanical systems, as well as any other formal commissioning requirements, the Contractor shall perform functional performance tests to verify that all systems are designed, installed, calibrated and adjusted to perform as required in the Contract.

- B. Comply with all applicable specification sections including, but not be limited to, "Basic HVAC Requirements", "Testing, Adjusting and Balancing", "Automatic Temperature Controls" and "Commissioning", where applicable.
- C. Prior to functional performance testing, all indicating, recording and control devices shall be calibrated. A verification calibration report shall be provided with the final test report.
- D. Provide functional performance testing to verify proper operation of each and every control sequence indicated throughout the contract documents.
- E. Failure of Tests: Should any test, verification, or demonstration fail to meet the specification requirements, the component of the system causing the failure shall be repaired, replaced or readjusted. The failed test, verification, or demonstration shall then be repeated.
- F. A "Functional Performance Test Verification Form" is included at the end of Section 230900. This form (electronic version is available upon request) shall be completed for all mechanical equipment provided under this contract. This shall include, but not be limited to each chiller, boiler, air handling unit, fan, pump, VAV terminal, fan coil unit, unit ventilator, DX cooling equipment, miscellaneous heating equipment, etc.
- G. Test Report: Upon satisfactory verification of calibration and functional performance tests, a copy of the final test results shall be bound in the operations and maintenance manual. The final report shall also include a full compliance statement, on company letterhead, indicating that all systems are installed and functioning per the contract requirements including drawings, specifications, control sequences and accepted submittals.
- H. The mechanical systems shall not be considered complete until all functional performance verification forms, calibration reports and compliance statement have been submitted and reviewed. Submit in accordance with the submittal requirements indicated elsewhere in these specifications.

3.7 FINAL TESTS, INSPECTION AND ACCEPTANCE

- A. At time of final inspection, Contractor shall recheck, in presence of Owner's Representative, random selections of data (water and air quantities, air motion, and sound levels) recorded in Certified Report. In addition, courtrooms, auditoriums, and conference rooms shall be rechecked. [Laboratories shall be rechecked for satisfactory air flow and motion in vicinity of and through hoods.]
 - 1. Points and areas for recheck shall be selected by Owner's Representative.
 - 2. Measurement and test procedures shall be same as approved for work forming basis of Certified Report.
 - 3. Selection for recheck (specific plus random), in general, will not exceed 25 percent of total number tabulated in report, except that special air systems may require a complete recheck for safety reasons.
- B. Retests: If random tests elicit a measured flow deviation of 10 percent or more from, or a sound level of 2 db or more, greater than that recorded in Certified Report listings, at 10 percent or more of the rechecked selections, report shall automatically be rejected. In the event the report is rejected, systems shall be readjusted and tested, new data recorded, new Certified Reports submitted, and new inspection tests made, at no additional cost to the Owner.
- C. Marking of Settings: Settings of valves, splitters, dampers, and other adjustment devices shall be permanently marked by the Contractor so that adjustment can be restored if disturbed at any time.

END OF SECTION 23 05 93

AIR DUCT LEAKAGE TEST SUMMARY FORM

Project Name: _____ Project Number: _____ Page __ of __

DESIGN DATA						FIELD TEST DATA RECORD								
Duct Test Section (No./Color)	Air System	Total System CFM	Test Section CFM	Allowable Leakage %	Allowable Leakage CFM	Diameter		Pressure (in. w.g.)		Actual Leakage CFM	Actual Leakage %	Test Result Pass/Fail	Test Performed By (initials)	Test Witnessed By (initials)
						Orifice	Tube	Duct(1)	Across Orifice					
				1.0%										
				1.0%										
				1.0%										
				1.0%										
				1.0%										
				1.0%										
				1.0%										
				1.0%										
				1.0%										
				1.0%										
				1.0%										
				1.0%										
				1.0%										

Testing Performed By: _____
 (Company/Individual Name)

Witnessed/Certified By: _____
 (Company/Individual Name)

(1) Duct test pressure shall be 6.0 in. w.g. for High/Medium Pressure ductwork, or 2.0 in. w.g. for Low Pressure ductwork.

SECTION 23 07 00 - HVAC INSULATION**PART 1 - GENERAL****1.1 DESCRIPTION OF WORK**

- A. Extent of mechanical insulation required by this section is indicated on drawings and schedules, by requirements of this section, and all other Division-23 sections.
- B. Types of mechanical insulation specified in this section include the following:
 - 1. Ductwork System Insulation:
 - a. Fiberglass

1.2 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of mechanical insulation products, of types and sizes required, whose products have been in satisfactory use in similar service for not less than five (5) years.
- B. Installer's Qualifications: Firms with at least five (5) years successful installation experience on projects with mechanical insulations similar to that required for this project. Provide installer's certification by the manufacturer's training program where applicable.
- C. Flame/Smoke Ratings: Provide composite mechanical insulation (insulation, jackets, coverings, sealers, mastics and adhesives) with flame-spread index of 25 or less, and smoke-developed index of 50 or less, as tested by ASTM E 84 (NFPA 255) method.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data and installation instructions for each type of mechanical insulation. Submit schedule showing manufacturer's product number, k-value, thickness, and furnished accessories, and intended use for each mechanical system requiring insulation.
- B. Maintenance Data: Submit maintenance data and replacement material lists for each type of mechanical insulation. Include this data and product data in maintenance manual.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver insulation, coverings, cements, adhesives, and coatings to site in containers with manufacturer's stamp or label, affixed showing fire hazard indexes of products.
- B. Protect insulation against dirt, water, and chemical and mechanical damage. Do not install damaged or wet insulation; remove from project site.

PART 2 - PRODUCTS**2.1 MANUFACTURERS**

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work, shall be limited to the following:
 - 1. Owens Corning
 - 2. Johns Manville
 - 3. Certainteed
 - 4. Armacell
 - 5. Knauf
 - 6. Aeroflex

2.2 DUCTWORK INSULATION MATERIALS (INDOOR)

- A. Rigid Fiberglass Ductwork Insulation: ASTM C 612-00, Type 1A (up to 450°F) (up to 232°C), minimum k-value of 0.27 BTU-in/hr-ft²-deg F at a mean temperature of 75°F (24°C).
- B. Flexible Fiberglass Ductwork Insulation: ASTM C 553, Type I, maximum k-value of 0.27 BTU-in/hr-ft²-deg F or minimum "out of package" R-value of 6.7 at a mean temperature of 75°F. For ductwork in ceiling space directly below roof, provide insulation with maximum k-value of 0.25 and minimum "out of package" R-value of 8.0 (1.5 LBS/FT³ density).
- C. Ductwork Insulation Accessories: Provide bands, wires, tape, anchors, corner angles, and similar accessories as recommended by insulation manufacturer for applications indicated.
- D. Ductwork Insulation Compounds: Provide cements, adhesives, coatings, sealers, protective finishes and similar compounds as recommended by insulation manufacturer for applications indicated.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine areas and conditions under which mechanical insulation is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.
- B. Only install mechanical insulation on systems while not in operation.

3.2 DUCTWORK SYSTEM INSULATION

- A. Insulation Omitted: Do not insulate fibrous glass ductwork, or lined ductwork located inside the building.
- B. Cold Ductwork:
 - 1. Application Requirements: Insulate the following cold ductwork:
 - a. Unconditioned outdoor air intake ductwork between air entrance and fan inlet or HVAC unit inlet.
 - b. HVAC supply air ductwork from air handling unit/fan discharge to diffuser or register, including all duct accessories (sound attenuators, etc.).
 - c. HVAC conditioned outside air ductwork connected to DOAS (dedicated outside air) system from unit discharge to diffuser or register.
 - d. HVAC return ductwork located in ceiling directly adjacent to roof, including all duct accessories (sound attenuators, etc.).
 - e. HVAC exhaust ductwork located in ceiling directly adjacent to 1200E as manufactured by Buckaroos, Inc. or equivalent.

3.3 INSTALLATION OF DUCTWORK INSULATION

- A. General: Install insulation products in accordance with manufacturer's written instructions, and in accordance with recognized industry practices to ensure that insulation serves its intended purpose.
 - 1. Insulation materials shall not be applied until systems have been witnessed, documented, and submitted to meet pressure testing requirements indicated throughout these specifications.
 - 2. Install insulation materials with smooth and even surfaces.
 - 3. Clean and dry ductwork prior to insulating. Butt insulation joints firmly together to ensure complete and tight fit over surfaces to be covered.
 - 4. Maintain integrity of vapor-barrier on ductwork insulation, and protect it to prevent puncture and other damage. Seal all joints with vapor barrier material.
 - 5. Extend ductwork insulation without interruption through walls, floors and similar ductwork penetrations, except where otherwise indicated.

- B. Lined Ductwork: Except as otherwise indicated, omit insulation on ductwork where internal insulation or sound lining has been specified.
- C. Corner Angles: Except for oven and hood exhaust duct insulation, install corner angles on external corners of insulation on ductwork in exposed finished spaces before covering with jacketing.
- D. All balancing damper handles shall be exposed and visible on externally insulated ductwork.

3.4 COORDINATION

- A. Coordinate size and location of supports, hangers, and insulation shields specified in Division-23 Section "Hangers and Supports for HVAC Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application, duct Installer for duct insulation application, and equipment Installer for equipment insulation application. Before preparing piping and ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

3.5 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

3.6 EXISTING INSULATION REPAIR/REPLACEMENT

- A. Repair damaged sections of existing mechanical insulation, either previously damaged or damaged during this construction period. Insulation shall be as specified herein.
- B. Provide new insulation on existing mechanical piping where existing insulation has been removed due to damage, repair or abatement of existing hazardous materials.

3.7 PROTECTION AND REPLACEMENT

- A. Replace damaged insulation which cannot be repaired satisfactorily, including units with vapor barrier damage and moisture saturated units.
- B. Protection: Insulation Installer shall advise Contractor of required protection for insulation work during remainder of construction period, to avoid damage and deterioration.

END OF SECTION 23 07 00

SECTION 23 09 00 - AUTOMATIC CONTROL SYSTEMS (ELECTRIC-ELECTRONIC)**PART 1 - GENERAL****1.1 SUMMARY**

- A. Scope: The extent of automatic controls work is indicated on the drawings and schedules and by the requirements of this Section, and all other Division-23 sections. The work includes, but is not limited to the following:
1. The provision of a complete and operational control system, including all devices necessary to perform the functions herein described or indicated on the drawings.
 2. The provision of 120 and 208 volt line voltage and 5 and 24 volt low voltage wiring and conduit types shall be installed in accordance with Division-26 of these specifications.
 3. The ATC contractor shall furnish and install all electrical wiring and conduit from power source, including termination, to all required ATC related power connections including, but not limited to, DDC controllers (provide low voltage controllers for air terminal units including transformers and disconnect switches as required), sensors, valve and damper actuators (including smoke dampers), air flow monitors, ATC panels, etc. The ATC contractor shall obtain a separate electrical permit as required by the local authority. The ATC contractor shall be wholly responsible for all power requirements necessary for a complete installation from the power source to all ATC related connections. All electrical work shall be installed in accordance with Division-26 of these specifications.
 4. The ATC contractor shall interface with fire alarm devices as required to accomplish equipment shutdown, alarms, etc. indicated in sequences.
 5. The ATC contractor shall coordinate and verify that all controllers, devices, and accessories are provided as required to accomplish all control functions and sequences indicated in the contract documents. Where control related devices are not provided by an equipment manufacturer, it shall be the responsibility of the ATC contractor to provide the control devices required to accomplish the functions and sequences indicated.
 6. All drilling, cutting and patching associated with the installation of control systems.
- B. Types: Provide automatic control systems of the following types:
1. Direct Digital Control (DDC) with electric actuation of valve and damper actuators.
 2. The automatic temperature control system shall include remote interface and web access capability. All building management system control features including, but not limited to, points, alarms, scheduling, graphics, trending, etc. shall be available for control and monitoring through web access as well as remote interface (coordinate exact location with the using agency, where applicable).

1.2 QUALITY ASSURANCE

- A. Systems Engineering: The systems engineering phase shall include the selection and integration of components into a complete system which will meet the performance and prescriptive requirements of the Contract, together with drawings, specifications, descriptions of operation, diagrams and other materials listed under "Submittals" paragraph of this Section.
- B. Testing and Adjusting During and After Installation:
1. The testing and adjusting includes the submission of a test plan which shall describe in detail the method by which each component, subsystem, and system will be tested, calibrated, adjusted, and retested after installation in accordance with the specified sequences of operation and other characteristics of the control system. A report on test results, including set points and operating ranges of all components shall be submitted.
 2. The testing specified in this paragraph shall not replace the testing specified in "Commissioning Tests and Verification" article of this Section.
- C. Commissioning Testing and Verifications: The final phase of the quality assurance program of the project is the commissioning testing and verifications. This phase is to assure that the project

is fully completed and that the systems are performing in accordance to specifications from end to end of the control systems. Demonstrations of the automatic control systems to the commissioning team in accordance to the requirements specified in Part 3 of this Section are required. A report on test results, including set points and operating ranges of all components, shall be submitted.

- D. Testing: The testing phase of quality assurance includes the submission of a test plan which shall describe in detail the method by which each component, subsystem, and system will be tested, calibrated and retested after installation to perform in accordance with the specified sequences of operation and other characteristics of the control system.
- E. Reporting and Demonstration: This phase shall include the submission of a written report describing the "actions taken during the testing" phase, and including the set points and operating ranges of all equipment and a demonstration that the system performs in accordance with contract requirements.
- F. Operating Instructions and Training: This phase of quality assurance includes the training of operating personnel utilizing written operating instructions prepared and approved under the "Submittals" paragraph of this Section, and the mounting of laminated control diagrams where directed.
- G. Maintenance Manuals: This phase includes the submission of four hard bound copies of all manufacturers' cuts, maintenance and operating instructions, test reports and demonstration material, copies of control diagrams, and copies of the manufacturers' certifications.

1.3 SUBMITTALS

- A. Shop Drawings: For each system to be controlled, prepare a drawing which includes a system flow diagram, control diagram, sequence of operation and schedule of components. Control diagrams shall be complete with end-to-end connections of piping and wiring from component terminal.
- B. Manufacturer's Data: For each manufactured device or subsystem submit manufacturers' specifications and printed photograph of the proposed device or subsystem. Include engineering descriptions, principle of operation and application, and proposed model, style or size clearly indicated.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. The automatic temperature controls shall be furnished, installed, commissioned and warranted by one of the following acceptable providers:
 - 1. Johnson Controls, Inc. - Factory Branch Office - Sparks, MD
 - 2. Siemens Building Technologies - Factory Branch Office - Baltimore, MD
 - 3. Honeywell – Factory Branch Office - Baltimore, MD
- B. No distributors, wholesalers or manufacturers' representatives other than those listed above will be acceptable. In addition, manufacturers not listed above will not be acceptable.

2.2 SYSTEMS INTEGRATION

- A. Control Loop Characteristics: Carefully evaluate the characteristics of each control loop, the time constants, equipment characteristics, control accuracy, and reliability and provide a system which will operate smoothly, without hunting, and within the accuracies specified.
- B. System Components: Select components including sensors, transmitters, controllers, control devices, actuators, and instrumentation considering such factors as hysteresis, relaxation time, span, limits, and response time.

2.3 THERMOSTATS

- A. Types: Provide electronic thermostats which operate in an analog proportional or binary two-position mode as required by the sequence of operation.
- B. Mounting: Mount thermostats in non-public spaces except room thermostats.
- C. Electric Analog Thermostats: Provide electric analog thermostat with the following characteristics:
 - 1. Sensor shall be of the bulb or capillary type which shall actuate a 135 ohm 3-wire potentiometer for 0-10 VDC, or 4-20 milliamp proportioning control action of balanced bridge motor actuators.
 - 2. Sensor shall have adjustable setpoint range of not less than 80°F (27°C) throughout the range of 0°F to plus 250°F (-18°C to plus 121°C).
 - 3. Adjustable proportional band ranges from 3°F to 25°F (-16°C to -4°C) and capillary length of not less than 5 feet (1500 mm) shall be provided.

2.4 DAMPERS

- A. Standards: Provide opposed blade and parallel blade factory fabricated dampers of extruded aluminum, galvanized steel or stainless steel with metallic anti-friction non-ferrous bearing in accordance with Sheet Metal and Air Conditioning Contractors' National Association (SMACNA) standards.
- B. Types: Use parallel blade dampers in mixing chambers and plenums. Use opposed blade dampers for volume control, face and bypass dampers, smoke dampers, fan discharge, and variable air volume control.
- C. Pressure Rating: For fan systems less than 10-inch water gauge (2490 Pa) static pressure, design and construct dampers to withstand a pressure of 150 pounds per square foot (7.1 kPa) without damage, leakage, flexure, or distortion.
- D. Leakage: Maximum air leakage rate for all dampers shall not exceed 10 cubic feet of air per minute per square foot (50 L/s/m²) at atmospheric pressure when closed against a 4-inch water gauge (1000 Pa) static pressure.
- E. Operators: Damper operators shall have sufficient power to open and close the dampers and limit the leakage to the specified rate. Power wiring shall be extended to operator by this contractor.
- F. Shafts and Bearings: Provide cadmium plated steel shafts in permanently lubricated bronze sleeve bearings or permanently lubricated ball bearings.
- G. Blade Sizes: Reinforced or ribbed blades shall not exceed 8 inches (200 mm) in width nor 48 inches (1200 mm) in length.
 - 1. Flat or unreinforced blades will not be acceptable.
 - 2. Damper sections exceeding 4 feet (1200 mm) in width or 4 feet (1200 mm) in height shall be constructed with multiple frames and linkages.
- H. Frames: Construct frames of factory welded galvanized steel hot dipped after construction or bolted extruded aluminum frames.
 - 1. Dampers larger than 8 square feet (.7 m²) in area shall have corner bracing gussets at each corner welded to the damper frame.
- I. Linkages: Provide linkages to uniformly transmit damper operating forces to each damper blade.
 - 1. Construct linkages of galvanized or cadmium plated steel or stainless steel.
 - 2. Bearings and joints shall be ball and socket or sleeve bearings of brass, bronze or stainless steel, with plated bolts and locking nuts.
- J. Seals: Provide mechanically attached elastomer or neoprene blade tip seal along the full length of each blade edge and flexible stainless steel seals along damper blade ends where the blades abut the frame. Adhesives or staples will not be acceptable.

- K. Damper Mounting: Mount dampers to casings and ductwork in conformance with SMACNA standards. Provide welded or bolted galvanized steel structural supports for dampers larger than 20 square feet (1.9 m²). Through bolt damper frames to structural supports.

2.5 ELECTRIC ACTUATORS

- A. General: Provide electric motor driven actuators (operators) arranged "Fail Safe" in the event of power failure. Unless indicated otherwise, the fail position of each valve shall be the "last position" or "current position" at the time of failure. Design operators to be quiet in operation and function within a range 85 to 100 percent input power potential.
- B. Electric Actuators: Provide hydraulic or gear type electric actuators.
 - 1. When operated at rated voltage each actuator shall deliver the torque required for continuous uniform movement of the control device from limit to limit.
 - 2. Provide an end switch to limit travel and design the actuator to continuously stroke without damage.
 - 3. Operators shall function properly within a range of 85 to 120 percent of line voltage. For actuators with input power greater than 100 watts, gears shall be ground steel, oil immersed, shaft shall be hardened steel running in bronze, copper alloy or ball bearing and operator and gear trains shall be totally enclosed in dustproof cast iron, cast steel or cast aluminum housing.
 - 4. Actuators with input power less than 100 watts may use fiber or reinforced nylon gears with steel shaft, copper alloy or nylon bearings and pressed steel enclosures.
 - 5. Two position actuators shall be of the single direction, spring return or reversing type.
 - 6. Proportioning operators shall be capable of stopping at all points in the cycle and starting in either direction from any point.
 - 7. Reversing and proportioning operators shall have limit switches to limit travel in either direction.
 - 8. For actuators with greater than 400 watts input, provide totally enclosed reversible induction motors with auxiliary hand crank and permanently lubricated bearings.
 - 9. All valve and damper actuators shall be 24 volt. Use of 120 volt actuators will be considered for selective applications such as: large valves (approximately 8-inch and larger), or line voltage control for unit heaters, cabinet heaters, etc. where acceptable to the using agency. In all cases (24 volt and 120 volt), power for valve and damper actuators shall be provided by the ATC contractor.
- C. Damper Operator Mounting: Mount damper operators where accessible for maintenance.
 - 1. If located outside the duct or casing, mount operators on a 14 gauge (2.0 mm) reinforced support plate arranged to allow insulation between the support plate and the face of the duct or casing.
 - 2. Brace damper operators rigid to show no deflection or movement over the full range of the damper stroke.

2.6 SYSTEM DIAGRAMS

- A. Mounting: Mount control diagrams adjacent to each local control panel on a furniture steel extension either bolted to wall or to an extension of the control cabinet structural support.
 - 1. Control diagrams shall include system one-line diagram, system control diagram, sequence of operations, and schedule of control devices.
 - 2. Diagrams shall be hermetically sealed in laminated 16 gauge (1.6 mm) plastic.
 - 3. Diagrams shall be permanent, black on white background, not subject to fading when subjected to artificial or natural light. Diazo prints are not acceptable.
 - 4. Diagrams shall represent the current, "as-built" status of the control system, after acceptance by the representative of the Owner.
 - 5. Obsolete, out of date, or field modified diagrams shall be removed, and new current diagrams furnished.

6. Diagrams and devices on local control panels shall be identified with engraved phenolic nameplates, white on black, minimum 1/4-inch (6 mm) high block capital lettering, screwed or bolted to panel or mounting plate face. Adhesive attachments are not acceptable.

2.7 WIRING

- A. General: Provide a complete system of electric wiring for temperature control apparatus including control power transformers and wiring to the transformer primary.
- B. All wiring shall be installed in conduit. Refer to Division-26 section, "Raceways." MC cable is prohibited in all locations.
- C. Wiring: Wire for low voltage AC shall be minimum 300 volt insulated copper No. 18 AWG or larger conforming to NFPA 70, Type MTW, THHN or TFFN, installed in accordance with Division-26 of these specifications.
 1. For low voltage DC and an electronic circuit carrying less than 0.5 amperes, cables of two or more conductors not smaller than No. 18 AWG solid copper or No. 18 AWG solid copper if not shielded may be used in lieu of individual wires.
 2. Cables carrying analog signals shall be shielded, if required by the manufacturer.
 3. Cables shall be terminated in solder or screw type terminal strips.
 4. Cables shall not be tapped at any intermediate points.
 5. All wire shall be color coded or numbered for identification. Identify as indicated on shop drawings and "as-built" drawings.
 6. Wire terminating in screw type terminal strips shall have pressure connectors conforming to UL 486A, "Wire Connectors and Soldering Lugs for Use with Copper Conductors," or UL 486B, "Wire Connectors for Use with Aluminum Conductors."
 7. Wire terminations without connectors or traveling pressure pads will not be accepted.
- D. The contractor shall in no case combine control wiring (line or low voltage) with power wiring in the same conduit.

2.8 CARBON MONOXIDE (CO) AND NITROGEN DIOXIDE (NO₂) SENSORS

- A. Description: CO and NO₂ detection devices shall be tied to the purge exhaust system.
- B. Provide CO and NO₂ combination sensor model AG04 in AGPE metal enclosure by Veris or approved equal.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Wiring and Conduit: Provide wiring and conduit to connect the automatic control system components for an operational system.
 1. Provide wiring in accordance with requirements indicated in this section.
 2. Run conduit in straight lines, parallel to the lines of the building, and rack on factory furnished mounting blocks attached to the building structure. Where run buried in slabs provide long sweep rigid conduit bends extending 6 inches (150 mm) above the slab at slab penetrations.
 3. Do not bury or conceal wiring beneath building insulation.
 4. Locate wiring clear of access doors, accessible ceilings, lighting fixtures, walkways, or any location subject to damage or abrasion.
- B. Identification: Label or code each field wire at each end, and each controller and controlled device.
 1. Identification shall be permanent, robust, not subject to fading, and flameproof.
 2. Permanently mark terminal blocks at wire termination points.
 3. Identify each control device with an engraved laminated phenolic nameplate, white on black, lettering not less than 1/8-inch (3 mm) height, on 1-1/2-inch (40 mm) by 1-inch (25 mm) tag and brass interlocked chain secured to the control device. Name shall correspond with identification on the shop drawings.

4. Identify sensors, controllers, relays, either mounted in local or central control panels, or remote mounted with a similar name tag as specified above. Attach to or adjacent to controllers with stainless steel or brass screws or rivets. Adhesives will not be acceptable. Do not attach to removable controller covers.
- C. Space Sensors: Install space sensors as follows.
1. Space sensor including space thermostats, aspirating thermostats, humidistats, pressure or differential pressure sensors shall be enclosed in cast brushed aluminum or 16 gauge (1.6 mm) brushed and ground stainless steel enclosures. Enclosures shall be tamperproof. Setpoint adjustment or settings shall not be visible or adjustable from outside sensor enclosure. Sensors shall be securely mounted and rigid.
 2. Locate room thermostats and other room sensors approximately 48 inches (1200 mm) above the floor (or otherwise as required to meet the most current ADA guidelines) on inside wall where they will respond to average conditions in the space.
 3. Sensors mounted on outside walls, if unavoidable, shall be mounted on factory made insulated brushed stainless steel bases.
 4. Provide thermostat/sensor guards in all areas subject to potential damage. Thermostat/sensor guards shall be clear, impact resistant lockable plastic or approved equivalent. Thermostat/sensor guards shall be provided in the following areas and other similar type spaces subject to potential damage: gymnasium, multi-purpose rooms, fitness areas, activity rooms, mechanical rooms, electrical rooms, etc.
- D. For single phase motors, provide relays and/or contactors of appropriate horsepower and voltage rating as required to energize/de-energize equipment as indicated in sequences.

3.2 TEST PLAN

- A. Test Plan: Prepare a written test plan indicating in a step-by-step, logical fashion, the procedures by which the automatic control system will be tested, adjusted, and checked.
- B. Pre-Approval: Not less than six (6) weeks prior to testing, provide four (4) copies of the proposed test plan for approval. Meet and discuss the test plan, and make agreed changes to the written plan.
- C. Content: Plan shall include, as a minimum, for each system and sub-system of the automatic control work the following:
1. System name.
 2. List of devices with brief description of functional purpose of each.
 3. A description of the expected signal values transmitted by the sensor.
 4. A description of the expected signal values transmitted by the controller to the control device or actuator.
 5. A description of the expected values of the control medium from limit-to-limit.
 6. A description of the instrumentation required to test the system.
 7. A description of the expected field adjustments for transmitter, controller, and control actuator should control parameters fall outside of expected values.
 8. A log sheet or sheets on which expected and field read values will be recorded and final field read values indicating that the system is operating in accordance with contract requirements.

3.3 TESTS DURING AND AFTER INSTALLATION

- A. Instrumentation and Control: Calibration test each controller as follows:
1. Disconnect the sensor input signal to the controller and provide a compatible test signal generator.
 2. Simulate expected transmitter values and input to the controller. Record controller branch line values.
 3. Examine control device and determine that the device is responding.
 4. Simulate maximum and minimum transmitter signal values and verify minimum and maximum controller output values and control device minimum and maximum stroke range.

5. Record all values and recalibrate controller as necessary to conform with specified control ramps, reset schedule, proportional relationship, reset relationship, and derivative reaction.
6. When the controller and control device portion of each loop are responding as designed, reconnect the sensor transmitter input line.
7. After mechanical equipment control becomes operational, perform an operational test of each control loop recording sensor, transmitter, controller input, controller output and control medium parameter.
8. Entire test shall be witnessed by an owner's representative.
9. Upon satisfactory test a copy of final test results shall be bound in the operating and maintenance manual.

3.4 FUNCTIONAL PERFORMANCE TESTING AND VERIFICATION

- A. General: In addition to the tests required during and after installation of all mechanical systems, as well as any other formal commissioning requirements, the Contractor shall perform functional performance tests to verify that all systems are designed, installed, calibrated and adjusted to perform as required in the Contract.
- B. Comply with all applicable specification sections including, but not be limited to, "Basic HVAC Requirements", "Testing, Adjusting and Balancing", "Automatic Temperature Controls" and "Commissioning", where applicable.
- C. Prior to functional performance testing, all indicating, recording and control devices shall be calibrated. A calibration verification report shall be provided with the final test report.
- D. Provide functional performance testing to verify proper operation of each and every control sequence indicated throughout the contract documents.
- E. Failure of Tests: Should any test, verification, or demonstration fail to meet the specification requirements, the component of the system causing the failure shall be repaired, replaced or readjusted. The failed test, verification, or demonstration shall then be repeated.
- F. A "Functional Performance Test Verification Form" is included at the end of this section. This form (electronic version is available upon request) shall be completed for all mechanical equipment provided under this contract. This shall include, but not be limited to each chiller, boiler, air handling unit, fan, pump, VAV terminal, fan coil unit, unit ventilator, DX cooling equipment, miscellaneous heating equipment, etc.
- G. Test Report: Upon satisfactory verification of calibration and functional performance tests, a copy of the final test results shall be bound in the operations and maintenance manual. The final report shall also include a full compliance statement, on company letterhead, indicating that all systems are installed and functioning per the contract requirements including drawings, specifications, control sequences and accepted submittals.
- H. The mechanical systems shall not be considered complete until all functional performance verification forms, calibration reports and compliance statement have been submitted and reviewed. Submit in accordance with the submittal requirements indicated elsewhere in these specifications.

END OF SECTION 23 09 00

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FUNCTIONAL PERFORMANCE TEST VERIFICATION FORM

Project _____

Name: _____

FUNCTIONAL VERIFICATION FOR: _____ (Insert Equipment Name, i.e. Chiller, Boiler, AHU, Fan, Pump, VAV, etc.)							
SEQUENCE OF OPERATION		Controlling Specified (Y/N)	as	ATC Initials	Technician	Date	Notes
	(Insert complete sequence of operation as indicated in approved ATC submittal)						
	Example: Air Handling Unit Control						
	1. General:						
	1.1 Supply and return fans shall be interlocked. Fans shall operate continuously in the occupied mode. HOA switch shall be in the AUTO position.						
	1.2 Occupied-Unoccupied shall be as determined by the EMCS.						
	2. Temperature Control:						
	2.1 Occupied						
	A. When the outside air enthalpy is above the return air enthalpy, D-1, D-2 and D-3 shall modulate as follows:						

Page _____

SECTION 23 31 13 - LOW PRESSURE DUCTWORK**PART 1 - GENERAL****1.1 DESCRIPTION OF WORK**

- A. Extent of low pressure ductwork is indicated on drawings and in schedules, and by requirements of this section and all other Division-23 sections. Low pressure duct systems shall be defined as those duct systems which have an external static pressure (E.S.P.) of less than two-inches (2") water gauge (wg) (500 Pa). See schedules on drawings for external static pressure information.
- B. Types of low pressure ductwork which may be required for this project include the following:
 - 1. Outdoor air ductwork (conditioned or unconditioned)
 - 2. Exhaust ductwork
- C. Pressure Classification:
 - 1. All ductwork provided under this section shall be "Duct Pressure Class 2" as defined by SMACNA Standards.
- D. Duct Leakage Classification:
 - 1. All ductwork provided under this section shall be "Leakage Class 2", or better as required to meet maximum duct leakage requirements indicated in this section.

1.2 QUALITY ASSURANCE

- A. Installer: A firm with a minimum of five (5) years of successful installation experience on projects with low pressure ductwork systems similar to that required for project.
- B. SMACNA Standards: Comply with latest edition of SMACNA Standards for fabrication, storage and installation of low pressure ductwork. In addition, all new ductwork shall comply with SMACNA's "Duct Cleanliness for New Construction Guidelines." The "Duct Cleanliness Level" for all ductwork shall meet the requirements of the "Advanced Level."
- C. ASHRAE Standards: Comply with ASHRAE Standards for fabrication and installation of low pressure ductwork.
- D. NFPA Compliance: Comply with ANSI/NFPA 90A "Standard for the Installation of Air-Conditioning and Ventilating Systems" and ANSI/NFPA 90B "Standard for the Installation of Warm Air Heating and Air-Conditioning Systems."
- E. Field Reference Manual: Have available at project field office, copy of SMACNA Standards - latest edition.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's specifications on manufactured products used for work of this section.
- B. Shop Drawings: Submit dimensioned layouts of ductwork showing both the accurately scaled ductwork and its relation to space enclosure as required by Division-23 Section, "Basic HVAC Requirements". Show modifications of indicated requirements, made to conform to local shop practice, and how those modifications ensure that free area, materials, and rigidity are not reduced.
- C. Record Drawings: At project closeout, submit record drawings of installed ductwork, duct accessories, and outlets and inlets.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Protect shop-fabricated ductwork, accessories and purchased products from damage during shipping, storage and handling. Prevent end damage and prevent dirt and moisture from entering ducts and fittings.
- B. All ductwork shall be shipped to the site with covered ends. The ductwork shall be covered with 3-mil (minimum) shrink wrap, with a minimum 2-inch overlap on all sides, to provide a water-tight seal at each opening. The covered ends shall remain intact until installation.
- C. Store ductwork, accessories and purchased products inside and protect from weather.
- D. Ductwork fittings and accessories stored on site for installation shall be covered with protective tarps and elevated a minimum of four inches until installed.
- E. Provide periodic (weekly) photographs of the jobsite storage to document that the ductwork is stored in accordance with the criteria outlined in this specification section.
- F. Lined ductwork not stored in accordance with the above criteria shall be replaced in its entirety. Unlined ductwork not stored in accordance with the above criteria shall be cleaned and inspected by the Owner's representative prior to installation. Contractor shall clean unlined ductwork to the satisfaction of the Owner, or replace at the Owner's discretion.

PART 2 - PRODUCTS

2.1 DUCTWORK MATERIALS

- A. Exposed Ductwork Materials: Where ductwork is indicated to be exposed to view in occupied spaces, provide materials which are free from visual imperfections including pitting, seam marks, roller marks, oil canning, stains and discolorations, and other imperfections, including those which would impair painting. Provide interior lining or double wall duct as indicated on the drawings and/or these specifications.
- B. Sheet Metal: Except as otherwise indicated, fabricate ductwork from galvanized sheet steel complying with ANSI/ASTM A 527, lockforming quality, with ANSI/ASTM A 525, G90 zinc coating.
- C. Stainless Steel Sheet: Where indicated (S/S), provide stainless steel complying with ANSI/ASTM A 167; AISI Type 302/304/316 with No. 4 directional polish where exposed to view in occupied spaces. Protect finished surfaces with mill-applied adhesive protective paper, maintained through fabrication and installation.
- D. Aluminum Sheet: Where indicated (Al-), provide aluminum complying with ANSI/ASTM B 209, Alloy 3003, Temper H14.
- E. Copper Sheet: Where indicated (Cp-), provide copper complying with ANSI/ASTM B 370 cold-rolled, except where soft temper required for unusual forming.

2.2 MISCELLANEOUS DUCTWORK MATERIALS

- A. General: Provide miscellaneous materials and products of types and sizes indicated. Provide type and size required to comply with ductwork system requirements including proper connection of ductwork and equipment.
- B. Duct Liner: Minimum one inch (25 mm) thick (unless otherwise noted) fiberglass, minimum R-value of 4.2 (k-value 0.24 or better), complying with ASTM C 1071, ASTM G 21, ASTM G 22, NFPA 90A, NFPA 90B and UL 181. Duct lining shall contain an EPA registered antimicrobial agent which resists the growth of bacteria and fungi as proven by tests in accordance with ASTM G21 and G22. Liner noise reduction coefficient (NRC) shall be 0.70 or better. Surface of liner shall have water repellent properties. Duct liner shall be Johns Manville Linacoustic RC or equivalent by Certainteed, Knauf or Owens Corning.
- C. Duct Liner: Liner shall be one inch (25 mm) thick flexible, elastomeric, closed-cell, thermal insulation. The liner and adhesive assembly shall comply with NFPA 90A, 90B and UL 181. Liner shall not support microbial growth in accordance with ASTM C1071, ASTM G21 (fungal) and

ASTM G22 (bacterial). Flame spread rating shall be 25 or less and smoke developed rating shall be 50 or less. Liner shall be approved by Factory Mutual Research and shall be AP Armaflex SA, AP Coilflex (rectangular duct), or AP Spiralflex (circular duct) as manufactured by Armacell or equivalent.

- D. Duct Liner Adhesive: Comply with Adhesive and Sealant Council, Inc. (ASC) and ASTM C916.
- E. Duct Liner Fasteners: Comply with SMACNA Standards. Fasteners shall not compress liner by more than 1/8".
- F. Duct Sealant: Non-hardening, non-migrating, oil based mastic or liquid elastic sealant (type applicable for fabrication and installation) as compounded and recommended by manufacturer specifically for sealing joints and seams in ductwork. Sealant shall be solvent (oil) based, water based or silicone based as follows:
 - 1. Solvent (oil) based sealant shall be used for indoor applications on all new construction installations. In addition, for indoor renovation projects, solvent (oil) based sealant shall be included in the contractor's bid and utilized wherever the sealant odor is not objectionable to the owner. Contractor shall coordinate with the owner's representative prior to the duct installation.
 - 2. Water based sealant shall be utilized for indoor renovation applications where the odor from solvent (oil) based sealant is objectionable to the owner. Contractor shall coordinate with the owner's representative prior to the duct installation.
 - 3. Silicone based solvent shall be utilized for all outdoor duct installation applications.
 - 4. Regardless of duct sealant type, maximum duct leakage requirements outlined in these Division-23 specifications shall be maintained.
- G. Duct Cement: Non-hardening migrating mastic or liquid neoprene based cement (type applicable for fabrication/installation detail) as compounded and recommended by manufacturer specifically for cementing fitting components, or longitudinal seams in ductwork.
- H. Ductwork Support Materials: Except as otherwise indicated, provide hot-dipped galvanized steel fasteners, anchors, rods, straps, trim and angles for support of ductwork.
 - 1. Except where space is indicated as "High Humidity" area, interior support materials of not less than 1/4" (6 mm) diameter or 3/16" (4.8 mm) thickness may be plain (not galvanized).
 - 2. For exposed stainless steel ductwork, provide matching stainless steel support materials.
 - 3. For copper ductwork, provide copper, bronze or brass support materials.
 - 4. For aluminum ductwork, provide aluminum support materials except where materials are electrolytically separated from ductwork.

2.3 FABRICATION

- A. Shop fabricate ductwork in 4 (1200 mm), 8 (2400 mm), 10 (3000 mm) or 12-foot (3600 mm) lengths, unless otherwise indicated or required to complete runs. Pre-assemble work in shop to greatest extent possible, so as to minimize field assembly of systems. Disassemble systems only to extent necessary for shipping and handling. Match-mark sections for reassembly and coordinated installation.
- B. Shop fabricate ductwork of gauges and reinforcement complying with SMACNA Standards - latest edition.
- C. Shop fabricate ductwork of gauges and reinforcement complying with ASHRAE Standards.
- D. Fabricate duct fittings to match adjoining ducts, and to comply with duct requirements as applicable to fittings. Except as otherwise indicated, fabricate elbows with center-line radius equal to one and one-half times the associated duct width; and fabricate to include turning vanes in elbows where shorter radius is necessary. Limit angular tapers to 30 degrees for contracting tapers and 20 degrees for expanding tapers.
- E. Fabricate ductwork with accessories installed during fabrication to the greatest extent possible. Refer to Division-23 section "Ductwork Accessories" for accessory requirements.

- F. Fabricate ductwork with duct liner in each section of duct where indicated. Laminate liner to internal surfaces of duct in accordance with instructions by manufacturers of lining and adhesive, and fasten with mechanical fasteners.
- G. Low pressure rectangular ductwork, fittings, etc., shall be constructed, installed and supported in accordance with current SMACNA Standards of gauges not less than the following:

<u>Maximum Side</u>	<u>Minimum Gauge</u>
Up to 12" (Up to 300 mm)	26 (.5 mm)
13" to 30" (325 mm to 750 mm)	24 (.7 mm)
31" to 60" (775 mm to 1500 mm)	22 (.8 mm)
61" to 84" (1525 mm to 2100 mm)	20 (1.0 mm)
Over 84" (Over 2100 mm)	18 (1.3 mm)

- H. All factory or shop fabricated ductwork shall be constructed as required to meet the testing requirements indicated in this section and Division-23 section "Testing, Adjusting and Balancing."

2.4 FRESH AIR INTAKE PLENUMS

- A. Fresh air intake plenums shall be double wall construction (minimum 18 gauge exterior wall, 20 gauge interior wall) with 2" (50 mm) thick, three pound density insulation.

PART 3 - EXECUTION

3.1 INSTALLATION OF DUCTWORK

- A. General: Assemble, install, support and seal ductwork in accordance with recognized industry practices which will achieve air tight (not to exceed 1% leakage) and noiseless (no objectionable noise) systems, capable of performing each indicated service. Install each run with minimum of joints. Align ductwork accurately at connections, within 1/8" (3 mm) misalignment tolerance and with internal surfaces smooth. Support ducts rigidly with suitable ties, braces, hangers and anchors of type which will hold ducts true-to-shape and to prevent buckling.
- B. Seal ductwork to SMACNA Standard Seal Class "A" and provide additional sealant as required to meet duct test requirements of this section.
- C. Install concrete inserts as required, for support of ductwork in coordination with formwork, as required to avoid delays in work.
- D. Complete fabrication of work at project as necessary to match shop-fabricated work and accommodate installation requirements.
- E. Locate ductwork runs, except as otherwise indicated, vertically and horizontally and avoid diagonal runs wherever possible. Locate runs as indicated by diagrams, details and notations or, if not otherwise indicated, run ductwork in shortest route which does not obstruct usable space or block access for servicing building and its equipment. Hold ducts close to walls, overhead construction, columns, and other structural and permanent-enclosure elements of building. Limit clearance to 1/2" (13 mm) where furring is shown for enclosure or concealment of ducts, but allow for insulation thickness, if any. Where possible, locate insulated ductwork for 1" (25 mm) clearance outside of insulation. Wherever possible in finished and occupied spaces, conceal ductwork from view, by locating in mechanical shafts, hollow wall construction or above suspended ceilings. Do not encase horizontal runs in solid partitions, except as specifically shown. Coordinate layout with suspended ceiling and lighting layouts and similar finished work.
- F. Electrical Equipment Spaces: Do not run ductwork through transformer vaults and their electrical equipment spaces and enclosures.
- G. Where ducts pass through interior partitions and exterior walls, conceal space between construction opening and duct or duct-plus-insulation with sheet metal flanges of same gauge as duct. Overlap opening on four (4) sides by at least 1-1/2" (40 mm).
- H. Coordinate duct installations with installation of accessories, dampers, coil frames, equipment, controls and other associated work of ductwork system.

- I. Support ductwork in manner complying with SMACNA Standards - latest edition of hangers and supports section.
- J. Where vapors will be exhausted (dishwasher, cart wash, tunnel wash, canopy hood over sterilizers, etc.), ductwork shall be sloped back toward the source of moisture.
- K. All exposed ductwork (in non-mechanical rooms) shall be primed and painted with paint appropriate for sheet metal surfaces. See architectural section "Painting".
- L. Provide gasketed duct access doors as required to provide maintainable access to the upstream side of coils, humidifiers, etc.

3.2 INSTALLATION OF LINED DUCTWORK

- A. Provide lined ductwork at the following locations, and as otherwise indicated:
 - 1. All ductwork (supply, return, conditioned outside air, DOAS/ERU exhaust return) within the Mechanical Room.
 - 2. All ductwork within 25 feet upstream and downstream of air handling equipment (in all directions, including all duct branches and mains within 25 feet of equipment), including return air fans, with the exception of unconditioned outdoor air intake ductwork.
 - 3. Supply air ductwork downstream of air terminals.
 - 4. All air transfer ductwork, unless otherwise indicated.
- B. Dimensions on drawings indicate inside clear dimensions.
- C. Fiberglass liner exposed to the air stream shall not be utilized for outdoor air intake ductwork.
- D. Where ductwork is exposed to view in occupied areas, rectangular ductwork shall be lined and round ductwork shall be double wall duct with internal lining, unless otherwise noted.

3.3 CLEANING AND PROTECTION

- A. Prior to installation, thoroughly clean ductwork internally of dust and debris. Clean external surfaces of foreign substances which might cause corrosive deterioration of metal or might interfere with painting or cause paint deterioration.
- B. Strip protective paper from stainless steel ductwork surfaces, and repair finish wherever it has been damaged.
- C. Temporary Closure: At ends of ducts which are not connected to equipment or air distribution devices at time of ductwork installation, install sheet metal temporary closures which will prevent entrance of dust and debris until the time all connections are to be completed.
- D. Provide MERV 13 filter media at all return air inlet locations throughout the duration of construction. Filter media shall not be removed until final filters are installed in the air handling units.

3.4 DUCT TESTING

- A. Prior to the balancing of systems by the AABC certified balancing contractor, all low pressure ductwork shall be tested by the mechanical contractor for duct leakage. Duct leakage shall not exceed 1%. In addition, current SMACNA and AABC Standards shall apply, where applicable, to meet the maximum 1% leakage. Duct leakage shall not exceed 1% of design cfm for a duration of ten (10) minutes. Test pressures shall be not less than the following:
 - 1. Ductwork systems less than 2.0 in. wg E.S.P.: Test to 2 in. wg
- B. Insulation materials shall not be applied until systems have been witnessed, documented, and submitted to meet the above testing requirements.
- C. The balance contractor shall witness and certify all duct pressure tests.
- D. Contractor shall submit duct leakage test results to the A/E within 72 hours of completed tests. Only test results that meet the specified leakage requirements shall be submitted. Duct test results shall be recorded on the "Air Duct Leakage Test Summary Form" located at the end of

Section 230593; no other forms will be accepted. In addition, the duct leakage submittals shall include 11x17 drawing(s) as required to clearly indicate the full extent of the duct test section (each duct test section shall be numbered and color coded).

- E. All duct leakage test results shall be included with the final TAB report and the O&M Manual. The orifice tube calibration chart shall also be included with the final duct leakage test report information.

3.5 BALANCING

- A. Refer to Division-23 section "Testing, Adjusting and Balancing" for air distribution balancing of low pressure ductwork; not work of this section.

END OF SECTION 23 31 13

SECTION 23 33 00 - DUCTWORK ACCESSORIES**PART 1 - GENERAL****1.1 DESCRIPTION OF WORK**

- A. Extent of ductwork accessories work is indicated on drawings and in schedules, and by requirements of this section and all other Division-23 sections.
- B. Types of ductwork accessories required for project include the following:
 - 1. Dampers:
 - a. Control dampers
 - 2. Duct hardware
 - 3. Duct access doors
 - 4. Flexible connections
 - 5. Penetration seals
- C. Duct Cleaning: Each of the following HVAC systems listed shall be cleaned and sanitized in their entirety:
 - 1. All existing supply ductwork
 - 2. All existing return ductwork
 - 3. All existing exhaust ductwork and fans
 - 4. All existing air handling units and associated fans

1.2 QUALITY ASSURANCE

- A. Codes and Standards:
 - 1. SMACNA Compliance: Comply with applicable portions of latest edition of SMACNA Standards. In addition, all duct accessories shall comply with SMACNA's "Duct Cleanliness for New Construction Guidelines." The "Duct Cleanliness Level" for all ductwork shall meet the requirements of the "Advanced Level."
 - 2. Industry Standards: Comply with ASHRAE recommendations pertaining to construction of ductwork accessories, except as otherwise indicated.
 - 3. UL Compliance: Construct, test, and label fire, smoke and combination fire/smoke dampers in accordance with UL Standards 555 and 555S.
 - 4. NFPA Compliance: Comply with applicable provisions of NFPA 90A "Air Conditioning and Ventilating Systems", pertaining to installation of ductwork accessories.
- B. Duct Cleaning Contractor:
 - 1. Duct cleaning contractor shall have been regularly engaged in commercial type duct cleaning services for a minimum of five (5) years of successful operation.
 - 2. NADCA Certified: The duct cleaning contractor shall be certified by the National Air Duct Cleaners Association (NADCA).

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data for each type of ductwork accessory, including dimensions, capacities, materials of construction and installation instructions.
- B. Shop Drawings: Submit manufacturer's assembly-type shop drawings for each type of ductwork accessory showing interfacing requirements with ductwork, method of fastening or support, and methods of assembly of components.
- C. Maintenance Data: Submit manufacturer's maintenance data including parts lists for each type of duct accessory. Include this data, product data, and shop drawings in maintenance manual.
- D. Duct cleaning contractor shall submit proposed approach, methodology and detailed cleaning and sanitizing process for each system listed above for approval prior to work being performed.

In addition, provide documentation of NADCA certification, as well as five (5) years of successful performance.

PART 2 - PRODUCTS

2.1 DAMPERS

- A. Control Dampers: Refer to Division-23 section "Automatic Control Systems" for control dampers; not work of this section.

2.2 DUCT HARDWARE

- A. General: Provide duct hardware, manufactured by one manufacturer for all items on project, for the following:
 - 1. Test Holes: Provide duct test holes in ductwork at fan inlet and outlet, and elsewhere as indicated, consisting of slot and cover, for instrument tests.
 - 2. Quadrant Locks: Provide for each damper, quadrant lock device on one end of shaft; and end bearing plate on other end for damper lengths over 12" (300 mm). Provide extended quadrant locks and end extended bearing plates for externally insulated ductwork.

2.3 DUCT ACCESS DOORS

- A. General: Provide duct access doors where required for duct accessory access. Provide access doors for fire dampers, smoke dampers and smoke detectors. Install access doors upstream of duct type smoke detectors.
- B. Construction: Construct of same or greater gage as ductwork served and provide insulated doors for insulated ductwork. Provide flush frames for uninsulated ductwork and extended frames for externally insulated duct. Provide one side hinged, other side with one handle-type latch for doors 12" (300 mm) high and smaller, 2 handle-type latches for larger doors.

2.4 FLEXIBLE CONNECTIONS

- A. General: Provide flexible duct connections wherever ductwork connects to vibration isolated equipment. Construct flexible connections of neoprene-coated flame retardant fabric crimped into duct flanges for attachment to duct and equipment. Make airtight joint. Provide adequate joint flexibility to allow for thermal, axial, transverse, and torsional movement, and also capable of absorbing vibrations of connected equipment.

2.5 PENETRATION SEALS

- A. Provide seals for all openings through fire-rated walls, floors or ceilings used as passage for mechanical components such as ductwork. See Division-23 section "Basic HVAC Materials and Methods" for penetration seals and firestopping requirements.
- B. Provide seals for all openings through walls, floors or ceilings used as passage for mechanical components such as ductwork.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine areas and conditions under which ductwork accessories will be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF DUCTWORK ACCESSORIES

- A. Install ductwork accessories in accordance with manufacturer's installation instructions, with applicable portions of details of construction as shown in SMACNA standards, and in accordance with recognized industry practices to ensure that products serve intended function.

- B. Install balancing dampers where indicated, and at each ducted air inlet and outlet. Dampers are not required where a single air outlet occurs downstream of an air terminal (VAVs, fan powered boxes, etc.).
- C. Install turning vanes in square or rectangular elbows (45 degrees and greater) in supply, return and exhaust air systems, and elsewhere as indicated.
- D. Install airtight access doors to open against system air pressure, with latches operable from either side, except outside only where duct is too small for person to enter. Duct access panels shall be adequately sized to provide access to all fire and/or smoke damper fusible links.
- E. All electrical connections to smoke damper actuators and smoke detectors (duct or ceiling mounted) shall be provided by the ATC contractor.
- F. Coordinate with other work, including ductwork, as necessary to interface installation of ductwork accessories properly with other work.

3.3 DUCT CLEANING

- A. Prior to cleaning or sanitizing ductwork/equipment, all equipment utilized to perform those processes shall be sanitized. Examine ductwork/equipment prior to performing work and provide new duct openings where required to provide visual inspection of the duct interior.
- B. Unless indicated otherwise, the systems shall be cleaned and sanitized in the following order:
 - 1. Exhaust systems
- C. Duct cleaning of the above systems listed shall include air devices, terminal reheat units, etc.
- D. Cleaning Process:
 - 1. General:
 - a. Systems shall be de-energized while duct cleaning and sanitizing are in progress.
 - b. HEPA filter vacuums shall be used to keep room air clean. Ceiling tile shall be handled with care, and repaired or replaced as required to restore to the original condition.
 - 2. Air Handler Cleaning Procedures:
 - a. Vacuum completely, beginning with the area upstream of the filters. Filters shall be replaced at the completion of the work.
 - b. Vacuum the fan and fan chamber.
 - c. Wash/degrease fan blades as required.
 - d. Wash/degrease chamber upstream of the coils as required.
 - e. Clean coils.
 - f. Sanitize.
 - 3. Coil Cleaning Procedure: The procedure shall be customized to the situation encountered. The most heavily soiled coils may take a more complicated procedure of solution/pressure spraying. Most require only low pressure application of special cleaning solution and rinsing after they are first fully vacuumed.
 - 4. Furniture Coverage from Incidental Dirt: As required, drape surrounding instruments, computers and areas with plastic to protect them from any incidental dirt generated during the cleaning process. Work environment shall be clean at all times. Floor shall be vacuumed as needed.
 - 5. Duct Cleaning: Cleaning shall be accomplished by mechanical means in conjunction with the use of High CFM HEPA style vacuums and three (3) filtered canister vacuums. Mechanical means may include vacuum brushing of the duct interior, auger style mechanical devices, or high pressure air activated in duct cleaning devices to scrape off any dirt adhered to duct walls. Cleaning may be accomplished by a combination of these methods. Where possible, clean a full run or section before beginning another to insure full cleaning coverage. All material in the vacuum shall be disposed of daily after being treated with a sanitizer.

6. Sanitizing Process: Sanitizing shall be accomplished in two stages. First, it shall be done as each section of the air system is cleaned. The sanitization process shall be repeated again after the complete system has been cleaned. All sanitizing shall be completed before access is sealed. Diffusers shall be cleaned and sanitized. EPA recognized/registered sanitizers only shall be used. MSDS information shall be supplied for materials selected. Sanitizers/encapsulants shall not be used as a substitute for proper cleaning.
7. Clean Tests: Tests for bacteria/fungi shall be performed after all cleaning and sanitizing is completed to insure the clean standards have been met. This shall be done while the system is in operation and shall be a minimum of forty-eight (48) hours after the last sanitation has been completed.
8. Closing and Sealing: Provide galvanized sheet metal plate(s) to be used as access for the majority of locations. Square cut 22 gauge metal shall be used with each plate to lap its edges by one inch all around. Screws shall be placed at four inch (100 mm) intervals and the plate shall be sealed with a water-based fireproof sealant to ensure proper seal of the system to match existing pressure classification.
9. Encapsulation: There may be times when it is necessary to use an encapsulant on interior lined duct. It should be used only if circumstances require it (for example, the lining may be breaking down), and shall be agreed to in advance by the client. It shall not be used as a substitute for cleaning.
10. Duct cleaning shall be performed by Applied Building Technologies, Inc. or equivalent.

3.4 FIELD QUALITY CONTROL

- A. Operate installed duct accessories to demonstrate compliance with requirements. Test for air leakage while system is operating. Repair or replace faulty accessories, as required to obtain proper operation and leakproof performance.

3.5 ADJUSTING AND CLEANING

- A. Adjusting: Adjust ductwork accessories for proper settings, install fusible links in fire dampers and adjust for proper operation.
 1. Final positioning of manual dampers is specified in Division-23 section "Testing, Adjusting and Balancing."
- B. Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.
- C. Provide MERV 13 filter media at all return air inlet locations throughout the duration of construction. Filter media shall not be removed until final filters are installed in the air handling units.

END OF SECTION 23 33 00

SECTION 23 34 00 - FANS**PART 1 - GENERAL****1.1 DESCRIPTION OF WORK**

- A. Extent of fan work required by this section is indicated on drawings and schedules, and by requirements of this section and all other Division 23 sections.
- B. Types of fans required for project include the following:
 - 1. Inline Centrifugal Fans
- C. Refer to the requirements of Division-26.

1.2 QUALITY ASSURANCE

- A. Codes and Standards:
 - 1. AMCA Compliance: Provide fans bearing the AMCA Certified Ratings Seal. Sound rate fans in accordance with AMCA 300 "Test Code for Sound Rating Air Moving Devices".
 - 2. ASHRAE Compliance: Test and rate fans in accordance with ASHRAE 51 (AMCA 210) "Laboratory Methods of Testing Fans for Rating".
 - 3. UL Compliance: Provide fans electrical components which have been listed and labeled by UL.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data for fans, including specifications, capacity ratings, fan performance curves with operating point clearly indicated, gages and finishes of materials, dimensions, weights, accessories furnished, and installation instructions.
- B. Shop Drawings: Submit assembly-type shop drawings showing fan dimensions, required clearances, construction details, and field connection details.
- C. Wiring Diagrams: Submit manufacturer's electrical requirements for power supply wiring to fan units. Submit manufacturer's ladder-type wiring diagrams for interlock and control wiring. Clearly differentiate between portions of wiring that are factory-installed and portions to be field-installed.
- D. Maintenance Data: Submit maintenance instructions, including lubrication instructions, motor and drive replacement, and spare parts lists. Include this data, product data, shop drawings, and wiring diagrams in maintenance manuals.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Deliver fans with factory-installed shipping skids and lifting lugs; pack components in factory-fabricated protective containers.
- B. Handle fans carefully to avoid damage to components, enclosures, and finish. Do not install damaged components; replace and return damaged components to fans manufacturer.
- C. Store fans in clean dry place and protect from weather and construction traffic.
- D. Comply with manufacturer's rigging and installation instructions for fans, and moving them to final location.

PART 2 - PRODUCTS**2.1 INLINE CENTRIFUGAL FANS**

- A. Fans shall be inline fans with non-overloading backwardly inclined wheels.

- B. Wheel diameters shall be in accordance with the standard sizes adopted by AMCA for non-overloading fans. Wheels shall be all aluminum construction with extra wide backwardly blades for maximum efficiency and quiet operation.
 - C. Bearings shall be "Air Handling Quality Bearings" with an L10-200,000 hour rating based on the maximum allowable speed range of the fan.
 - D. Fan housings shall be of heavy gauge galvanized steel, suitably braced to prevent vibration and pulsation. Fans with 27" (675 mm) and larger wheels shall be provided with recessed unpunched flanges on inlet and discharge. All fans shall be equipped with support brackets suitable for horizontal, vertical and all-angle mounting. Integral adjustable motor mount shall be provided in location as indicated on the drawings.
 - E. The fan shafts shall be designed so that first critical speed is a minimum of 1.4 times the maximum allowable fan speed. Shafts shall be of solid hot-rolled steel accurately turned, ground, polished and ring gauges for accuracy.
 - F. Fans shall be provided with adjustable pitch V-belt drive and OSHA belt guard. Fans shall be designed for straight-through airflow, with fan bearings, fan and motor sheaves, belts, and motor completely isolated from the airstream and exterior to the fan housing, to facilitate inspection and maintenance. Fans shall be provided with bolted access door for wheel inspection and cleaning.
 - G. Fan wheel shall be statically and dynamically balanced, and the complete fan assembly shall be balanced at design operating speed prior to shipment.
 - H. All fans shall be licensed to bear the AMCA Certified Ratings Seal. Performance curves shall be submitted for approval, and include static pressure, brake horsepower, and static efficiency plotted against air volume. Sound Power Levels by Octave Bands, based on AMCA Standard 300, shall be submitted for approval. Fan sound power levels shall not exceed those listed on the drawings.
 - I. Fan shall be Twin City model SSI or equivalent.
- 2.2 MOTORS (TYPICAL FOR ALL FANS)
- A. See Division-23 section, "Electrical Provisions for HVAC Equipment" for minimum motor efficiencies and other requirements.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine areas and conditions under which fans are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 INSTALLATION OF FANS

- A. General: Install fans where indicated, in accordance with manufacturer's installation instructions, and with recognized industry practices, to ensure that fans comply with requirements and serve intended purposes.
- B. Access: Provide access and service space around and over fans as indicated, but in no case less than that recommended by manufacturer.
- C. Support: Provide 4" (100 mm) high concrete pad under floor-mounted fans.
- D. Isolation: Set fans on vibration isolators, fasten in accordance with manufacturer's installation instructions.
- E. Electrical Wiring: Install electrical devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer's wiring diagram submittal to Electrical Installer.

1. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division-26 sections. Ensure that rotation is in direction indicated and intended for proper performance. Do not proceed with centrifugal fan start-up until wiring installation is acceptable to fan Installer.
 - F. Ductwork Connections: Refer to Division-23 ductwork sections. Provide flexible connections on inlet and outlet duct connections.
- 3.3 FIELD QUALITY CONTROL
- A. Upon completion of installation of fans, and after motor has been energized with normal power source, test equipment to demonstrate compliance with requirements. Where possible, field correct malfunctioning equipment, then retest to demonstrate compliance. Replace equipment which cannot be satisfactorily corrected.
- 3.4 ADJUSTING AND BALANCING
- A. Start-up, test, and adjust centrifugal fans in presence of manufacturer's authorized representative.
- 3.5 SPARE PARTS
- A. General: Furnish to Owner, with receipt, one spare set of belts for each belt driven centrifugal fan.

END OF SECTION 23 34 00

SECTION 23 82 00 - HEATING AND COOLING TERMINAL UNITS**PART 1 - GENERAL****1.1 DESCRIPTION OF WORK**

- A. Extent of terminal unit work is indicated by drawings and schedules, and by requirements of this section and all other Division-23 sections.
- B. Types of terminal units required for project include the following:
 - 1. Electric Unit heaters
- C. Refer to requirements of Division-26.

1.2 QUALITY ASSURANCE

- A. Codes and Standards:
 - 1. I=B=R Compliance: Test and rate finned tube radiation in accordance with I=B=R, provide published ratings bearing emblem of I=B=R.
 - 2. ARI Compliance: Provide coil ratings in accordance with ARI Standard 410 "Forced Circulation Air-Cooling and Air-Heating Coils".
 - 3. ASHRAE Compliance: Test coils in accordance with ASHRAE Standard 33 "Methods of Testing Forced Circulation Air Cooling and Heating Coils".
 - 4. ARI Compliance: Test and rate fan coil units in accordance with ARI Standard 440 "Room Fan Coil Air-Conditioners".
 - 5. UL Compliance: Construct and install fan coil units in compliance with UL 883 "Safety Standards for Fan Coil Units and Room Fan Heater Units".
 - 6. ARI Compliance: Test and rate unit ventilators in accordance with ARI Standard 330 "Unit Ventilators".
 - 7. UL Compliance: Provide electrical components for terminal units which have been listed and labeled by UL.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's specifications for terminal units showing dimensions, capacities, ratings, performance characteristics, gages and finishes of materials, and installation instructions.
- B. Shop Drawings: Submit assembly-type shop drawings showing unit dimensions, construction details, and field connection details.
- C. Wiring Diagrams: Submit manufacturer's electrical requirements for power supply wiring to terminal units. Submit manufacturer's ladder-type wiring diagrams for interlock and control wiring. Clearly differentiate between portions of wiring that are factory installed and portions to be field-installed.
- D. Maintenance Data: Submit maintenance instructions, including lubrication instructions, filter replacement, motor and drive replacement, and spare parts lists. Include this data, product data, and shop drawings in maintenance manuals.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Handle terminal units and components carefully to prevent damage, breaking, denting and scoring. Do not install damaged terminal units or components; replace with new.
- B. Store terminal units and components in clean dry place. Protect from weather, dirt, fumes, water, construction debris, and physical damage.
- C. Comply with Manufacturer's rigging and installation instructions for unloading terminal units, and moving them to final location.

PART 2 - PRODUCTS

2.1 ELECTRIC UNIT HEATERS

- A. General: Provide unit heaters where indicated, of sizes and capacities as scheduled. All units shall be UL listed.
- B. Cabinets: The cabinet shall be constructed from 18 gauge (1.3 mm) die formed, furniture grade steel.
 - 1. Individually adjustable louvers with 30 degree downward stops shall be furnished.
 - 2. All metal surfaces of the casing shall be phosphate coated to resist corrosion and finished with baked enamel.
 - 3. Provide mounting brackets as required.
- C. Elements: The electric heating bank shall consist of metal sheath heating elements. The elements shall have a copper clad steel sheath and aluminum fins.
- D. Motors and Fans: Explosion proof motors shall be provided. Motors shall be totally enclosed, continuous heavy duty all-angle operation, equipped with built-in thermal overload protection. Fans shall be aluminum, directly connected to fan motor, designed specifically for unit heater application.
- E. Controls: Automatic reset thermal overload protector shall be of the linear capillary type, wired for instantaneous de-energizing in case of thermal overload.
 - 1. Fans shall be complete with delay feature to eliminate cold draft. Element shall heat-up before fan energizes, then fan continues to distribute heat after element shuts off.
 - 2. Provide a low voltage control transformer for remote wall mounted thermostat and summer fan switch.
 - 3. Unit Mounted Temperature Sensor

PART 3 - EXECUTION

3.1 INSPECTION

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

3.2 INSTALLATION OF UNIT HEATERS

- A. General: Install unit heaters as indicated, and in accordance with manufacturer's installation instructions.
- B. Uncrate units and inspect for damage. Verify that nameplate data corresponds with unit designation.
- C. Hang units from building substrate, not from piping. Mount as high as possible to maintain greatest headroom possible unless otherwise indicated.
- D. Support units with rod-type hangers anchored to building substrate.
- E. Protect units with protective covers during balance of construction.

3.3 ELECTRICAL WIRING

- A. General: Install electrical devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer's wiring diagram submittal to Electrical Installer.
 - 1. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division-26 sections. Do not proceed with equipment start-up until wiring installation is acceptable to equipment installer.

3.4 ADJUSTING AND CLEANING

- A. General: After construction is completed, including painting, clean unit exposed surfaces, vacuum clean terminal coils and inside of cabinets.
- B. Retouch any marred or scratched surfaces of factory-finished cabinets, using finish materials furnished by manufacturer.

END OF SECTION 23 82 00

SECTION 26 01 00 - BASIC ELECTRICAL MATERIALS AND METHODS**PART 1 - GENERAL****1.1 CONTRACT DOCUMENTS**

- A. Unless otherwise modified, provisions of General Conditions, Supplementary Conditions and Division-01 govern work under the Electrical Divisions.
- B. The drawings and specifications shall be followed in layout of work.
- C. The Architectural drawings shall be used for all dimensional information. Do not scale from the Electrical drawings.
- D. Contract Document Interpretation/Discrepancies:
 - 1. Should the Contractor discover any discrepancies or omissions on the drawings or in the specifications, he shall notify the Architect/Engineer (A/E) of such conditions prior to the bid date. Otherwise, it will be understood that the drawings and specifications are clear as to what is intended and shall be as interpreted by the A/E.
 - 2. In addition, should any contradiction, ambiguity, inconsistency, discrepancy or conflict appear in or between any of the Contract Documents, the Contractor, shall, before proceeding with the work in question, notify the A/E and request an interpretation. In no case shall he proceed with the affected work until advised by the A/E.
 - 3. If the Contractor fails to make a request for interpretation of discrepancies or conflicts in the drawings or specifications, no excuse will be accepted for failure to carry out the work in a satisfactory manner, as interpreted by the A/E. In all cases, the Contractor will be deemed to have estimated the most stringent materials and methods (i.e. the highest quality materials and most expensive manner of completing the work) unless he has requested and obtained written authorization as to which methods or materials will be required.
 - 4. Each and every trade or subcontractor will be deemed to have familiarized himself with all drawings of this project, including Site/Civil, Architectural, Structural, Mechanical, Electrical, Information Technology, etc. so as to avoid coordination errors, omissions, and misinterpretations. No additional compensation will be authorized for alleged errors, omissions, and misinterpretation, whether they are a result of failure to observe these requirements or not.
- E. The complete set of Architectural, Structural, Civil, Mechanical, and Electrical drawings, specifications, and addenda apply to this work.

1.2 DESCRIPTION

- A. Unless otherwise modified in other Sections, or on the contract drawings, which define the scope and arrangement of the electrical work to be provided, the applicable provisions of these General Requirements shall govern the furnishing of all supervision, labor, equipment, tools, services, and materials necessary to install a complete electrical system ready for continuous and successful operation. The work shall include, but not be limited to, the furnishing and installation of the following items, as applicable:
 - 1. Electrical services, including metering facilities, meeting the requirements of and in coordination with the local electric power company. Refer to the latest edition of the local power company manuals for service details.
 - 2. Power and lighting panelboards, and all required overcurrent devices.
 - 3. Power feeders, branch circuit wiring and disconnect switches for mechanical equipment.
 - 4. Motor starters, including those provided by Division 23.
 - 5. Lighting and receptacle feeders and branch circuit wiring.
 - 6. Lighting fixtures with lamps.
 - 7. Exit and emergency lighting.
 - 8. Fire alarm system.

9. Telephone services and associated systems, including raceways and outlets, meeting the requirements of and in coordination with the local telephone company.
- B. Provide seals for all openings through smoke and fire-rated walls, floors, or ceilings used as passage for electrical conduits, cables, and cable trays per the smoke and fire stopping requirements in this section. This applies to both new and existing penetrations.

1.3 PERMITS, INSPECTION AND CERTIFICATION

- A. Permits: Refer to the General Conditions of the Contract.
- B. Inspections:
 1. Refer to the latest edition of the local power company manuals for service inspection requirements.
 2. See submittal requirements section of this specification section for additional work related to the inspection documentation needed for all underground work.
- C. Certifications:
 1. Certificates of final inspection and approval required by agencies or authorities having jurisdiction shall cover all electrical work.
 2. All certificates of final inspection and approval shall be delivered to the Engineer prior to final acceptance of the electrical work.

1.4 CODES, STANDARDS AND REFERENCES

- A. The electrical work covered under the specifications and drawings shall be performed in strict accordance with the latest adopted edition of the following codes and standards:
 1. National Electrical Code (NEC), NFPA 70
 2. Applicable codes and standards of the National Fire Protection Association (NFPA)
 3. National Electrical Safety Code, ANSI C2
 4. International Building Code (IBC)
 5. International Energy Conservation Code (IECC)
 6. American with Disabilities Act (ADA)
 7. All authorities having jurisdiction
- B. The work covered under the specifications and drawings shall be performed using the following references as minimum standards for construction and testing:
 1. American National Standard Institute (ANSI)
 2. National Electrical Manufacturers' Association (NEMA)
 3. Underwriter's Laboratories (UL)
 4. The Occupational Safety and Health Act (OSHA)
 5. InterNational Electrical Testing Association (NETA)
 6. Applicable standards of the utility company and the telephone company
 7. American Society of Testing Materials (ASTM)
 8. Institute of Electrical and Electronic Engineers (IEEE)
 9. Illuminating Engineering Society (IES)
 10. Insulated Cable Engineers Association (ICEA)
 11. Lightning Protection Institute (LPI)
- C. Electrical construction materials shall, where a listing is normal for the particular class of material, be listed in "Electrical Construction Material List" of the Underwriter's Laboratories, Inc. (UL) and shall bear the listing label. Electrical equipment shall, where a listing is normal for the particular class of equipment, be listed in the "Electrical Appliance and Utilization Equipment List" of the Underwriter's Laboratories, Inc. (UL) and shall bear the listing label. Materials and equipment listed and labeled as "approved for the purpose" by a Nationally Recognized Testing Laboratory (NRTL), inspection agency or approved organization shall be acceptable.

1.5 CLARIFICATION OF DRAWINGS

- A. Should a bidder find discrepancies in or omissions from the drawings or specifications, or should he be in doubt in regard to their intent, the Contractor shall notify the Engineer before submitting bid proposal. The Engineer shall then send written instructions to all bidders.

1.6 SUBMITTALS, REVIEW AND ACCEPTANCE

- A. Complete shop drawings and material lists shall be submitted by the Contractor for review by the Engineer in accordance with the requirements of the GENERAL PROVISIONS. Equipment and materials for which shop drawings are not submitted shall be provided as specified, and other manufacturers and products will not be allowed. No work shall be fabricated or ordered by the Contractor until approval has been given by the Engineer.
- B. Complete shop drawings showing dimensions, materials, arrangements, and other pertinent data shall be submitted.
- C. Complete lists of materials and equipment shall be submitted. Full description catalog or other data shall be submitted.
- D. Shop drawings and material lists shall be submitted for, but not limited to the following:
 - 1. Conduit
 - 2. Wire
 - 3. Boxes, Fittings, and Wire Troughs
 - 4. Cabinets
 - 5. Wiring Devices
 - 6. Panelboards
 - 7. Safety Switches
 - 8. Low Voltage Fuses
 - 9. Enclosed Circuit Breakers
 - 10. Lighting Fixtures and Components
 - 11. Lighting Control Equipment
 - 12. Surface Metal Raceways
 - 13. Motor Starters
 - 14. Emergency Lighting Equipment
 - 15. As elsewhere indicated on the drawings or in the specifications.
- E. Submit a photographic record of all underground installations, captured prior to concealment. Present adequate quantity and perspectives to convey the entire installation and its compliance with the contract drawings and specifications. Failure to submit a meaningful record may result in a further requirement to excavate portions for review and inspection, at the request of the owner or A/E team, at no additional cost.
- F. Submittals shall include but not be limited to the following information: Size, type, functional characteristics, compliance with standards, required service access which shall be suitable for intended location and use, electrical service connections and requirements, and deviations from Contract Document requirements.
- G. 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.
- H. Submit shop drawings and/or diagrams for all specially fabricated items, modifications to standard items, specially designed systems where detailed design is not shown on the contract drawings or where the proposed installation differs from that shown on the contract drawings.
- I. Submittals shall include Riser Diagrams and Schematic Wiring Diagrams, complete conduit and wire requirements, outlet and junction box sizes and power requirements, for the following systems:
 - 1. Grounding Systems
 - 2. Fire Alarm Systems

3. As indicated elsewhere on the drawings or specifications.
- J. Submit 1/4" (6 mm) or 1/2" (13 mm) scale plans showing layout of equipment in electrical and communication equipment rooms and closets, elevator machine rooms, etc., indicating sizes of equipment, dimensions, clearances, etc. based on equipment being installed.
- K. Prepare and stamp each submittal in a form indicating that the documents have been contractor reviewed, are complete and are in compliance with the requirements of these contract drawings and specifications.
- L. In general, catalog cuts, specification sheets, descriptive data, etc., shall be acceptable for submittal of all equipment specified by standard catalog numbers, unless otherwise noted in the construction documents.
- M. Shop drawings shall be clearly legible; poor reproductions or reduced photographic copies that are not legible shall be rejected.
- N. Before submission of shop drawings the Contractor shall carefully check same for proper capacity, operating characteristics, physical arrangement accessories, etc., as specified or noted on drawings. If shop drawings are submitted and indicate little or no prior checking by the Contractor, they shall be rejected.
- O. Review Period: BKM shall be allotted two (2) weeks for the processing, review and return of all submittals. It shall be incumbent upon the Contractor to include this time period in their schedule.
1. Resubmittals: BKM shall be allotted an additional two weeks (14 days) for the review of each resubmittal. Again, it shall be the Contractor's responsibility to submit the appropriate materials in a timely fashion.
 2. Contract Extension: No extension in contract time will be authorized as a result of the timeline addressed above.
- P. Submittal Identifications:
1. Place a permanent label or title block on each submittal for identification.
 2. Indicate name of firm or entity that prepared each submittal on label or title block.
 3. Provide a space approximately 4 by 5 inches on label or beside title block to record contractor's review and approval markings and action taken by A/E.
 4. Include the following information on label for processing and recording action taken:
 - a. Project name
 - b. Date
 - c. Name and address of A/E
 - d. Name and address of contractor
 - e. Name and address of subcontractor
 - f. Name and address of supplier
 - g. Name of manufacturer
 - h. Unique identifier, including revision number
 - i. Number and title of appropriate specification section
 - j. Drawing number and detail references, as appropriate
 - k. Other necessary identification
 - l. Example: 262416-01-0
 - 1) 262416 references the spec section
 - 2) 01 indicates this is the first submittal from this spec section
 - 3) 0 indicates this is the original submittal (where 1 would indicate this is the first re-submittal)
- Q. Submittals not in compliance with the requirements of this section will be returned without review.
- R. Submittals will be checked only for general conformance with the design concept and are subject to the original contract documents, as well as any corrections and comments noted. Comments noted, if any, will not be considered a complete list of all omissions, deviations and corrections necessary to meet the requirements of the contract documents. The contractor will be responsible to confirm that the final product and installation will be in conformance with the contract

documents in their entirety, including the responsibility to fully coordinate all work with other trades and to confirm the correctness of dimensions, quantities, and capacities. Submittal review does not authorize or constitute a change to the contract requirements and does not release the contractor of responsibility to conform to the contract requirements. Requirements of the contract are not waived by review of any and all substitutions. The contractor must fulfill the terms of the contract.

- S. Where material or equipment is identified by proprietary name, model number and/or manufacturer, furnish the named item, or equivalent, subject to acceptance. Suitability of only the named item has been verified. Where more than one item is named, only the first named item has been verified as suitable.
- T. Substituted items or items other than first named shall be equal or better in quality and performance and must be suitable for the available space, required arrangement, application and clearances. Submit any and all data necessary to determine the suitability of substituted items. Substitutions must be submitted for consideration seven (7) days prior to the original bid date. Consideration of substitutions shall be at the sole discretion of the Engineer. Substitution submittals shall include all information required in the "Submittals" sub-section of this specification section, as well as all other requirements indicated throughout the Division-26 specifications. All changes incurred as a result of a substitution shall be provided at no additional cost to the Owner.
- U. Substitutions will not be permitted for specific items of material or equipment where specifically noted.
- V. Compliance Review Form: Each equipment submittal must include a Compliance Review Form formatted as follows:
 - 1. Section 1: Certify that the submittal is in complete compliance with the plans and specifications, except for the numbered and footnoted deviations and exceptions as defined herein. Deviations or exceptions taken in a cover letter or by contradiction or omission shall not constitute a release from the requirement that the equipment be in complete compliance with the plans and specifications.
 - 2. Section 2: Provide a detailed paragraph by paragraph annotation of the specification with an individual "C", "D", or "E" noted in the margin, as follows:
 - a. "C" shall mean compliance with no exceptions. Provide a numbered footnote (i.e. C1, C2, C3, etc.) for each comment or clarification.
 - b. "D" shall mean compliance with deviations. For each deviation, provide a numbered footnote (i.e. D1, D2, D3, etc.) with a detailed explanation of how the intent of this specification is to be satisfied.
 - c. "E" shall mean exception. The equipment offered is not in compliance with the specifications. For each exception, provide a numbered footnote (i.e. E1, E2, E3, etc.) with a detailed description of the exception.
- W. Electronic Submittals: Should the contractor elect to submit electronic shop drawings/submittals, the procedure shall be as follows:
 - 1. Provide a transmittal with the electronic shop drawing/submittal indicating that the document was transmitted electronically. Transmittal shall also include verification of the contractor's review indicating compliance with the contract documents.
 - 2. Sequentially number all pages on the electronic shop drawing/submittal. The total number of pages shall be reflected in the transmittal.
 - 3. Submittal review comments shall be transmitted electronically. Large documents will be scanned with comments as necessary and returned electronically.
 - 4. All shop drawings such as, but not limited to: coordination drawings, ductwork shop drawings, fire alarm drawings, ductbank layouts, etc. shall be submitted in hard copy, full size format.
 - 5. Provide hard copy of the shop drawing/submittal for each of the Operations and Maintenance Manuals.
 - 6. Failure to comply with the above will result in the submittal being returned and marked "Not Reviewed".

- X. The engineer will provide a maximum of two (2) submittal reviews per equipment submittal; the initial review plus one (1) re-submittal. Should the re-submittal be returned "Not Acceptable" or "Revise and Resubmit", the contractor shall choose one of the following courses of action:
1. Provide the exact manufacturer and model indicated in the contract documents as the basis of design, or
 2. Reimburse the engineer for all additional review time required to achieve a submittal review from the engineer of "No Exceptions Taken."
 3. Should the contractor choose option 2 above, the engineer shall be reimbursed at an hourly rate of \$175 per hour with payment due prior to the return of the final submittal. In addition, the contractor shall accept complete responsibility for all delays resulting from the submittal review process extending beyond two (2) reviews per equipment submittal.
- Y. Resubmittals: Resubmittals shall comply with paragraph 1.06 of this section and the following additional requirements.
1. Resubmittals shall include a written response to each submittal comment. Provide a detailed comment by comment annotation of the submittal review comments with an individual "C", "D", or "E" as follows:
 - a. "C" shall mean compliance with no exceptions. Provide a numbered footnote (i.e. C1, C2, C3, etc.) for each comment or clarification.
 - b. "D" shall mean compliance with deviations. For each deviation, provide a numbered footnote (i.e. D1, D2, D3, etc.) with a detailed explanation of how the intent of this specification is to be satisfied.
 - c. "E" shall mean exception. The equipment offered is not in compliance with the specifications. For each exception, provide a numbered footnote (i.e. E1, E2, E3, etc.) with a detailed description of the exception.

1.7 RECORD DOCUMENTS

- A. The Contractor shall maintain a record set of electrical prints at the project site and shall indicate thereon any changes made to the contract drawings, including, but not limited to addenda, field sketches, RFI responses, supplemental drawings, sketches, etc. Where changes are made that are reflective of supplemental instructions, revisions, RFI responses, etc., the Contractor shall make clear references to those changes.
- B. A separate set of neat, legible electrical contract prints shall be kept at the project site at all times during the construction of the work for the express purpose of showing any and all changes indicated in paragraph A. above. The prints shall be marked up daily showing all changes to the original documents. The prints shall be marked up in a neat, legible manner using a red pen. Periodic review of the Record Documents will be conducted by the Owner's Representative or A/E. Should this review indicate that the Record Documents are deficient or not up to date, the Contractor shall immediately bring the documents into compliance and make the corrections.
- C. Upon completion of the project and before final close-out, the Contractor shall be responsible for producing a final set of record documents in electronic AutoCad or Revit format. One (1) set of full size prints, one (1) CD of the electronic CADD drawings (in AutoCad or Revit and pdf format), along with the red-lined marked up field set shall be delivered to the owner upon completion. If requested, the electronic AutoCad or Revit documents shall be up-loaded to the owner's FTP site. The final AutoCad or Revit documents shall indicate in the title or revision block "RECORD DOCUMENTS" along with the date completed. The electronic format shall be compatible with the owner's preferred version of AutoCad or Revit. Coordinate with the owner before producing the CD or up-loading to the FTP site. Not acceptable are contractor installation drawings, shop drawings or multi-layers of work on a single drawing. The final as-built product shall mirror the contract bid documents using the project page layout, format and project title block.
- D. Electronic files (AutoCad or Revit) of mechanical, electrical and plumbing (MEP) drawings may be made available upon receipt of a signed copy of the Engineer's Electronic Document Disclaimer (available upon request). The electronic files shall not be utilized for the preparation of coordination/installation/fabrication shop drawings. Coordination/installation/fabrication shop

drawings shall be created independently from the electronic MEP files (i.e. AutoCad drawings and/or Revit model). Please note: the electronic MEP Revit model (where applicable) was created at a level of detail similar to BIM LOD 300; however, some MEP elements were modified to provide clarity and legibility to the two-dimensional construction documents. In addition, the electronic files may include delegated design elements that may differ as a result of the final delegated design to be completed by the Contractor (this may include all disciplines including architectural, structural, etc.). Modifications of the MEP systems to accommodate those delegated design elements shall be provided by the Contractor at no additional cost to the Owner.

- E. Should the Contractor's electronic Record Documents not be considered complete, they will be returned for completion and/or correction.

1.8 OPERATING INSTRUCTIONS AND MAINTENANCE MANUALS

- A. Upon completion of all work, the Contractor shall thoroughly instruct the Owner's representatives in the proper operation and maintenance of all electrical equipment and systems. Instructions shall be done only after completed systems have been put into operation and tested for proper operation and performance. Instructions shall be given only by experts in the equipment or systems and shall include descriptions and demonstrations for procedures of operation, data record keeping, etc.
- B. The Contractor shall demonstrate, by actual usage, the proper operation of each and all portions of the various systems to the Owner or his appointed representative. Additional instructional periods shall be provided as required elsewhere in these specifications.
- C. Following completion of the Electrical Contract and prior to the instructional period and final acceptance of the contract, the Contractor shall prepare three (3) Operating and Maintenance Manuals describing the electrical systems and equipment. Data in the manuals shall include, but not be limited to, the following:
 - 1. Test results for all testing conducted in accordance with Division-26 Section, "Inspections, Testing and Start-up".
 - 2. List of materials and equipment with name and address of vendor.
 - 3. List of lamps, fuses (style and ampere rating), overload heaters, and other expendable equipment and devices with type, size or ordering description with name and address of vendor.
 - 4. Operating, maintenance, and installation instructions for all systems and components with name and address of vendor and servicing supplier.
 - 5. A certificate of approval from the Electrical Inspector.
 - 6. A final copy of the approved coordination study.
 - 7. Final copies of shop drawings and submittals.
 - 8. Manufacturer's guarantees and warranties.
- D. Manuals shall be of the loose leaf type, in heavy duty binders, with a master index and dividers with plastic tabs indicating system and equipment described.

1.9 RISER PLAQUE

- A. Provide a computer generated riser diagram, 24" x 36" (600 mm x 900 mm) (nominal), of the completed distribution system showing incoming services, switchboard, feeders, transformers, panelboards and related equipment. All feeders and circuits shall be sized and all equipment identified. Drawing shall be framed with plexiglass overlay.

1.10 GUARANTEE

- A. Guarantee obligations shall be as hereinbefore specified in the GENERAL PROVISIONS of these specifications, except as follows:
 - 1. Guarantee the complete electrical system free from all mechanical and electrical defects for a period of two (2) years beginning from the day of final acceptance of the work or beneficial occupancy by the Owner, whichever occurs first.

2. During the guarantee period, the Contractor shall be responsible for the proper adjustments of all systems, equipment and apparatus installed by him and do work necessary to insure efficient and proper functioning of the systems and equipment.
3. Upon receipt of notice from the Owner of failure of any part of the electrical installation during the guarantee period, new replacement parts shall be furnished and installed promptly at no cost.
4. Within the two (2) year warranty/guarantee period, manufacturer's recommended maintenance shall be provided by the Contractor.

1.11 DEFINITIONS

A. The following definitions apply to firestopping:

1. Assembly: Particular arrangement of materials specific to given type of construction described or detailed in referenced documents.
2. Barriers: Time rated fire walls, smoke barrier walls, time rated ceiling/floor assemblies and structural floors.
3. Firestopping: Methods and materials applied in penetrations and unprotected openings to limit spread of heat, fire, gases and smoke.
4. Penetration: Opening or foreign material passing through or into barrier or structural floor such that full thickness of rated materials is not obtained.
5. Construction Gaps: Gaps between adjacent sections of walls, exterior walls, at wall tops between top of wall and ceiling, and structural floors or roof decks; and gaps between adjacent sections of structural floors.
6. System: Specific products and applications classified and numbered by Underwriters Laboratories, Inc. to close specific barrier penetrations.
7. Sleeve: Metal fabrication or pipe section extending through thickness of barrier and used to permanently guard penetration. Sleeves are described as part of penetrating system in other sections and may or may not be required.

PART 2 - PRODUCTS

2.1 MATERIAL AND EQUIPMENT

- A. All materials and equipment shall be new, the best of their respective kinds and suitable for the conditions and duties imposed on them. Replacement parts shall be available. A permanent service organization maintained or trained by the manufacturer shall be available for service.
- B. The Contractor shall set-in place and connect all electrical equipment furnished under Division-26 and all other Divisions of the Contract.
- C. Verify exact electrical service requirements for each piece of equipment receiving electrical connections. Provide proper service for each.
- D. Include any and all items required by the National Electrical Code and field conditions for the proper connection and installation of each piece of equipment.
- E. Products of one manufacturer shall be used where two or more items of the same kind are required.

2.2 EQUIPMENT DEVIATIONS

- A. The Contractor shall be governed by the requirements of the GENERAL PROVISIONS of these specifications. After an item has been approved, no substitution will be permitted except where such substitution is considered by the Engineer to be in the best interest of the Owner.
- B. The Contractor shall notify the Engineer of any changes in electrical characteristics of equipment being installed as opposed to that specified.
- C. Where the Contractor proposes to use an item of equipment other than that specified or detailed on the drawings, which requires any redesign of the structure, partitions, foundations, piping, ductwork, wiring, or any other part of the mechanical, electrical, or architectural layout, all such

redesign, and all new drawings, and detailing required shall, with the approval of the Engineer, be prepared by the Contractor at the Contractor's own expense.

- D. Where such approved deviation requires a different quantity and arrangement of ductwork, piping, wiring, conduit, and equipment from that specified or indicated on the drawings, with the approval of the Engineer, the Contractor shall furnish and install such ductwork, piping, structural supports, insulation, controllers, motors, starters, electrical wiring and conduit, and any other additional equipment required by the system, at no additional cost to the Owner.

2.3 FIRESTOPPING

- A. All penetrations through fire barriers shall be firestopped with an approved material that is capable of maintaining the fire resistance rating of the barrier. All firestop sealants shall conform to ASTM E 814, ASTM E 119, UL 1479, UL 2079 CAN/ULC S115, and CAN/ULC S101.
- B. Firestop material shall be latex based, intumescent caulk intended for use for all thru-penetrations with piping, ducts, cable trays, conduit, and cables. \
- C. When exposed to high temperatures or fires, the caulk shall expand in volume to quickly close off voids left by melting or burning construction materials. Caulk shall be applied by a standard caulk gun and remain flexible after curing.
- D. Acceptable products shall be limited to Johns Manville "Firetemp-C1;" Hilti "FS-One;" or 3M "CP25WB+." Coordinate with General Contractor such that a single manufacturer/product is utilized throughout the project for all fire and smoke stopping materials.

2.4 SMOKE STOPPING

- A. All penetrations through smoke barriers, smoke partitions, or any other surface required to resist the passage of smoke shall be provided with a smoke stop sealant and/or system that has been independently tested to provide an acceptable smoke seal that will resist the passage of smoke. Smoke stop systems (including product and installation) shall conform to all applicable standards (including but not limited to ASTM, UL and NFPA), as well as all other local, state or federal requirements.
- B. Acceptable manufacturers shall be limited to the manufacturers that may provide firestopping materials/systems (see paragraph 2.03 of this section). Coordinate with the General Contractor such that a single manufacturer/product is utilized throughout the project for all fire and smoke stopping materials.

PART 3 - EXECUTION

3.1 SUPERVISION AND COORDINATION

- A. The Contractor shall have competent supervision on the site at all times to layout, check, coordinate and supervise the installation of all electrical work and be responsible for the accuracy thereof. He shall plan the installation of all electrical work, giving consideration to the work of other trades, to prevent interference.
- B. Determine the location, size, etc. of all chases, sleeve openings, etc. required for the proper installation of the electrical work and see that such are provided. All chases, sleeves, openings, etc. shall be set prior to erection of new work to prevent delay in the progress of other work or trades.
- C. Conditions and/or situations which prevent the proper installation of any equipment or item where shown on the drawings shall be called to the attention of the Engineer for instructions.
- D. Equipment shall be shipped or fabricated in sections of suitable size for entering the building and being removed from the finished building in the future if necessary.
- E. Fully investigate all peculiarities and space limitations for all materials and equipment.
- F. Outlet, pull and junction boxes and appliances which require operation, examination, adjustment, servicing or maintenance shall be readily accessible.

- G. Take all field measurements necessary for this work and assume responsibility for their accuracy.
- H. Coordinate the electrical work with all sub-contractors. All work shall be so arranged that there will be no delay in the proper installation and completion of any part or parts of electrical equipment. All electrical work shall be installed in proper sequence with other trades without any unnecessary delay.
- I. Make all sub-contractors, suppliers and manufacturers fully aware of all requirements of the Contract.
- J. Coordinate the spacing and arrangement of lighting fixtures, diffusers, grilles and access panels in ceilings to establish a symmetrical pattern. Unless otherwise indicated, items in modular ceiling systems shall be centered in individual tiles.
- K. Coordinate the rough-in of all electrical work performed under other Divisions of these specifications.
- L. Drawings indicate the approximate locations of outlets, apparatus and equipment. The runs of feeders and branch circuits as shown are schematic. Final routing is governed by structural conditions and other obstructions. This does not mean that the design may be changed; it merely refers to the exact run of a raceway between given points.
- M. The drawings are diagrammatic and indicate the general arrangement of the equipment, the runs of conduit and the manner of connection.
- N. The architectural, structural, mechanical, as well as the electrical drawings, shall be consulted in order to be entirely familiar with conditions to be encountered and special details.
- O. The Contractor shall be solely responsible for the proper arrangement of conduit.
- P. The Engineer shall make all final decisions as to any conditions which require the changing of any work.

3.2 STORAGE AND PROTECTION OF EQUIPMENT AND WORK

- A. All materials and equipment shall be properly and effectively protected by the Contractor during the execution of the work.
- B. All electrical equipment to be used in the construction shall be properly stored and protected against the elements. All equipment shall be stored under cover, and shall not be stored at the construction site on the ground, in mud, water, snow, rain, sleet or dust. Large diameter cables may be stored on reels outside, however, all cable ends shall be waterproofed and the reels covered with weatherproof materials. Such weatherproof materials shall be heavy-duty, securely fastened and made impervious to the elements.
- C. Conventional electrical construction materials such as building wire, outlet and junction boxes, wiring devices, conduit, lighting fixtures, fittings, etc., shall be stored in construction buildings, covered trailers or portable covered warehouses. Any equipment subject to damage or corrosion from excessive moisture shall be stored in dry, heated areas. Any equipment containing plastic or material subject to damage caused by excessive heat or sunlight shall be stored to prevent such damage. This includes plastic ducts and lenses.
- D. All gear and equipment, if delivered to the construction site before the building is under cover and the equipment site prepared shall be warehoused and protected. All gear and equipment shall be covered and protected from the elements and other damage and shall be stored in a clean, dry, heated atmosphere, under cover at the Contractor's expense.
- E. All gear and equipment delivered to the construction site after the building is under cover shall be protected as described above and in addition shall be provided with auxiliary heat to prevent condensation damage. The gear shall also be protected against damage caused by carelessness of workmen who are installing equipment connected to or adjacent to the above electrical equipment.
- F. Equipment damaged as a result of the above conditions shall be properly repaired at the Contractor's expense or shall be replaced at the Contractor's expense, if, in the opinion of the

Engineer the equipment has been damaged to such an extent it cannot operate properly after repairs are made.

- G. All electrical enclosures exposed to construction damages such as paint spots, spackling or plaster spatter, grout splashes, waterproofing compound, tar spots or runs and pipe covering compound splashes, shall be completely covered and protected against damage.
- H. In the event leakage into the building of any foreign material or fluid occurs or may occur, the Contractor shall take all steps as described above to protect any and all equipment.
- I. After connections to electrical equipment are complete and the equipment is ready for operation, all construction debris shall be removed from all enclosures. Such debris includes dust, dirt, wire clippings, tape and insulation removed in order to make connections.

3.3 CUTTING AND PATCHING

- A. All cutting of walls, floors, roofs, ceilings and/or partitions for the passage of conduit, etc., and closing up of superfluous openings around them in connection with the work under this contract, including the removal of all debris caused thereby, shall be performed by the Contractor.
- B. All cutting, patching and finishing shall be performed in accordance with the requirements of the respective division of the specification and shall conform to adjacent work, subject to the approval of the Engineer.
- C. Any work already in place that has been disturbed in the execution of the work shall be repaired and restored in harmony with the surrounding work.
- D. Do not cut structural members without approval of the Engineer.
- E. Patching shall be uniform in appearance and shall match with the surrounding surface.

3.4 PENETRATION OF WATERPROOF AND FIREPROOF CONSTRUCTION

- A. Coordinate the work to minimize penetration of waterproof construction including roofs, exterior walls and interior waterproof construction. Where such penetrations are necessary, provide all necessary curbs, sleeves, shields, flashings, pitch pockets, fittings and caulking to make the penetrations absolutely watertight.
- B. Where waterproofing or fireproofing have been removed or damaged in the execution of the work, the Contractor shall have such damage repaired by the respective trades working on the project.
- C. Install penetration seal materials in accordance with printed instructions of the UL Fire Resistance Directory and in accordance with manufacturer's instruction.
- D. Seal holes or voids made by penetrations to ensure an effective smoke barrier.
- E. Slots, sleeves and other penetrations in floors, wall or other general construction shall be closed and sealed with an approved firestopping material.
- F. Floor slots and openings shall be closed with 16 gauge (1.6 mm) galvanized steel sheet supported on 1-inch by 1-inch by 1/8-inch (25 mm by 25 mm by 3 mm) structural angle drilled or supported with powder-driven studs into the building structure. Firestop with a layer of firestopping material not less than 1-inch (25 mm) thick which completely fills the opening. The top surface of the firestopping material shall be approximately 1-inch (25 mm) below the finished floor slab.
- G. Openings in walls shall be closed with 16 gauge (1.6 mm) galvanized steel sheet securely attached at the midpoint of the wall thickness and firestopped on both sides of the steel sheet with not less than 1/2-inch (13 mm) thick layer of non-sagging firestopping material to fully cover the opening.
- H. Single or multiple pipes passing through walls and floors shall have the annulus space between pipes or between pipes and structure filled with firestopping material to provide a fire rating equal to the rating of the floors and walls being penetrated. The annulus between exposed conduit and walls or floors in finished spaces shall be filled, sealed, and painted to match adjacent surfaces.

- I. In fire-rated partitions where horizontal separation of opposite-facing electrical boxes is less than 24 inches, provide UL listed firestop around electrical boxes as required to maintain fire rating of wall.

3.5 MANNER OF INSTALLATION

- A. Provide equipment supports consisting of structural racks, hangers, rods, etc.
- B. Equipment supports shall be designed and constructed to safely support and distribute loads evenly over building areas, and withstand stresses to which they may be subjected.
- C. Coordinate the location and installation of supports and sleeves to be set in concrete.
- D. Provide finish metal access doors and frames as indicated or required for access to concealed electrical equipment requiring inspection, adjustment, maintenance, manual operation, etc., or required by code.
- E. In suspended metal pan, lay-in-panel, and accessible tile ceilings, the ceiling element may be used as the access panel.
- F. Access doors in 1-1/2 hour fire-rated construction shall bear the Underwriter's Laboratories "B" label.
- G. Floor-mounted equipment (switchboards, generators, transformers, sub-stations, motor control centers, starters, control cabinets, etc.) shall be provided with concrete foundations.
- H. Concrete foundations shall be reinforced to suit the loads placed on them and shall be in strict accordance with the equipment manufacturer's recommendations. Concrete materials and methods shall be as specified in Division-3 of these specifications. The Contractor shall refer to this Division to determine specific requirements.
- I. Unless otherwise indicated or required, concrete foundations shall extend 4-inches (100 mm) above the finished floor, at least 3-inches (75 mm) beyond the equipment base in all directions, shall have the top edges chamfered 1" (25 mm) and shall have the same surface finish as the adjacent and surrounding floor. Where equipment weight is such that the floor slab will support the equipment the concrete foundations shall be securely anchored to the floor slab with steel dowels. Properly prepare existing floors: remove paint or dirt, clean and scarify as necessary.
- J. The Contractor shall furnish and set, with proper templates, all anchor bolts and inserts required for the proper attachment of his equipment to the concrete foundations. Anchor bolts shall be of the size and number required by the equipment and/or recommended by the equipment manufacturer and shall be in accordance with the requirements detailed on the drawings and/or specified herein. Anchor bolts shall also be compatible where applicable, with vibration isolation requirements specified for the equipment. Anchor bolts shall be of adequate size and shall engage a steel plate of adequate dimensions cast into the slab.
- K. The drawings indicate the wiring method. The number of current carrying conductors per raceway or cable shall be as indicated. The number of current carrying conductors cannot exceed three (3) per raceway or cable, unless the ampacity adjustment factors of NEC Article 310 are applied.
- L. Each new and existing electrical penetration through a smoke and fire-rated wall, ceiling, or floor shall be sealed with an approved smoke and fire stopping method coordinated with the rating of the associated wall, ceiling, or floor construction.

3.6 CLEANING AND PAINTING

- A. All equipment and conduit shall be thoroughly cleaned of all cutting waste from reaming and tapping. All burrs and other foreign matter shall be removed. Should any part of the system be stopped up by such refuse after the various equipment and apparatus have been accepted, the Contractor shall be required to pay for all labor and materials required to locate and remove the obstruction, and replace and repair all work in any way disturbed thereby. All enclosures, etc., shall be cleaned of all rubbish, plaster, and other debris at the completion of the work.

- B. Paint all exposed metal surfaces, except for galvanized surfaces and extruded aluminum cable and wire duct, of all electrical equipment in mechanical rooms and equipment spaces. Paint all backboards in all telephone and electrical rooms.
- C. Do not paint nameplates or other elements where such application would interfere with operation or maintenance of equipment.
- D. All scratches or marred areas on factory painted equipment shall be touched up to match finish.

3.7 IDENTIFICATION

- A. Equipment (disconnects, panelboards, starters, relays, switches with pilot lights, pushbutton stations, etc.) shall be identified as to its function, equipment, or area served, etc. In finished areas and mechanical rooms and equipment spaces identification shall be engraved phenolic plates with approximate 3/16" (5 mm) high black letters on white background. Equipment connected to the emergency power system shall be provided with phenolic plates utilizing white letters on red background. Plates shall be attached to front of devices with stainless steel, oval head, machine screws. Panelboards and equipment cabinets shall also be identified with stenciled letters, 3/4" (19 mm) high, on inside of cabinet door, colored to contrast with background.
- B. All conduits containing electrical feeders shall be identified with vinyl cloth pipe markers by W.H. Brady or Seton. Labels shall be applied whenever a conduit enters or leaves a switchboard, panelboard, or a junction or pull box, and at each side of penetrations of walls or floors. Provide individual numbers and letters to indicate feeder number and voltage.
- C. All pull box and junction box covers shall be stenciled to indicate voltage, service and/or system. All stenciling shall be clear and legible from a distance of five (5) feet.
- D. No embossed plastic tape markers will be permitted for use in marking equipment.
- E. All underground feeders, branch circuits, ductbanks, etc. shall be identified with a continuous plastic tape equal to Allen Marking Tape. Tape shall be six inches wide, waterproof, chemically resistant, yellow marked "Caution - Buried Electrical Line Below". Tape shall be located approximately midway from grade to top of feeder.
- F. Receptacle Cover Plates: Provide label on front of cover plate unless otherwise noted. Label shall indicate source panel and circuit number. Label shall be a laminated, adhesive backed, peel-off, polyester type label. Label shall be comprised of a polyester base/substrate and a clear polyester top layer/laminate. The label ink shall be printed underneath the clear polyester laminate. Label shall have black lettering on clear background. Label width shall be a nominal 0.47" (12 mm) wide. Basis of design is the TZe labeling tape by Brother Mobile Solutions, Inc. For use with the Brother P-Touch EDGE Series labeling tools.
 - 1. For outdoor receptacles, label on front cover shall be the phenolic type, 1/16" thick.
- G. All identification shall be subject to the approval of the Engineer.

3.8 EXAMINATION OF SITE

- A. The Contractor shall examine the premises prior to submitting his bid and observe the conditions under which the work will be done or other circumstances which will affect the contemplated work. No allowance will be made for any work in connection with any error or negligence on the Contractor's part. No claim for extra compensation will be recognized for difficulties encountered which, in the opinion of the Owner, would have been revealed by proper examination.

3.9 ELECTRICAL DEMOLITION

- A. All demolition of existing electrical equipment, conduit, wiring devices, lighting fixtures, etc. shall be performed under this section of the specification. The areas of demolition are defined on the architectural drawings and specific references are made on the electrical drawings.
- B. The electrical demolition in the renovation areas indicated on the drawings shall be complete and include all electrical work in the area unless noted otherwise.

- C. Existing electrical systems passing through areas of demolition to serve equipment beyond the demolition areas shall remain in service, or be suitably relocated and restored to normal operation, throughout the demolition and reconstruction of the area. The Contractor shall investigate and identify such equipment prior to demolition.
- D. Provide temporary electrical service to equipment disturbed by the demolition until such time as the permanent service can be restored.
- E. The local power company shall disconnect and remove all equipment and facilities that they own and/or maintain. The Contractor shall make and be responsible for all arrangements with the local power company to accomplish removal of their equipment.
- F. Where conduit and wiring to remain are inadvertently damaged or disturbed, cut out and remove damaged portion and all damaged wiring from the source switchboard, panelboard or pullbox to the destination connection point. Provide new wiring of equal capacity.
- G. Exposed conduit and conduit within accessible ceilings, floors and walls to be demolished shall be removed in its entirety, including all conduit, supports, junction boxes, etc. Conduit concealed within non-accessible ceilings, floors and walls abandoned in place, shall be cut flush with walls and floors, plugged, and the adjacent surface patched to match existing.
- H. Wiring to be demolished shall be removed from both concealed and exposed conduit. No wiring which becomes unused as a result of the Contract shall be abandoned in place.
- I. Equipment specified or indicated to be demolished, shall be removed from the project site and shall not be reused. Equipment required to be temporarily disconnected and relocated shall be carefully removed, stored, cleaned, reinstalled, reconnected and made operational.
- J. All material being disposed of shall be done as required to meet the applicable environmental regulations for all local, state, and federal agencies. Examples include, but are not limited to, light fixture ballasts, fluorescent lamps, and batteries.
- K. Any outages in systems shall be coordinated with the Owner. Where duration of proposed outage cannot be tolerated by the Owner, provide temporary connections as required to maintain service.
- L. Disconnect abandoned outlets and remove devices and wiring back to point of use. Provide blank cover for abandoned outlets.
- M. The contractor shall use care when performing selective building and site demolition. The contractor shall be responsible for damage inclusive of but not limited to: building finishes, lighting (interior and exterior), furniture, structure, site, utilities (above and below ground), mechanical, plumbing, telecommunications and electrical equipment / systems. Should any damage occur or should any remedial work be required, the contractor shall be responsible to repair and or replace the damaged item(s) to the Owner's satisfaction at no additional cost. The contractor shall be responsible for surveying (including contacting Miss Utility), photo documenting and restoring the surrounding work site(s) to the original pre-demolition condition and / or to the Owner's satisfaction upon completion of the work at no additional cost.
- N. Repair adjacent construction and finishes damaged during demolition. Patch all holes left from demolished equipment. Paint surfaces exposed by demolition to match adjacent surfaces.

3.10 CONNECTIONS TO EXISTING WORK

- A. When the work specified hereafter connects to any existing equipment, conduit, wiring, etc., the Contractor shall perform all necessary alterations, cutting, fitting, etc., of the existing work as may be necessary or required to make satisfactory connections between the new and existing work and shall leave the completed work in a finished and workmanlike condition, to the satisfaction of the Engineer.
- B. When the work specified hereafter or under other Sections or Divisions of the contract necessitates relocation of existing equipment, conduit, wiring, etc., the Contractor shall perform all work and make all necessary changes to existing work as may be required to leave the completed work in a finished and workmanlike manner to the satisfaction of the Engineer.

- C. The Contractor is cautioned that all existing electrical systems and life safety systems must remain in service during all phases of construction.
- D. The Contractor shall work in close cooperation with the Owner for any temporary outages.
- E. It is imperative that all interruptions of the electrical service and standby service be kept to an absolute minimum. The Contractor must submit a written request to the Owner for any and all interruptions of the electrical service or the standby service 72 hours in advance of the planned outage.

3.11 WORKMANSHIP

- A. All materials and equipment shall be installed and completed in a first class workmanlike manner and in accordance with the best modern methods and practice. Any materials installed which do not present an orderly and reasonably neat or workmanlike appearance shall be removed and replaced when so directed by the Engineer. The removal and replacement of this work shall be done, when directed in writing by the Engineer, at the Contractor's expense.

3.12 REPAIR OF EXISTING PROPERTY

- A. All work shall be carefully laid out in advance, and where cutting, channeling, chasing, trenching, or drilling of floors, walls, partitions, ceiling, or other surfaces is necessary for the proper installation, support, or anchorage of raceways, outlet boxes, or other electrical work, this work shall be carefully done, and any damage to building, piping, equipment, or ground shall be properly repaired by skilled mechanics of the trades involved, at no additional cost to the Owner.

3.13 TEMPORARY ELECTRICAL SERVICE

- A. The Contractor shall provide temporary electrical service on the site as is necessary to enable his work and the work of others on the job to proceed and to test the operation of all apparatus, devices, systems which require electrical energy.
- B. The Contractor is responsible for temporary power as may be required for construction or as may be required to maintain critical operations during changeover of feeders or services. The Contractor is responsible for providing all equipment, making all arrangements (including all work needed to submit a service application to the power company), and making all connections required for temporary power.
- C. The Contractor shall disconnect and remove all equipment and facilities required for temporary power at the completion of the project.

3.14 PUNCH-OUT PROCEDURES

- A. Preliminary Punch-out:
 - 1. Prior to requesting an inspection from the Owner, Engineer, or Permit Official, the General Contractor or Construction Manager (GC or CM) shall provide a preliminary punch-out of the area in question.
 - 2. Once completed, their punch list shall be supplied to each trade for corrections and completion. The punch list shall also be provided to the Engineer for their use.
 - 3. Upon being informed that the trade contractors have addressed all of the outstanding items, the GC / CM shall backcheck the work and update the punch list.
- B. Final Punch-out:
 - 1. Final punch-out by the engineer shall not commence until the GC or CM has exhausted their review and has signed off on all items.
 - 2. A copy of the sign-off shall be provided to the Engineer for their record.
 - 3. Once the above has been completed, the Engineer shall be notified that the work is substantially complete and ready for a final punch-out.
 - 4. Depending on the size, schedule, and project complexity, punch-outs may be requested for specific areas or systems, rather than the facility as a whole. Examples of specific requests include the following:

- a. Above ceiling
- b. Mock-ups for any repetitive installation to confirm acceptance prior to continuing (labs, dorms, offices, etc.)
- c. Equipment rooms

END OF SECTION 26 01 00

SECTION 26 02 00 - PROJECT CLOSEOUT ELECTRICAL**PART 1 - GENERAL****1.1 SUMMARY**

- A. This section provides a summary of the primary electrical project closeout activities, however, this section does not attempt to address all project closeout requirements. Closeout activities referenced in this section include the following:
 - 1. Testing
 - 2. Start-up
 - 3. Punch-out Procedures
 - 4. Operation and Maintenance Manuals (O & M Manuals)
 - 5. Demonstration and Training
 - 6. Record Documents
 - 7. Close-out Documents
- B. This Section shall not supersede any other close-out section or requirements of the Contract. Refer to other Divisions of the specifications and the General Requirements of the Contract for further instructions.

PART 2 - PRODUCTS

Not Applicable

PART 3 - EXECUTION**3.1 TESTING**

- A. The Contractor shall perform systems and equipment inspections and tests as specified in each Division-28 and Division-26 specifications section. Particular attention shall be paid to Division-26 section "Inspections, Testing and Start-up."
- B. The Contractor shall perform systems and equipment inspections and tests as specified in each Division-26 section. Particular attention shall be paid to Division-26 section "Inspections, Testing and Start-up."

3.2 START-UP

- A. The Contractor shall perform start-up on each piece of electrical equipment as specified in each section of Division-26.
- B. Where indicated in each section of Division-26, the services of a factory authorized and certified technician shall be required to perform the equipment start-up. Start-up by any other organization other than as required by the manufacturer is unacceptable.
- C. Start-up reports shall be provided for all equipment and be included in the final O & M Manuals.

3.3 PUNCH-OUT PROCEDURES

- A. Preliminary Punch-out:
 - 1. Prior to requesting an inspection from the Owner, Engineer, or Permit Official, the General Contractor or Construction Manager (GC or CM) shall provide a preliminary punch-out of the area in question.
 - 2. Once completed, their punch list shall be supplied to each trade for corrections and completion. The punch list shall also be provided to the Engineer for their use.
 - 3. Upon being informed that the trade contractors have addressed all of the outstanding items, the GC / CM shall backcheck the work and update the punch list.
- B. Final Punch-out:

1. Final punch-out by the engineer shall not commence until the GC or CM has exhausted their review and has signed off on all items.
 2. A copy of the sign-off shall be provided to the Engineer for their record.
 3. Once the above has been completed, the Engineer shall be notified that the work is substantially complete and ready for a final punch-out.
 4. Depending on the size, schedule, and project complexity, punch-outs may be requested for specific areas or systems, rather than the facility as a whole. Examples of specific requests include the following:
 - a. Above ceiling
 - b. Mock-ups for any repetitive installation to confirm acceptance prior to continuing (labs, dorms, offices, etc.)
 - c. Equipment rooms
- C. Upon completion of any and all punch lists (i.e. above ceiling, final, partial, phased, factory review, or specific item) the contractor shall provide an item by item sign-off indicating the date and who completed the item. The sign-off shall be submitted to the A/E and owner before final payment is processed. Should the contractor disagree with any item, they shall provide a written exception giving reason for review.

3.4 OPERATION AND MAINTENANCE MANUALS

- A. Submit Operation and Maintenance Manuals in three-ring binders with each section separated by tab dividers. Include protective plastic sleeves for any software or folded large documents submitted.
- B. At a minimum, the manual shall contain the following:
1. Test results for all testing conducted in accordance with Division-26 Section, "Inspections, Testing and Start-up".
 2. List of materials and equipment with name and address of vendor.
 3. List of lamps, fuses (style and ampere rating), overload heaters, and other expendable equipment and devices with type, size or ordering description with name and address of vendor.
 4. Operating, maintenance, and installation instructions for all systems and components with name and address of vendor and servicing supplier.
 5. A certificate of approval from the Electrical Inspector.
 6. A final copy of the approved coordination study.
 7. Final copies of shop drawings and submittals.
 8. Manufacturer's guarantees and warranties.
 9. A full compliance statement, on company letterhead, indicating that all systems are installed and functioning per the contract requirements including drawings, specifications, control sequences and accepted submittals.
- C. The O & M manuals shall be submitted to the A/E for review of general conformance.

3.5 DEMONSTRATION AND TRAINING

- A. Upon completion of work, instruct the owner's representative in the proper operation and maintenance of each electrical system in accordance with applicable specification sections.
- B. Instructions shall be given by persons expert in the operation and maintenance of each system / equipment.
- C. Prepare statement(s) for signing by Owner's representative indicating the date of completion of instructions and hours expended. Furnish copies of signed statements to the A/E.
- D. Final demonstration of all electrical equipment shall be recorded in DVD compatible format. Provide DVD's to the Owner.

3.6 RECORD DOCUMENTS

- A. The Contractor shall maintain a record set of electrical prints at the project site and shall indicate thereon any changes made to the contract drawings, including, but not limited to addenda, field sketches, RFI responses, supplemental drawings, sketches, etc. Where changes are made that are reflective of supplemental instructions, revisions, RFI responses, etc., the Contractor shall make clear references to those changes.
- B. A separate set of neat, legible electrical contract prints shall be kept at the project site at all times during the construction of the work for the express purpose of showing any and all changes indicated in paragraph A. above. The prints shall be marked up daily showing all changes to the original documents. The prints shall be marked up in a neat, legible manner using a red pen. Periodic review of the Record Documents will be conducted by the Owner's Representative or A/E. Should this review indicate that the Record Documents are deficient or not up to date, the Contractor shall immediately bring the documents into compliance and make the corrections
- C. Upon completion of the project and before final close-out, the Contractor shall be responsible for producing a final set of record documents in electronic CADD format. One (1) set of full size prints, one (1) CD of the electronic CADD drawings (in AutoCad and pdf format), along with the red-lined marked up field set shall be delivered to the owner upon completion. If requested, the electronic CADD documents shall be up-loaded to the owner's FTP site. The final CADD documents shall indicate in the title or revision block "RECORD DOCUMENTS" along with the date completed. The electronic format shall be compatible with the owner's preferred version of AutoCad. Coordinate with the owner before producing the CD or up-loading to the FTP site. Not acceptable are contractor installation drawings, shop drawings or multi-layers of work on a single drawing. The final as-built product shall mirror the contract bid documents using the project page layout, format and project title block.
- D. Computer (CADD) files of electrical drawings will be made available to the Contractor upon receipt of a signed waiver (available upon request). One CD will be made available to the general contractor or construction manager for distribution to the trades.
- E. Should the Contractor's electronic Record Documents not be considered complete, they will be returned for completion and/or correction.

3.7 CLOSEOUT DOCUMENTS

- A. Prior to Substantial Completion and /or Final Payment, the Contractor shall prepare and submit the following:
 - 1. Final punch lists indicating completion of all items.
 - 2. All record drawings.
 - 3. All record specifications.
 - 4. Operation and Maintenance Manuals.
 - 5. Complete final cleaning.
 - 6. Remove temporary facilities and complete site restoration.
 - 7. Where lightning protection system work is provided, provide UL Master Label Certificate.

END OF SECTION 26 02 00

SECTION 26 05 01 - INSPECTIONS, TESTING AND START-UP**PART 1 - GENERAL****1.1 DESCRIPTION**

- A. The intent of the inspection, testing, and check-out work specified herein is to ensure that all electrical workmanship and equipment, whether Owner furnished or Contractor furnished, is installed and performs in accordance with the Contract Documents, manufacturer's instructions and all applicable codes and requirements. Also, it is intended to ensure the following:
 - 1. Equipment has not been subjected to damage during shipment or installation.
 - 2. Equipment is in accordance with the specifications.
 - 3. A bench mark is established for routine maintenance and troubleshooting.
 - 4. Successful start-up without last minute interruptions and delays.
 - 5. Each system component is installed satisfactorily and will perform its function reliably throughout its life and the life of the overall system.
- B. Testing requirements in other sections of this Specification are intended to compliment and not supersede nor be superseded by this Section.

1.2 RELATED SECTIONS

- A. Division-01 Section - Submittals.
- B. Division-01 Section - Quality Control.
- C. Division-01 Section - Materials and Equipment.
- D. Division-26 - Electrical Specifications.

1.3 REFERENCES

- A. American National Standards Institute (ANSI)
 - 1. ANSI C2, National Electrical Safety Code
 - 2. ANSI Z244-1, American National Standard for Personnel Protection
- B. American Society of Testing and Materials (ASTM)
- C. Institute of Electrical and Electronic Engineers (IEEE)
- D. Insulated Cable Engineers Association (ICEA)
- E. International Electrical Testing Association (NETA)
- F. National Electrical Manufacturer's Association (NEMA)
- G. National Fire Protection Association (NFPA)
 - 1. ANSI/NFPA 70, National Electrical Code
 - 2. ANSI/NFPA 70B, Electrical Equipment Maintenance
 - 3. ANSI/NFPA 70E, Electrical Safety Requirements for Employee Workplaces
 - 4. ANSI/NFPA 780, Lightning Protection Code
- H. Occupational Safety and Health Administration (OSHA)
- I. State and Local Codes and Ordinances

1.4 SUBMITTALS

- A. Provide resumes for personnel conducting tests and evidence of the testing firm's qualifications, accreditation and experience.
- B. Provide a list of test equipment to be utilized including the manufacturer's name, model number, serial number, accuracy, and last date of calibration.

- C. Provide industry standards or guide specifications used in lieu of National Standards.
- D. Provide testing procedures and schedules.

1.5 TEST INSTRUMENT CALIBRATION

- A. The contractor shall have a calibration program which assures that all applicable test instrumentation is maintained within rated accuracy.
- B. The accuracy shall be directly traceable to the National Institute of Standards and Technology (NIST).
- C. Instruments shall be calibrated in accordance with the following frequency schedule:
 - 1. Field instruments, analog: six (6) months.
 - 2. Field instruments, digital: twelve (12) months.
 - 3. Laboratory instruments: twelve (12) months.
 - 4. Leased specialty equipment: twelve (12) months.
- D. Calibration labels shall be visible on all equipment and shall have a date of calibration and due date. Calibration records shall be available for review by the Owner.

PART 2 - PRODUCTS Not Applicable

PART 3 - EXECUTION

3.1 COORDINATION

- A. Provide all necessary supervision and labor, materials, tools, test instruments and other equipment or services required to inspect, test, adjust, set, calibrate, functionally and operationally check all work and equipment.
- B. Prepare procedures and schedules for all inspections, tests, settings and calibrations specified or otherwise required. The procedures must provide specific instructions for the checking and testing of each component in addition to the system functional checks. All procedures submitted shall include proposed job safety rules.
- C. Provide a suitable and stable source of electrical power to each test site. The Owner shall approve all sources of electrical power for testing.
- D. Notify the Owner prior to the commencement of any testing.

3.2 INSPECTIONS AND TESTS

- A. Equipment purchased by the Contractor or purchased by the Owner but installed by the Contractor shall be inspected and tested to determine its condition.
- B. The inspections, tests and checks described herein shall not be considered as complete and all inclusive. Additional normal standard construction (and sometimes repetitive) checks and tests shall be provided as necessary throughout the project, prior to final acceptance by the Owner.
- C. At any stage of construction and when observed, any electrical equipment or system determined to be damaged, faulty, or requiring repairs shall be reported to the Owner. Corrective action may require prior approval.
- D. Perform routine insulation resistance, continuity and phase rotation tests for all distribution and utilization equipment prior to and in addition to tests performed by the testing firm specified herein.
- E. The Contractor shall provide testing of the following systems and equipment.
 - 1. Grounding systems
- F. The Contractor shall provide visual and mechanical inspections of the following systems and equipment.

1. Panelboards
 2. Low voltage wiring (600 volt and below)
 3. Molded case circuit breakers rated less than 400 amperes
 4. Motor control
 5. Air switches (600 volt and below)
 6. Lighting control system
 7. Fire detection and alarm system
- G. All circuit breakers and protective devices shall be set and tested at the settings specified in the approved protective device coordination study. All fuses shall be selected and installed in accordance with the approved coordination study.
- H. All circuit breakers and protective devices shall be set as recommended by the manufacturer and tested at those settings. All fuses shall be selected and installed in accordance with the manufacturer's recommendations.
- I. The rotation of all motors shall be checked and corrective action shall be taken where necessary to obtain correct rotation.

3.3 CERTIFICATION

- A. Provide certified test reports. Test reports shall meet the criteria of a Nationally Recognized Testing Laboratory (NRTL) recognized by OSHA. The certification shall attest to the fact that the electrical installation has been installed and tested in accordance with the applicable National Standards or, where no National Standard exists, the applicable industry standard or guide specification for the equipment involved.
- B. The following information shall be included in the test reports.
1. Description of equipment tested (manufacturer, model number, serial number).
 2. Description of test and standards used.
 3. Description of test equipment.
 4. Test results with pass/fail criteria.
 5. Conclusions and recommendations.
 6. Names of personnel conducting the test.
- C. Provide three (3) copies of the complete test report no later than thirty (30) days following completion of the tests.

END OF SECTION 26 05 01

SECTION 26 05 19 - WIRES AND CABLES**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. The Drawings and Division-26 Section, Basic Electrical Materials and Methods, apply to this Section.

1.2 SUMMARY

- A. The Contractor shall provide, install and terminate all wires and cables for power, lighting, signal, control and related systems rated 600 volts and less.

1.3 SUBMITTALS

- A. Submit product data for electrical wires, cables and connectors.

1.4 QUALITY ASSURANCE

- A. All wires, cables and connectors and the installation of wires, cables and connectors shall comply with the following standards:
 - 1. NFPA 70 "National Electrical Code."
 - 2. UL Standards pertaining to wires and cables:
 - a. UL Std 44, Rubber Insulated Wires and Cables
 - b. UL Std 83, Thermoplastic - Insulated Wires and Cables
 - c. UL Std 486A, Wire Connectors and Soldering Lugs for Use with Copper Conductors, UL Std 486B for Use with Copper or Aluminum
 - d. UL Std 854, Service Entrance Cable
 - 3. Applicable NEMA Standards pertaining to wires and cables.
 - 4. Applicable IEEE Standards pertaining to wires and cables.
- B. Wires, cables and connectors shall be listed and labeled by UL.

PART 2 - PRODUCTS**2.1 WIRES AND CABLES**

- A. All wiring #14 and larger shall be soft drawn copper, 98 percent conductivity, 600 volt insulation, type THHN/THWN.
- B. All wiring connections to lighting fixtures shall have insulation suitable for the temperatures to be encountered in accordance with the NEC.
- C. All wiring #8 and larger for feeders and branch circuits shall be stranded.
- D. Minimum wire sizes shall be #12 for power and lighting circuits and #14 for control circuits unless otherwise noted.
- E. All wiring shall have identification markings along the outer covering denoting conductor size, type of insulation, and manufacturer's trade name. All wiring shall be color coded as follows:

PHASE	120/208 VOLTS 277/480 VOLTS	
A	Black	Brown
B	Red	Orange
C	Blue	Yellow
Neutral	White	Gray

- | | | | |
|--|--------|-------|-------|
| | Ground | Green | Green |
|--|--------|-------|-------|
- F. Wiring in sizes up to #8 shall have colored insulation, wiring in sizes #6 and larger shall be coded by colored tape applied no more than 6 inches (150 mm) from each termination and spanning a minimum length of 6 inches (150 mm) of insulation.
- G. All emergency wiring shall be clearly identified as emergency in all outlets, fixtures, etc.
- H. Direct burial conductors and cables shall be Type USE (UL 44).
- 2.2 METAL CLAD (MC) CABLE
- A. The maximum allowable branch circuit conductor size utilizing MC cable shall be #10 AWG.
- B. The following standards shall apply:
1. UL Standard 1569 for MC Cable
 2. UL Standard 83 for Thermoplastic Insulated Wires
 3. Federal Specification J-C-30B
 4. NEC Article 330
- C. Each circuit conductor and the grounding conductor shall be solid, uncoated copper insulated with PVC and jacketed with nylon complying with the physical and electrical requirements of UL Standard 83 for type THHN.
- D. All cables shall contain a green THHN grounding conductor.
- E. The cables shall be rated 194°F (90°C) and 600 volts.
- F. Cables which are intended for wiring systems in hospitals, nursing homes, and all other health care related facilities shall comply with NEC - Articles 330 and 517. Cables for use in plenum ceilings shall comply with NEC 300-22 (C).
- G. Fittings: As specified in Division 26 "Raceways" for flexible metal conduits.

PART 3 - EXECUTION

3.1 WIRING METHODS

- A. Wiring shall not be installed until building is under roof.
- B. All wiring for lighting and power circuits shall be sized as follows unless otherwise indicated:
- | | |
|--------------------------------|-----------|
| 120 Volt Branch Circuit Length | Wire Size |
| 0-75' (0-22.5 m)..... | #12 |
| 75-150' (22.5-45 m)..... | #10 |
| Over 150' (Over 45 m)..... | # 8 |
| 277 Volt Branch Circuit Length | Wire Size |
| 0-200' (0-60 m)..... | #12 |
| Over 200' (Over 60m)..... | #10 |
- C. In accordance with the above where the size of branch circuit conductors is increased by the minimum required by the NEC for the branch circuit rating, it is the Contractor's responsibility to ensure that the termination provisions of all equipment connected to such circuits are listed as suitable for the conductor sizes involved.
- D. Emergency lighting and exit sign circuits shall not be installed in raceway, boxes, etc. with other wiring systems, except at lighting fixtures.
- E. Wire pulling compounds shall be polywater or equivalent. The use of oils and greases shall not be permitted.

- F. All field-installed control wire and cable terminating in motor control centers, panelboards, junction boxes, etc. shall be identified with pre-stamped tubular type markers or pressure sensitive linen labels covered with clear heat shrinkable tubing. Labels shall indicate circuit numbers, terminal numbers, etc. of each conductor. The identification labels shall be as manufactured by the W.H. Brady Company, Tyton, or equivalent.
- G. No conductors shall be installed in raceways before the raceway system is properly installed and all work on the building which is liable to injure the conductors has been completed. Immediately before installing the conductors, the raceway, fittings and boxes shall be thoroughly cleaned and dried.
- H. The sharing of the neutral conductor for branch circuits is prohibited unless specifically called for on the drawings.
- I. Conductors shall be continuous between cabinets, outlets and/or junction boxes; no splices or taps shall be made within the raceway itself. Under no circumstances shall feeder conductors be spliced.
- J. At least six inches (150 mm) of free conductors shall be left at each outlet, cabinet, junction box, etc. where they are connected or spliced.
- K. Wiring devices shall not be used as splices; pigtails (line, neutral and grounding) from circuit wiring shall be provided to allow removal of the device without opening the circuit.
- L. Wiring in cabinets shall be neatly laced or tied.
- M. Underground direct burial single conductor wiring shall be tied together at intervals not exceeding 10 feet (3 m). The requirements for installation of underground raceways also apply to underground direct burial wiring.
- N. Provide a grounded circuit conductor (neutral) to all wall switch locations.

3.2 METAL CLAD (MC) CABLE INSTALLATION

- A. MC cable shall not be used within electrical rooms, mechanical rooms, janitor's closets, or in any exposed locations.
- B. MC cable shall not be used for feeders or branch circuit homeruns.
- C. MC cable shall be clipped directly to walls using clips or straps supplied by the manufacturer. Spacing of supports for non-fire rated circuits shall not exceed 6 feet (1800 mm) on center.
- D. Minimum bend radius shall be as recommended by the manufacturer.
- E. MC cable may only be used for lighting whips; maximum 6 foot length, in accessible locations.

3.3 TESTING

- A. Feeders shall be checked using a megohm tester to determine the insulation resistance levels prior to energizing.
- B. Branch circuits shall be tested to ensure electrical continuity and to ensure the system is free of short-circuits.

END OF SECTION 26 05 19

SECTION 26 05 26 - GROUNDING**PART 1 - GENERAL****1.1 DESCRIPTION**

- A. This section specifies general grounding and bonding requirements for all electrical installations.

1.2 RELATED DOCUMENTS

- A. The Drawings and Division-26 Section, "Basic Electrical Materials and Methods", apply to this Section.

1.3 SUMMARY

- A. All systems, circuits and equipment shall be grounded and bonded in accordance with Article 250 of the National Electrical Code and the requirements of these Specifications and the Drawings.

1.4 SUBMITTALS

- A. In accordance with section Submittals and Division-26 Section, "Basic Electrical Materials and Methods", the following shall be furnished:
1. Test Reports: Certified test reports of ground resistance.
 2. Certifications: Two weeks prior to final inspection, deliver to the Owner six (6) copies of the certification that the materials and installation are in accordance with the drawings and specifications and have been properly installed.
 3. Provide product data for all grounding and bonding components and accessories.

1.5 QUALITY ASSURANCE

- A. All grounding components and accessories shall comply with and shall be installed in accordance with NFPA 70, Article 250 of the National Electrical Code, and applicable sections of UL Std 467, "Electrical Grounding and Bonding Equipment", and UL Std 869, "Electrical Service Equipment".
- B. Grounding and bonding components and accessories shall be UL listed and labeled for the specific application for which they are being used.

PART 2 - PRODUCTS**2.1 GROUNDING AND BONDING**

- A. Provide electrical grounding and bonding components and accessories including, but not limited to, cables and wires, connectors, terminals, jumpers and surge arresters as required for a complete installation.
- B. Where more than one product meets the intended requirements, selection shall be at the discretion of the Installer.
- C. Provide electrical insulating tape, heat-shrinkable tubing, welding materials, straps and jumpers as recommended by manufacturer's written instructions and in accordance with standard industry practices.
- D. All below grade grounding connections shall be exothermic welds and splices and shall be by Caldweld or equal. All materials shall be supplied by one manufacturer to ensure compatibility.

2.2 GROUNDING CONDUCTORS

- A. Provide a grounding conductor with green insulation.
- B. General purpose insulating grounding conductors have insulation types as identified by the NEC and tested, certified, and labeled in accordance with UL Standards.

- C. Non-insulated grounding conductors shall be bare, soft drawn, single or multiple strand annealed copper in wire gauges or sizes as shown on the drawings or consistent with the requirements of NEC Article 250.

2.3 GROUND RODS

- A. Ground rods shall be copper clad, solid steel round bars, 3/4 inches (19 mm) in diameter and 10 feet (3 m) in length.

PART 3 - EXECUTION

3.1 INSTALLATION - GENERAL

- A. All equipment, conduit systems, raceway systems, metallic enclosures of electrical devices, switchgear enclosures, transformer frames and equipment, wiring devices and all metallic non-current carrying devices, etc. shall be completely grounded in accordance with the requirements of the National Electrical Code (latest edition).
- B. Grounding conductors shall be installed within conduit and shall be sized in accordance with NEC Article 250.
- C. Grounding conductors installed below grade shall be buried at least 24" below grade.
- D. Continuity of rigid steel raceways shall be insured by conduit hubs. All grounded neutral conductors shall be continuously identified. All grounding and bonding connections shall be solderless. All grounding and bonding connections to structural steel shall be exothermic welds. Ground fittings at water system connections shall have rigid clamp jaws. Perforated grounding straps shall not be acceptable.
- E. The secondary neutral conductor of transformers shall be continuous, identified throughout and grounded in an approved manner to the grounding electrode system. Conductor used to ground neutral conductor shall be sized in accordance with NEC Article 250.
- F. Provide insulated grounding conductors for all feeders and branch circuits. Provide grounding blocks, terminals, etc. for connection of ground wires in all distribution equipment, outlets, junction boxes and utilization equipment.
- G. Provide bonding for all metal piping systems and structural steel. Provide bonding connections to cold water and hot water, metal sanitary, gas piping and structural steel. Provide braided copper jumpers at meter, valves, equipment, etc. Bonding shall be in accordance with NEC Article 250.
- H. All grounding wire, lugs, jumpers and bus shall be copper except as specifically approved elsewhere in these Specifications.
- I. Where parallel feeders are used, each raceway shall contain an equipment ground conductor sized in accordance with NEC Article 250 for the combined parallel circuit amperage.
- J. Grounding electrode conductor shall be continuous and no splicing shall be allowed. Equipment grounding conductor splices shall be permitted in device boxes and pulling points, but should be minimized to keep ground resistance as low as possible.
- K. Receptacles shall be bonded to their outlet boxes with #12 copper straps. Straps may be omitted if self-grounding devices are utilized.
- L. Ground Rods: Drive rods until tops are 2 inches (50 mm) below finished floor or final grade, unless otherwise indicated.
 - 1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating, if any.
 - 2. For grounding electrode system, install at least [three] <Insert number> rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor. Make these connections in addition to the main water service entrance, building steel, and foundation rebar.

- M. Ufer Ground (Concrete-Encased Grounding Electrode): Fabricate according to NFPA 70, using a minimum of 20 feet (6 m) of bare copper conductor not smaller than No. 4 AWG.
 - 1. If concrete foundation is less than 20 feet (6 m) long, coil excess conductor within base of foundation.
 - 2. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building grounding grid or to grounding electrode external to concrete.

3.2 TESTING

- A. The ground resistance at the main switchboard ground bus shall not exceed 10 ohms.
- B. The ground resistance at outdoor pad mounted equipment shall not exceed 5 ohms.
- C. Resistance shall be tested by the fall of potential method according to IEEE 81.
 - 1. 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.
 - 2. If resistance levels are excessive, take additional steps to reduce resistance to acceptable levels (at no cost to the owner). Drive additional ground rods, provide additional grounding electrode conductors, etc. as needed to reduce resistance. Describe methods used to improve results within test report.
- D. Certified test results shall be provided in accordance with the requirements of Division-26 Section, "Inspections, Testing and Start-up" of these Specifications.

END OF SECTION 26 05 26

SECTION 26 05 29 - SUPPORTING DEVICES**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. The Drawings and Division-26 Section, "Basic Electrical Materials and Methods", apply to this Section.

1.2 SUMMARY

- A. Support all raceways, enclosures, cabinets, boxes, and related electrical equipment from the building structure as required by the NEC and as described in these Specifications.
- B. Support all lighting fixtures as required by the NEC and as described in these Specifications.

1.3 SUBMITTALS

- A. Provide product data for each type of manufactured supporting device.
- B. Provide shop drawings for each type of fabricated supporting device.

1.4 QUALITY ASSURANCE

- A. All components and the installation of all components shall comply with NFPA 70, "National Electrical Code," requirements.
- B. All supporting devices shall be listed and labeled by UL, ETL, CSA or a Nationally Recognized Testing Laboratory (NRTL).
- C. Comply with National Electrical Contractors Association's "Standard of Installation" pertaining to anchors, fasteners, hangers, supports and equipment mounting.

PART 2 - PRODUCTS**2.1 PROHIBITED MATERIALS**

- A. Nails, wires, perforated tape or plumber's tape are unacceptable for supporting or securing conduits.

2.2 MANUFACTURED SUPPORTING DEVICES

- A. Supporting devices shall comply with manufacturer's standard design and construction, fabricated from standard materials in accordance with published product information.
- B. Supporting devices shall be protected with a zinc coating or with a similar corrosion resistant coating or treatment. Devices for use outdoors shall be hot-dip galvanized.
- C. Raceways shall be supported using clevis hangers, riser clamps, conduit straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring steel clamps.
- D. Steel channels and associated support rods shall be selected to accommodate weight of associated raceway and wire.
- E. Anchors shall be provided of adequate size to support the load, and shall be compatible with the construction method encountered. Anchors shall be expansion or toggle bolt type.

2.3 FABRICATED SUPPORTING DEVICES

- A. Pipe sleeves shall be fabricated from galvanized sheet steel or Schedule 40 galvanized steel pipe.
- B. Sheet steel sleeves shall be round tube closed with snaplock, joint, welded spiral seams, or welded longitudinal joint. Fabricate sleeves from the following gauge steel: 3" (75 mm) and

smaller, 20 gauge (1.0 mm); 4" to 6" (100 mm to 150 mm), 16 gauge (1.6 mm); over 6" (150 mm), 14 gauge (2.0 mm).

- C. Mechanical Sleeve Seals: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between conduit and sleeve, connected with bolts and pressure plates which cause rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.
- D. Steel brackets shall be fabricated from angles, channels and other standard shapes. Brackets shall be assembled using welds and/or machine bolts to form a rigid assembly.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install hangers, anchors, sleeves and seals as indicated, in accordance with manufacturer's written instruction and following recognized industry practices to insure supporting devices comply with requirements. Comply with requirements of NECA, NEC and ANSI/NEMA for installation of supporting devices.
- B. Coordinate with other electrical work, including raceway and wiring work, as necessary to interface installation of supporting devices with other work.
- C. Install hangers, supports, clamps and attachments to support piping properly from building structure. Install supports within maximum spacing indicated by NEC or on drawings.
- D. Individual conduits shall be secured with steel pipe straps or lay-in pipe hangers.
- E. Multiple runs of suspended conduit shall be supported from trapeze style hangers.
- F. Multiple runs of conduit on ceiling or wall surfaces shall be mounted on flush or surface steel channels.
- G. Ceiling support wires shall not be used for support of conduits.
- H. Lighting fixtures shall be supported as recommended by the manufacturer. Recessed LED incandescent and fluorescent fixtures in suspended ceilings shall not be supported by the ceiling system. Fixtures shall be secured to the building's structure.
- I. Raceway supports shall be adequate to carry present and future load multiplied by a safety factor of at least four. In no case shall a support strength of less than 200 pounds (1380 kPa) be used.
- J. Manufactured watertight and fire-rated seals shall be provided for sealing conduits and cables passing through sleeves in floors and fire-rated walls. Seals shall be fire-resistant rubber plugs or other materials specifically designed to provide a watertight seal and a UL listed fire-resistant rating which meets or exceeds the rating of the floor or wall.
- K. All penetrations through floors or fire-rated walls shall be sealed to restore the fire rating around such penetrations. The sealing system shall fill all voids, shall be specifically designed for such use, and shall have a UL listed fire-resistant rating which meets or exceeds the rating of the floor or wall.
- L. Mechanical Sleeve Seals: Provide mechanical sleeve seals for sleeves located in foundation walls below grade, or in exterior walls. Loosely assemble rubber links around conduit with bolts and pressure plates located under each bolt head and nut. Push into sleeve and center. Tighten bolts until links have expanded to form watertight seal.
- M. Cable supports shall be provided for vertical conduits in accordance with NEC Article 300. Cable supports shall be multi-section wedge-type plugs with an outside diameter and the number and size of openings required for the conduit and conductors.
- N. Provide vibration isolators between enclosures of all vibration producing equipment, transformers, etc., and their supports or floor. Isolators shall be Mason Industrial type NK neoprene and cork sandwich or equal.

- O. Supports are required within 3 feet (900 mm) of each outlet box, junction box, device box, cabinet, conduit body or other tubing terminations.
- P. All junction boxes shall be supported from structure.

END OF SECTION 26 05 29

SECTION 26 05 33 - RACEWAYS**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. The Drawings and Division-26 Section, Basic Electrical Materials and Methods, apply to this Section.

1.2 SUMMARY

- A. All wiring shall be installed in raceways as hereinafter specified, unless otherwise indicated.

1.3 SUBMITTALS

- A. Submit product data for raceways, wireways and fittings.
- B. Submit manufacturer's written installation instructions for wireways, surface raceways and non-metallic raceways.
- C. Submit pulling calculations for all underground ductbank runs having cables larger than 4/0.
- D. For prewired surface raceway installations, submit drawings for approval showing the complete layout of all products that make up the complete system for each floor prior to installation with raceway lengths, device type (power or data), locations and circuits identified.

1.4 QUALITY ASSURANCE

- A. All raceway components and the installation of raceway components shall comply with the following standards:
 - 1. NFPA 70 "National Electrical Code"
 - 2. Applicable NEMA Standards
 - 3. Applicable UL Standards pertaining to raceway system
- B. Raceway components shall be listed and labeled by UL, ETL or CSA.

PART 2 - PRODUCTS**2.1 RIGID METAL CONDUIT**

- A. Rigid metal conduits and couplings shall be full weight, heavy wall steel, galvanized, with threaded connections conforming to the latest editions and revisions of ANSI Standard C-80.1 and UL Standard 6 which supersedes Federal Specification WW-C-581.
- B. Fittings shall be steel or cast malleable iron by Chrouse-Hinds, O-Z, T & B, Steel City, Efcor, or equal. O-Z type "AX" or equal fittings with bonding jumpers shall be used in each rigid metal conduit passing across a building expansion joint. Type of fitting shall be properly chosen for the movement anticipated.
- C. Insulating bushings shall be used on all rigid metal conduit terminations and shall be O-Z type "B" or equal.
- D. T & B Series 141, or equal, locknuts shall be used on both inside and outside on all enclosures.
- E. O-Z type "S", or equal, cable supports shall be used in conduit risers as required by the NEC.

2.2 INTERMEDIATE METAL CONDUIT

- A. Intermediate Metal Conduit (IMC) and couplings shall be steel, galvanized, with threaded connections, conforming to the latest editions and revisions of Federal Specifications WW-C-581E and Underwriter's Laboratories Standard 1242.

2.3 ELECTRICAL METALLIC TUBING

- A. Electrical Metallic Tubing (EMT) shall be galvanized, conforming to the latest editions and revisions of ANSI Standard C80.3, Federal Specifications WW-563, and Underwriter's Laboratories Standard 797.
- B. Expansion fitting with bonding jumpers shall be used in each EMT conduit passing across a building expansion joint.
- C. Steel concrete-tight (rain-tight in damp and liquid-tight in wet locations) compression type box connections and couplings with nylon insulating throats shall be used.
- D. O-Z type "SBT" or equal, insulated bushing shall be used on all EMT conduit terminations not in metal enclosures.

2.4 FLEXIBLE METAL CONDUIT

- A. Flexible metal conduit shall be steel, metal strip interlocked construction, zinc-coated, conforming to the latest editions and revisions of Federal Specification WW-C566B and Underwriter's Laboratories Standard for Flexible Steel Conduit, UL1.
- B. Liquidtight flexible metal conduit shall be type UL with PVC cover as manufactured by Anamet: trade name - "Sealtite," or "Hydrotite" as manufactured by Eastern Wire and Conduit or equal, conforming to UL360.
- C. Fittings and Connectors:
 - 1. Flexible Metallic Conduit: Steel, nylon insulated throat, equal to Crouse-Hinds ACB Series, or Thomas & Betts Tite-bite.
 - 2. Flexible Non-Metallic (Liquidtight): Steel, nylon insulated throat, equal to Crouse-Hinds Liquidator.
 - 3. Die-cast squeeze fittings will not be approved.

2.5 RIGID NONMETALLIC CONDUIT

- A. Polyvinyl Chloride (PVC) conduit shall be heavy wall Schedule 40 or Schedule 80 as noted conforming to the latest editions and revisions of Federal Specifications WC-1094, Underwriter's Laboratories Standard UL651, and NEMA Standard TC-2.
- B. All joints shall be leakproof, moisture-proof, permanent solvent cement type.
- C. Conduit and fittings shall be as manufactured by Carlon, Queen City Plastics or equal.

2.6 RIGID ALUMINUM CONDUIT

- A. Aluminum conduit shall not be used.

2.7 CONDUIT BODIES AND FITTINGS

- A. All couplings, elbows, cast fittings and conduit bodies shall be made of materials of high quality throughout and shall be a first-grade commercial product, well made and free from mechanical imperfections and defects.
- B. Bushings shall be used on all conduits to provide a smooth, well rounded, insulated surface. Bushings shall be metallic with plastic throats. The insulating material shall have a UL temperature rating of 302°F (150°C), it shall be molded-on to the metal and shall become an integral part of the bushing.
- C. Erickson or split couplings shall be used in lieu of running threads. Couplings shall be manufactured by O.Z./Gedney, or equal.
- D. Entrance seals shall be provided where conduits pass through exterior concrete or masonry walls below grade. The entrance seals shall consist of a hot dip galvanized shell, sealing gland assembly capable of providing a seal around the conduit to withstand fifty feet head of water without leakage. The shell of the seal shall have at least two (2) cast collars at a right angle to the

sleeve that is embedded in the concrete. Entrance seals shall be O.Z./Gedney Type WSK, FSK or equal.

- E. Conduit hubs shall be malleable iron, zinc plated rain-tight type complete with integral insulated throat, captive O-ring seal and oversize nut. Hubs shall be Myers "Screwite," O.Z./Gedney "Space Maker," or equal.

2.8 RIGID COATED CONDUIT

- A. Prior to application of the coatings, all conduit shall conform to Federal Specification WW-C-581 E, ANSI Standard C80.1 and UL Standard 6.
- B. Conduit shall be hot-dip galvanized inside and out prior to coating.
- C. Exterior surfaces shall be thoroughly cleaned and treated with an epoxy primer to provide a bond between the zinc and the PVC coating.
- D. Adhesion of the PVC coating to coating and fittings shall be greater than the tensile strength of the PVC coating itself.
- E. PVC exterior coating shall have a nominal thickness of .040" (1 mm) (40 mils) except where part configuration or application otherwise dictate.
- F. Exterior PVC coating on conduit and fittings shall be applied using the fluidized-bed process.
- G. A two-part, chemically cured, urethane coating having a nominal thickness of .002" (.05 mm) (2 mils) shall be applied to the interior surfaces of all conduit and feed-through fittings except where prohibited by design.
- H. Female coupling and fitting threads, as well as all male threads of conduit, elbows, nipples and fittings shall be protected from corrosion by application of two-part, chemically cured, urethane coating.
- I. Each female threaded opening on couplings or fittings shall be protected by an integral PVC sleeve extension formed during the coating process. The sleeve shall extend one pipe diameter or 2" (50 mm) (whichever is less) and have an inside diameter equal to the outside diameter of the uncoated conduit.
- J. Form 8 condulets shall be supplied with stainless steel screws with polyester encapsulated heads. Form 7 condulets shall be supplied with stainless steel screws.
- K. Finished conduit shall fully conform to the current NEMA Standard RN-1 and shall have a label affixed indicating compliance with UL Standard 6.
- L. Interior and exterior coating shall afford sufficient flexibility and elongation to permit field banding without damage.
- M. Approved Material: Perma-Cote supreme as manufactured by Perma-Cote Industries.

2.9 IDENTIFICATION

- A. Exposed raceways shall be identified at junction and pull boxes and at points not more than 20 feet (6 m) on centers. See Division-26 Section, Basic Electrical Materials and Methods for additional identification requirements.
- B. Labels shall indicate the system voltage and/or type of service and shall have an appropriate legend, such as:
 - 1. 480 VOLTS - POWER
 - 2. 480Y/277 VOLTS - LIGHTING
 - 3. 208Y/120 VOLTS - LIGHTING
 - 4. 208Y/120 VOLTS - POWER
 - 5. 120 VOLTS - CONTROL
 - 6. TELEPHONE

- C. Labels shall appear in white letters of 1/2 inch (13 mm) minimum height on a black background. Labels shall be installed in accordance with the manufacturer's instructions and sizes shall match the conduits to which they are applied. Labels shall be ordered sufficiently prior to their need so that they will be on hand when required for installation. Failure to allow adequate time for delivery of labels, including special legends, will not be considered valid reason for substitution of labels of a different type.

PART 3 - EXECUTION

3.1 WIRING METHODS

- A. Exterior locations above grade - rigid metal conduit.
- B. Crawl spaces - intermediate metal conduit.
- C. Exposed locations, up to 10' - 0" (3 m - 0 mm) AFF - intermediate metal conduit.
- D. Exposed locations, above 10' - 0" (3 m - 0 mm) AFF - electrical metallic tubing.
- E. Damp or wet locations - rigid metal conduit.
- F. Within concrete and masonry exterior walls - intermediate metal conduit.
- G. Within concrete floor slabs - rigid nonmetallic Schedule 40 PVC with rigid metal conduit stub-ups.
- H. Below slabs on grade - rigid nonmetallic Schedule 40 PVC with rigid metal conduit stub-ups.
- I. Conduits for all conductors rated greater than 600V unless encased in concrete - rigid metal conduit.
- J. Concealed locations, accessible, dry - electrical metallic tubing.
- K. Concealed locations, non-accessible, dry - electrical metallic tubing.
- L. Direct buried, exterior, feeders - rigid nonmetallic Schedule 80 PVC
- M. Direct buried, exterior, branch circuits (60 amperes or less) - jacketed metal clad cable or rigid nonmetallic Schedule 80 PVC.
- N. Above grade connections to substations - rigid metal conduit.
- O. Ducts encased in minimum of 2 inch (50 mm) thick concrete - rigid nonmetallic Schedule 40 PVC. All ducts shall have a round exterior with a round bore.
- P. Connections to motor terminal boxes, control panels mounted on equipment, dry-type transformers and other vibration producing equipment, dry locations - flexible metal conduit, 18"-36" (450 mm-900 mm) length.
- Q. Connections to motor terminal boxes, control panels mounted on equipment, dry-type transformers and other vibration producing equipment, damp and wet locations - liquidtight flexible metal conduit.
- R. Recessed lighting fixtures, between fixture and its respective outlet box - flexible metal conduit in lengths as permitted by the NEC, and providing sufficient slack to permit removal of fixture and access to outlet box.
- S. Minimum conduit size shall be 3/4" (19 mm).
- T. Non-insulating grounding conductors installed within a raceway shall be PVC Schedule 40 (where allowed by Code) or non-ferrous conduit.

3.2 INSTALLATION

- A. Unless otherwise noted on the contract drawings, all raceways shall be installed concealed in the floors, ceilings, walls or partitions of the building, and in such a manner as not to impair the integrity of the structure. Unless otherwise specified, raceways may be installed exposed in mechanical rooms, electrical rooms, large storage spaces and in large janitor's closets, pipe shafts, suspended ceiling spaces, and where required for equipment connections. Exposed

raceways shall be installed parallel or perpendicular to walls, structural members or intersection of vertical planes and ceilings, with right angle turns consisting of box-type fittings or symmetrical bends.

1. Exposed conduit in finished areas shall be covered with a 16 gauge steel primed and painted metal cover, secured to an adjacent structure and painted to match adjacent surfaces.
- B. The Contractor shall exercise the necessary precautions to prevent water, dirt, plaster or trash in raceways, fittings and boxes during the course of installation; raceways, fittings, or boxes clogged in such manner that cannot be thoroughly cleaned, shall be replaced. All unconnected conduit ends shall be properly capped. Raceways shall be kept at least 12 inches (300 mm) from parallel runs of flues, steam pipes or hot water pipes. Bends and offsets shall be kept to a minimum, and they shall be made without flattening or deformation with approved hickey or bending machine; the radius of the curve of the inner edge of any field bend shall not be less than the value specified in the National Electrical Code. Raceway runs shall not exceed 100 feet (30 m) between outlets; where necessary, even though not indicated on the drawings, box-type fittings or pull boxes shall be installed. Moisture traps shall be avoided as much as possible. Except as noted, raceways shall not be installed horizontally within concrete slabs-on-grade; raceways shall be installed underground, below the slab. Expansion fittings or other approved devices shall be used to provide for expansion and contraction where raceways cross expansion joints.
- C. Raceways shall have supports spaced not more than 8 feet (2400 mm) apart, except in vertical risers where 2 inch (50 mm) and larger rigid metal conduit may be supported at intervals not larger than 15 feet (4.5 m). Raceways shall be supported on approved types of zinc-coated wall brackets, clamps, ceiling trapeze hangers, strap hangers, or pipe straps firmly secured in an approved manner. All ends of raceways shall be reamed to remove rough edges. Raceways shall be firmly attached to sheet-metal enclosures NEMA type 1 by means of proper metallic, plastic throated bushings and locknuts; and to sheet-metal enclosures NEMA types 3, 4, 6, 12 or 13, by means of interchangeable, metallic, plastic-throated, raintight hubs. When installing locknuts and bushings, care shall be observed to see that the full number of threads project through to permit the bushing to be drawn tight against the end of the conduit, after which the locknut shall be made up sufficiently rigid to draw the bushing into firm electrical and mechanical contact with the box; two locknuts, one inside and one outside, plus the bushing, shall be used where required. Proper electrical continuity shall be established throughout the entire raceway system. An approved compound shall be applied to all field threads before installation.
- D. Conduits may be installed in concrete floor slabs with the following limitations:
 1. Maximum size - 1-1/4" (32 mm). Conduits larger than 1-1/4" (32 mm) may be installed in concrete floor slabs only with the specific permission of the Architect and Structural Engineer, or as specifically indicated on the drawings, all in accordance with the following limitations.
 - a. Minimum concrete cover - 1" (25 mm), above and below.
 - b. Minimum spacing between conduits - 7-1/2" o.c. (188 mm).
 - c. Maximum conduit outside diameter - 1/3 of slab thickness.
 - d. Installed between bottom and top reinforcing.
 - e. Secured to prevent possible change in positions as concrete is poured.
 - f. Water or damp-proofing integrity of slab is not disturbed.
 2. Conduits in close proximity to each other at panelboards, etc., shall be wrapped with wire mesh to prevent cracking of slab.
 3. Conduits shall not be installed in post tension slabs.
- E. All conduits shall be tested for clearance and smooth joints and then capped immediately after installation by T & B "push penny" plugs, or equal, to prevent entrance of moisture or debris.
- F. No wire shall be pulled into conduits until system is complete and the building is thoroughly dry.
- G. Conduits to outlets in demountable or dry wall partitions shall be run in ceiling spaces and not in floor slabs.

- H. Conduits turning from floor slabs up into partitions shall be totally concealed.
- I. Conduits passing from heated to unheated spaces, exterior spaces, refrigerated spaces, cold air plenums, etc., shall be suitably sealed with "Duxseal" by Johns Manville or sealing fittings to prevent accumulation of condensation.
- J. Conduits and sleeves penetrating floor slabs and fire-rated partitions shall have the chopped out space between the outer wall of the piping and the concrete sealed with fire resistant material listed by UL for use in fire rated floor and partition systems. Sleeves penetrating floor slabs shall extend 1-1/2" (40 mm) above the finished floor.
- K. Conduits less than 12" (300 mm) in length connecting outlets of adjoining rooms shall be sealed with "Duxseal" by Johns Manville to prevent noise transmission between rooms.
- L. Conduits run below concrete slabs shall have at least 6" of cover between the top of conduit and the bottom of the slab.
- M. Pull wires shall be installed in all empty conduits. Use No. 14 AWG monofilament plastic line having not less than 200-lb. (1380 kPa) tensile strength. A minimum of 12 inches (300 mm) of slack shall be provided at each end of the pull wire.

3.3 CLEANING

- A. Inspect all raceways; clear all blockages; and remove all burrs, dirt and construction debris from raceways before installing conductors.

END OF SECTION 26 05 33

SECTION 26 05 34 - BOXES, FITTINGS AND CABINETS**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. The Drawings and Division-26 Section, "Basic Electrical Materials and Methods", apply to this Section.

1.2 SUMMARY

- A. Provide and install outlet boxes, pull and junction boxes, cabinets and enclosures as required by the Drawings and as required by field conditions for a complete installation in accordance with the National Electrical Code.

1.3 SUBMITTALS

- A. Provide product data for all cabinets and enclosures.

1.4 QUALITY ASSURANCE

- A. All items provided under this Section shall be listed and labeled by UL or a Nationally Recognized Testing Laboratory (NRTL).
- B. The components and installation shall comply with NFPA 70 "National Electrical Code."
- C. Enclosures shall comply with NEMA Standard 250, "Enclosures for Electrical Equipment."

PART 2 - PRODUCTS**2.1 METALLIC OUTLET BOXES**

- A. Outlet boxes shall conform to UL 514A, "Metallic Outlet Boxes, Electrical," and fittings shall conform to UL 514B, "Fittings for Conduit and Outlet Boxes."
- B. Outlet boxes for indoor and dry locations shall be minimum 4" (100 mm) square or octagonal, 2-1/8 inch (53 mm) deep, zinc-coated sheet steel with stamped knockouts, threaded screw holes and mounting accessories suitable for each location and application. Straps, cable clamps, exterior rings and fixture studs shall be provided as required.
- C. Outlet boxes for outdoor or wet locations shall be minimum 4" (100 mm) square copper-free aluminum cast boxes with threaded raceway entries, threaded screw holes and mounting accessories suitable for each location and application. Straps, mounting feet, closure plugs, cable clamps, exterior rings and fixture studs shall be provided as required.
- D. Outlet boxes in concrete construction shall be of sufficient depth to keep conduits a minimum of 1" (25 mm) from the wall surface.
- E. No "thru-wall" boxes shall be used in partitions.
- F. Steel floor boxes shall be sheet steel construction, concrete tight, fully adjustable, with stamped knockouts, adjusting rings, and brass floor plates.
- G. Outlet boxes in masonry partitions shall have square corners with no mounting tabs and shall be of sufficient depth to suit the block or brick construction.

2.2 NONMETALLIC OUTLET BOXES

- A. Nonmetallic outlet boxes shall not be used.

2.3 ACCESS FLOOR BOXES

- A. Access floor boxes shall be fabricated from minimum 14 gauge galvanized steel. Boxes shall have a reinforced hinged cover with flange suitable for accepting carpet, tile or high pressure laminate. The box shall provide an unobstructed enclosure for power receptacles, data and communication outlets.
- B. Access floor boxes shall be provided with two (2) duplex receptacles, NEMA 5-20R, and two (2) duplex data outlets.
- C. Access floor boxes shall be removable from the access floor without disturbing floor panels. Access to box wiring space shall be through a removable cover on the bottom or back of the box. The top cover shall be capable of being closed with cords and cables exiting from the box. Cords and cables shall be protected from the closed cover by a retractable cable exit. When the cover is closed and no cords or cables are in place there shall be no obstructions above the floor.

2.4 PULL AND JUNCTION BOXES

- A. Pull and junction boxes over 100 cubic inches (.0016 m3) in volume shall comply with UL Standard 50, "Electrical Cabinets and Boxes."
- B. Boxes shall have screwed or bolted-on covers of the same material as the box and shall be sized to accommodate the application and the site conditions.
- C. Sheet steel boxes shall have welded seams and shall have structural bracing where required to provide a rigid assembly.
- D. All boxes for concealed work shall be constructed of minimum 12 gauge galvanized sheet steel with welded seams and shall be provided with mounting brackets. Integral bracing shall be provided where required to provide a rigid assembly.
- E. All boxes installed in wet locations or on the building exterior shall be constructed from galvanized sheet steel with gasketed covers.

2.5 CABINETS

- A. Cabinets shall conform to UL Standard 50, "Electrical Cabinets and Boxes."
- B. Backboxes shall be constructed from galvanized sheet steel, and fronts and doors shall be constructed from rolled sheet steel. Cabinets shall be NEMA 1 except as otherwise noted. Cabinets shall consist of a box and a one-piece frame front with a hinged door. Concealed fasteners shall secure front to box and provide adjustment to permit alignment of front and box.
- C. Hinges shall be flush, shall not be more than 6" (150 mm) from the top and bottom of the door, and shall be no more than 24" (600 mm) apart. Doors greater than 48" (1200 mm) in height shall have 3-point latching mechanism.
- D. Surface mounted cabinets shall have fronts of the same height and width as the box. Flush mounted cabinets shall have fronts which extend 3/4" (19 mm) beyond box in all directions.
- E. Double doors shall be provided for cabinets wider than 24" (600 mm).
- F. Doors shall have combination spring catch and key lock. All locks for cabinets of a common system shall be keyed alike.

PART 3 - EXECUTION

3.1 OUTLET BOXES

- A. Outlet boxes shall be firmly secured in place, plumb and level. Outlet boxes installed in suspended ceilings shall not be supported from the ceiling system. Outlet boxes for like devices shall have a uniform mounting height unless specifically noted otherwise.
- B. Outlet boxes over windows and doors shall be installed 7'-6" (2250 mm) above the finished floor, centered over the door or window unless otherwise noted.

- C. Outlet boxes shall be 6"-12" (150 mm-300 mm) from the strike side of the door frame when installed adjacent to a door opening.
- D. Outlet boxes at fixed work surfaces and counter tops shall be installed with the center of the box 6" (150 mm) above the work surface or counter surface unless otherwise noted.
- E. Covers shall be installed on all outlet boxes.
- F. Outlet boxes for wall mounted video equipment shall be installed with the center of the box 80" (2000 mm) above the finished floor or 6" (150 mm) below the finished ceiling, whichever is lower.
- G. Outlet boxes for electric water coolers shall be wall mounted and shall not be visible after the water cooler is installed. Mounting height shall be coordinated in the field.
- H. Coordinate outlet box locations with baseboard heating units. Contractor shall adjust box locations where necessary to accommodate installation and listing requirements of baseboard heating units. Advise Owner/Engineer of any necessary adjustments. Outlet boxes shall be installed above hydronic baseboard heat and below electric baseboard heat.
- I. Outlet box mounting heights are as indicated. Mounting heights shall be to the center line of the box.

3.2 PULL AND JUNCTION BOXES

- A. Pull and junction boxes shall be no smaller than 8 inches (200 mm) square by 4 inches (100 mm) deep.
- B. Boxes shall be the minimum size as required by the National Electrical Code or larger as indicated on the Drawings.
- C. Junction and pull boxes shall be furnished and installed where indicated on the Drawings or where required by the NEC.
- D. Boxes for communication, data and signaling systems shall be 50 percent larger than the size required by the NEC and shall be located to permit ready access for installation of future raceways and conductors.

3.3 CABINETS AND ENCLOSURES

- A. Fronts of cabinets and enclosures shall be mounted straight and plumb with building surfaces.
- B. Cabinets and enclosures 68" (1700 mm) or less in height shall be installed with the top of the cabinet or enclosure 72" (1800 mm) above the finished floor. All cabinets and enclosures shall be installed in accordance with the NEC.
- C. Cabinets and enclosures installed adjacent to one another shall be installed with the tops of the cabinets and enclosures at the same height.
- D. Cabinets and enclosures in finished areas shall be flush with the walls. Cabinets and enclosures in mechanical and electrical rooms shall be surface mounted unless otherwise noted.

3.4 GROUNDING

- A. All metallic boxes, cabinets and enclosures shall be effectively grounded in accordance with Article 250 of the NEC.
- B. Provide a grounding terminal in the interior of all boxes, cabinets and enclosures.

3.5 CLEANING

- A. After installation, clean and repair all boxes, cabinets and enclosures. Galvanized finishes shall be repaired using a zinc-rich paint as recommended by the manufacturer. Painted finishes shall be repaired using a matching paint from the manufacturer.

END OF SECTION 26 05 34

SECTION 26 05 73 - COORDINATION STUDY**PART 1 - GENERAL**

1.1 This section applies to the new garage only.

1.2 DESCRIPTION

- A. The Contractor shall engage the services of a qualified professional engineer to perform a short circuit and protective device coordination study and an arc flash hazard analysis. The Contractor is responsible for providing all pertinent information required by the preparers to complete the study. The study shall be performed in strict accordance with these specifications.
- B. The study shall include all portions of the electrical distribution system from the utility overcurrent device to the 208Y/120 volt branch circuit panelboards.
- C. The study shall be completed using the most current versions of NFPA 70E, Standard for Electrical Safety in the Workplace and IEEE-1584, Guide for Performing Arc-Flash Hazard Calculations.

PART 2 - PRODUCTS**2.1 SHORT CIRCUIT STUDY**

- A. The Contractor shall provide a short circuit study for the electrical distribution system. The study shall include the calculation of three phase bolted fault values and phase to ground fault values at every point of application of a protective device on the system. Momentary and interrupting duty values shall be calculated.
- B. Obtain a letter from the utility company indicating what the available fault current and X/R ratios are at the service entrance. Provide the letter in an appendix of the report.
- C. The short circuit calculations shall be performed by a computer program. Provide a computer generated single line diagram showing calculated and rated fault levels for each piece of electrical equipment.
- D. The short circuit study report must include a complete index of fault bus identifications. A system diagram indicating system configuration and the fault bus locations shall be provided in the study.
- E. Provide a complete printout of the results of the calculations.
- F. Momentary duty fault values shall be tabulated for both three phase and phase to ground faults including: bus identification, bus L-L voltage, symmetrical fault current values, symmetrical fault kVA values, and X/R ratio at each fault bus.
- G. Interrupting duty fault values shall be tabulated for both three phase and phase to ground faults including: bus values, symmetrical fault kVA values, X/R ratio at each fault bus, asymmetry factor at each fault bus, and the associated asymmetrical fault value at the bus.
- H. Manufacturer's published interrupting/withstand capabilities shall be compared to calculated fault current values to determine acceptability of each protective device installed on the system. A tabulation shall be provided detailing the comparison.
- I. The short circuit study shall report any deficiencies in interrupting capabilities and include recommendations for correcting such deficiencies.

2.2 PROTECTIVE DEVICE COORDINATION STUDY

- A. The Contractor shall provide a protective device coordination study for all protective devices installed on the electrical distribution system.

- B. The coordination study shall begin with the first upstream utility protective device and continue down through the distribution system to the first device on each feeder which does not have adjustable trip characteristics.
- C. Time-current coordination curve sheets shall be developed on log-log paper utilizing manufacturer's published time-current characteristics. Key coordination elements shall be plotted to demonstrate the level of coordination provided.
- D. Transformer damage characteristics as specified in American National Standards Institute/Institute of Electrical and Electronics Engineers (ANSI and IEEE) guidelines and inrush points shall be plotted to demonstrate the level of protection provided. Cable insulation withstand curves shall also be plotted to demonstrate protection provided.
- E. Each curve sheet shall have a single line diagram indicating the portion of the system being plotted.
- F. Each curve sheet shall be accompanied by a detailed narrative explaining the coordination provided, and any compromises made between protection and selectivity.
- G. The coordination study report shall provide complete tabulations of all protective devices, ratings and settings. Recommendations shall be provided to improve coordination where necessary.

2.3 ARC FLASH HAZARD ANALYSIS

- A. Provide arc flash hazard calculations for all electrical distribution equipment identified in NEC Article 110.16, Flash Protection.
- B. Provide arc flash hazard calculations per IEEE-1584. Calculations shall provide the flash protection boundary (ft.), arc flash hazard category and the required personnel protective equipment (PPE) for all electrical distribution system equipment included in the Arc Flash Hazard Analysis. Also provide incident energy level as calculated in analysis.
- C. Provide an arc flash hazard warning label on all electrical distribution system equipment included in the Arc Flash Hazard Analysis. The label shall comply with ANSI Z535.4-1998, Product Safety Signs and Labels. The label shall include, but not be limited to, the flash protection boundary, flash hazard category, and required PPE.
- D. Provide painted arc flash protection boundary line on floor in front of each piece of equipment involved in the arc flash hazard analysis. Painted line shall be minimum 4" wide with a painted stencil label stating "Arc Flash Protection Boundary". Color of painted line to be approved by the Owner.

PART 3 - EXECUTION

3.1 REPORT

- A. The short circuit and coordination study shall be completed prior to releasing for manufacture of all switchboards, fused switches, panelboards, circuit breakers and other equipment with overcurrent protection.
- B. Six (6) copies of a bound report shall be submitted for review and approval at the completion of the short circuit and coordination study. The report shall contain all of the items required by these specifications. The report must be submitted prior to the delivery of any distribution equipment submittals. Submittal reviews of distribution equipment shall be withheld until the report is received, reviewed, and approved.
- C. Time-current coordination curve sheets may be reduced to 8-1/2 x 11 size for inclusion in the report. However, full size curve sheets shall be provided, not necessarily bound, with each copy of the report.
- D. The Contractor shall warrant that errors and omissions in the study or report shall be corrected without charge to the Owner when so found within twelve (12) months from acceptance of the first report.

- E. Copies of the approved study shall be included in the manuals specified in Division-26 Section, "Basic Electrical Materials and Methods."

END OF SECTION 26 05 73

SECTION 26 24 16 - PANELBOARDS**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. The Drawings and Division-26 Section, Basic Electrical Materials and Methods, apply to this Section.
- B. Cabinets and enclosures shall conform to Division-26 Section, Boxes, Fittings and Cabinets.

1.2 SUMMARY

- A. Furnish and install panelboards, cabinets and boxes as indicated on the Drawings and as specified herein.

1.3 SUBMITTALS

- A. Provide product data for all panelboards, enclosures, cabinets, overcurrent devices and accessories.
- B. Provide time-current-characteristic curves for all phase overcurrent devices rated 100 amperes or more and for all ground fault protective devices.

1.4 QUALITY ASSURANCE

- A. Panelboards shall be supplied and installed in strict conformance with NFPA 70, National Electrical Code.
- B. Products supplied under this Section shall comply with applicable requirements of UL standards pertaining to panelboards, overcurrent devices, enclosures, and cabinets. Completed assemblies shall be UL listed and labeled.

PART 2 - PRODUCTS**2.1 PANELBOARDS**

- A. Acceptable manufacturers are listed below:
 - 1. Square D
 - 2. Eaton/Cutler Hammer
 - 3. General Electric (i.e., GE)
- B. Panels shall be of the circuit breaker type, and shall have capacity and arrangement as shown on the panel schedules or one-line diagram.
- C. Branch circuit breakers shall be bolt-on type and shall be of the ambient compensated, thermal magnetic type, which will provide inverse time delay overload, and instantaneous short circuit protection. Branch circuit breakers shall have one, two or three poles as designated on the panel schedule. No circuit breakers utilizing handle ties for two or three pole operation shall be acceptable. Voltage and current ratings shall be as indicated on the drawings.
- D. Refer to panel schedules on drawings for exact circuit breaker arrangements and interrupting capacities. Provide circuit breakers UL listed as type HACR for air conditioning equipment branch circuits.
- E. Main breakers and branch breakers shall have the same minimum ampere interrupting capacity. Series rating shall not be acceptable.
- F. Provide a typewritten directory for each panel, placed inside the panel door. The directory shall list all rooms served by each breaker, using the "Owner's" room numbers. Directories shall be installed in a metal directory frame under glass or minimum 0.03 (.75 mm) inch thick clear non-yellowing plastic. Spares and spaces shall be written in pencil.

- G. All circuit breakers which serve time clocks, telephone and communication equipment, refrigerators, exit signs, emergency circuits, fire alarm, security, and other miscellaneous control devices shall be equipped with mechanical handle locking devices.
- H. Where panels contain contactors, the contactors shall be mounted behind a hinged, locking door. Contactor section shall be below the circuit breaker section unless otherwise noted. Provide all required barriers. Contactors shall conform to the requirements of Division-26 Section, Disconnects, Switches and Contactors.
- I. Each panel shall be equipped with a ground bus, adequate for feeder and branch circuit equipment grounding conductors; bonded to box.
- J. Each panel and cabinet and the units comprising same shall bear the manufacturer's nameplate and the UL label. Panelboards used for service entrance equipment shall be UL Service Entrance rated/labeled.
- K. All single-phase, three-wire and three-phase, four-wire panels shall be equipped with a fully rated neutral bar. The neutral bar shall be sized to accommodate oversized neutral conductors where oversized neutral conductors are indicated on the Drawings.
- L. All bus shall be copper
- M. Cabinet and trim shall be of code gauge steel (minimum) with 4" (100 mm) (minimum) wiring gutter all around. All panelboards shall be equipped with a hinged, locking door and hinged trim. Two (2) keys shall be furnished with each cabinet, and all locks on all cabinets shall be keyed alike. Provide door-in-door panel cover.
- N. Where panels occur adjacent to one another in finished spaces, cabinets and doors for each panel shall be of the same height.
- O. Panelboards shall be painted with gray over rust preventive primer.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Mount panels in locations shown, making sure that code-required clearances exist.
- B. Where cabinets cannot be set fully flush due to shallowness of partition, trim protruding sides with approved metal or hardwood molding, fastened to cabinet so as to conceal intersection of wall and cabinet.
- C. If paint is damaged during shipping or installation, damaged portion shall be sanded smooth and entire panel repainted.
- D. Provide five (5) spare 3/4" (19 mm) conduits stubbed into accessible ceiling spaces above and below each flush mounted panel.
- E. Load Balancing: After substantial completion, but not more than 60 days after final acceptance, measure load balancing and make circuit changes.
 - 1. Measure loads during periods of normal system loading (coordinate with Owner).
 - 2. Perform load balancing circuit changes outside normal occupancy/working schedule of the Owner at time directed by Owner's representative.
 - 3. After circuit changes are completed, recheck loads during normal load period. Record all load readings before and after changes and submit test results.
 - 4. Tolerance: Difference exceeding 20 percent between phases within a panelboard is not acceptable. Rebalance and recheck as necessary to meet this requirement.

END OF SECTION 26 24 16

SECTION 26 27 26 - WIRING DEVICES**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. The Drawings and Division-26 Section, "Basic Electrical Materials and Methods", apply to this Section.
- B. The requirements for outlet boxes and device enclosures are provided in Division-26 Section, "Boxes, Fittings and Cabinets".

1.2 SUMMARY

- A. The Contractor shall furnish and install all wiring devices indicated on the Drawings or specified herein.

1.3 SUBMITTALS

- A. Provide product data for each type of wiring device specified.

1.4 QUALITY ASSURANCE

- A. All products and the installation of all products shall comply with NFPA 70, "National Electrical Code."
- B. Wiring devices shall be listed and labeled by UL and shall confirm to the latest UL and NEMA standards pertaining to wiring devices.

PART 2 - PRODUCTS**2.1 WIRING DEVICES**

- A. All wiring devices shall be Specification Grade.
- B. Wiring devices shall be ivory in color unless otherwise indicated.
- C. Convenience receptacles shall be duplex, grounding type, 20A, 2P, 3W, 125V, NEMA 5-20R, straight blade, nylon or high-strength thermoplastic material.
- D. Safety receptacles (tamper-resistant) shall be flush, specification grade, grounding type, 20A, 2P, 3W, 125VAC, NEMA 5-20R, straight blade, nylon or high-strength thermoplastic material unless indicated as special purpose outlet. Receptacles shall be designed to accept standard two-wire parallel connector caps and shall grip both sides of the connector wire. Receptacles shall utilize dual shutter system to prevent insertion of foreign objects.
- E. Convenience receptacles serving bathrooms, toilets, garages, piers, pools, fountains, outdoor and wet locations, and construction sites shall be of the ground fault interrupter type, duplex, grounding type, 20A, 2P, 3W, 125V, NEMA 5-20R, straight blade, nylon or high-strength thermoplastic material. Ground fault interrupter type receptacles (15 and 20 amp branch circuits) shall not be required in commercial kitchens when associated branch circuit is protected by a ground fault interrupter type circuit breaker.
- F. Convenience receptacles located in wet locations shall be of the ground fault interrupter, weather resistant type, duplex, grounding type, 20A, 2P, 3W, 125V, NEMA 5-20R, straight blade, nylon or high-strength thermoplastic, corrosion resistant material.
- G. Automatically controlled receptacles shall be labeled as required by NEC article 406.3 (E).
- H. Clock receptacles shall be single, grounding and hanger type, 15A, 2P, 3W, 125V, NEMA 5-15R, straight blade, nylon or high-strength thermoplastic material with stainless steel plate.
- I. Single throw toggle switches shall be quiet type rated 20A, 1P, 120/277 VAC.
- J. Single throw lighted toggle switches shall be quiet type rated 20A, 1P, 120/277 VAC, illuminated red polycarbonate handle. Handle shall glow when switch is on.

- K. Key operated light switches shall be rated 20A, 1P, 120/277 VAC, gray toggle cover, with two (2) keys furnished for each switch. All switches shall operate from the same key.
- L. Three-way toggle switches shall be quiet type rated 20A, 120/277 VAC. Switches shall be positive-action type and shall not permit a maintained neutral position.
- M. Four-way toggle switches shall be quiet type 20A, 120/277 VAC. Switches shall be positive-action type and shall not permit a maintained neutral position.
- N. Photo control relays shall be as specified in Division-26 Section, Lighting Fixtures.
- O. Wall plates for switches, receptacles, etc. in indoor dry areas, shall be satin finish stainless steel Type 302 for concealed raceways; and zinc-coated sheet steel or cast metal having round or beveled edges, for exposed raceways. Install galvanized steel wallplates in unfinished spaces.
- P. Wallbox Dimmers and Switches:
 - 1. All devices shall be UL listed specifically for the required loads (i.e., incandescent, fluorescent, low voltage, electronic low voltage). Manufacturer shall provide file card upon request. Universal dimmers shall not be acceptable.
 - 2. All dimmers and switches shall incorporate an air gap, which shall be accessible without removing the faceplate. The air gap switch shall be capable of meeting all applicable requirements of UL 20 and UL 1472 for air gap switches in incandescent dimmers. All dimmers and switches shall provide power failure memory. Should power be interrupted and subsequently returned, the lights will come back on to the same levels set prior to the power interruption. Restoration to some other default level is not acceptable.
 - 3. Dimmers and switches shall meet ANSI/IEEE Standard C62.41-1980, tested to withstand voltage surges of up to 6000V and current surges of up to 200A without damage.
 - 4. Dimmers and switches shall meet the UL 20 and UL 1472 limited short circuit test requirement for snap switches.
 - 5. Dimmer control shall be linear slide. Dimmer shall provide a smooth and continuous Square Law dimming curve.
 - 6. Dimmer shall be voltage regulated so that a +10% variation in line voltage shall cause not more than a +5% variation in load voltage when dimmer is operating at 40V (5% light output).
 - 7. Dimmers shall utilize a LC filter network to minimize interference with properly installed radio, audio and video equipment.
 - 8. Dimmer control slider shall be captured.
 - 9. Faceplate shall snap onto device with no visible means of attachment. Heat fins shall not be visible on front of device. At locations with multiple devices, one (1) seamless, multi-gang faceplate shall be provided. Contractor is responsible for coordination of proper backbox size and faceplate type.
 - 10. Dimmers, switches and faceplates shall be Lutron Nova T style, or approved equivalent.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install wiring devices and accessories as indicated, in accordance with manufacturer's written instructions, applicable requirements of NEC and in accordance with recognized industry practices to fulfill project requirements.
- B. Coordinate with other work, including painting and installation of electrical boxes and wiring.
- C. Install wiring devices only in electrical boxes which are clean; free from building materials, dirt, and debris.
- D. Install wiring devices after wiring work is completed.
- E. Install wallplates after painting work is completed.
- F. Install telephone/power service poles in accordance with final furnishing arrangement plan, plumb, true, and secure.

- G. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for wiring devices. Where manufacturer's torqueing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Standard 486A. Use properly scaled torque indicating hand tool.
 - H. Protect installed components from damage. Replace damaged items prior to final acceptance.
 - I. Provide weatherproof, in-use covers for all receptacles located in wet locations per NEC 406.9(B).
- 3.2 TESTING
- A. Prior to energizing circuits, test wiring for electrical continuity and short-circuits. Ensure proper polarity of connections is maintained. Subsequent to energizing, test wiring devices and demonstrate compliance with requirements, operating each operable device at least six (6) times.
 - B. Test ground fault interrupter operation with both local and remote fault simulations in accordance with manufacturer recommendations.

END OF SECTION 26 27 26

SECTION 26 27 36 - ELECTRICAL CONNECTIONS**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. The Drawings and Division-26 Section, "Basic Electrical Materials and Methods", apply to this Section.

1.2 SUMMARY

- A. The Contractor shall provide electrical connections to and between all equipment indicated on the Drawings and Schedules and in the Specifications.
- B. Electrical connections shall be provided for, but not limited to, electrical heaters; lighting fixtures; motors; motor starters and controllers; electrical distribution equipment; converters, rectifiers, transformers, and inverters; and communication, computer, clock, intercom, telephone, security, fire alarm and video systems.
- C. Unless otherwise specified, the Contractor shall, under this Section, mount and align all starters, control devices, safety switches and other related equipment whether specified in this or other Sections of the specifications, except where such items are factory mounted on the driven equipment. The mounting and alignment of starters and control devices for the automatic temperature control system are included in the Sections in which the equipment is specified.
- D. Unless otherwise specified, the Contractor shall, under this Section of the specifications, provide all wiring, including conduit, wire, junction boxes, disconnecting switches, overcurrent protection, etc., not specified elsewhere in this specification, to and between all motors, starters, control devices and related electrical equipment, whether specified in this or other Sections of this specification, except where such items are factory wired, as well as factory mounted on the driven equipment.
- E. Wiring for the automatic temperature control system is specified in other Sections of the specification.
- F. Unless otherwise specified, all wiring to motors, control equipment and related electrical equipment, shall be installed in conduits with flexible metal conduit connections utilized for final motor connections. Flexible conduits shall be large enough to accommodate motor feeder, ground conductors and control wires, whether or not so indicated on the drawings. Flexible conduits shall be limited to a maximum length of 6'-0" (1800 mm-0 mm).
- G. The drawings are diagrammatic. It is imperative that the contractor obtain exact rough-in information for all equipment well in advance of actual installation to provide coordination for his and other trades.

1.3 SUBMITTALS

- A. Submit product data for all materials and components used for electrical connections.

1.4 QUALITY ASSURANCE

- A. All materials and components and the installation of all materials and components shall comply with the requirements of the following standards:
 - 1. NFPA 70 "National Electrical Code"
 - 2. IEEE Standard 241 "IEEE Recommended Practice for Electric Power Systems in Commercial Buildings"
 - 3. Applicable standards of ANSI/IEEE and NEMA pertaining to the products and installation of products for electrical connections
 - 4. UL Standard 486A "Wire Connectors and Soldering Lugs for Use with Copper Conductors"

- B. All materials and components shall be listed and labeled by UL or ETL.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Provide all materials and components required for complete splices and terminations of all circuits. All wiring shall be spliced and terminated using lugs and/or terminal blocks, except as permitted elsewhere in these Specifications.
- B. All splices in branch circuit wiring rated 600 volts and less, except as permitted elsewhere in these Specifications, shall be made using compression type lugs specifically designed for the type, size and rating of the conductor. The lugs shall be installed using a tool specifically designed for the purpose.
- C. Splices in copper branch circuit wiring for sizes #12 and #10 AWG may be made with non-tool, pre-insulated, molded wire connectors with integral self-locking spring grip.
- D. All terminations of feeders and branch circuit wiring rated 600 volts or less, except as noted elsewhere in these specifications, shall be made using mechanical clamp-type set-screw lugs. Lugs which incorporate direct contact between the set-screw and the conductor shall not be permitted.
- E. Tapes:
1. Self-adhesive tapes shall be used to insulate conductor splices. Terminations shall be in conformance with the following standards:
 - a. 600 Volts, Nominal and Less: UL 510, ASTM D-2754, ASTM D-3005, and ASTM D-4388.
 - b. 600 Volts through 69 Kilo Volts: ASTM D-4388 and IEEE 48.
 2. Vinyl plastic electrical tape shall be used for all terminations and splices of conductors for circuits of 600 volts nominal and less, except terminations in motor terminal boxes, transformer terminations, lighting and all heat producing equipment terminations. Terminations of the equipment listed herein shall be insulated with pressure sensitive glass cloth tape.
 3. Ethylene propylene rubber (EPR) high voltage insulating tapes with liner shall be used for all splices and terminations over 600 volts nominal. The tapes shall be included a standard component of the manufacturer's compiled high voltage splice termination kits. All splices and terminations of 5 kV and 15 kV cables shall be accomplished with high voltage splice and termination kits only.
 4. Tapes and high voltage splice and termination kits shall be the standard product of 3M Corporation, Plymouth Rubber Company, Inc. or approved equivalent.
- F. Special lugs may be required to accommodate the size and number of conductors shown on the Drawings. The Contractor shall verify lug requirements for all circuit breakers and equipment terminals and shall provide correct lugs as required.
- G. Pre-insulated solderless ring or spade type crimp connectors and terminals shall be used for all alarm and control circuits.
- H. All connectors and terminals shall be of the proper size and ampacity, material and type for the application and service.

2.2 RACEWAYS AND FITTINGS

- A. The Contractor shall provide raceways and fittings of the types, sizes, and finish indicated for each type of service. Where the type of raceway is not specified, the Contractor shall provide and install a raceway of proper selection as determined by the installer to fulfill the wiring and equipment connection requirements and comply with NEC requirements for raceways.
- B. All raceways and fittings and the installation of all raceways and fittings shall comply with the requirements of these Specifications.

PART 3 - EXECUTION**3.1 INSPECTION**

- A. The Contractor shall inspect the area where electrical connections are to be installed. The installation of electrical connections shall not be permitted until site conditions are satisfactory.

3.2 INSTALLATION

- A. The Contractor shall install all electrical connections in accordance with the manufacturer's written instructions using recognized industry practices.
- B. Power, control, data, signal and communication circuits shall be connected to equipment in accordance with the manufacturer's wiring diagrams. The Contractor shall be fully responsible for the correct termination and interface of all electrical connections.
- C. Splices shall be insulated with tape which provides an insulation rating which meets or exceeds the insulation rating of the conductor. All outdoor splices shall be made watertight using tapes and sealants specifically designed and listed for outdoor applications.
- D. Wiring devices shall not be used as splices.
- E. Electrical connections shall be tightened in accordance with equipment manufacturer's published torque tightening values. The installer shall use proper tools which shall include torque screwdriver, torque wrench, and ratchet wrench with adjustable torque settings.
- F. UL Standard 486A torque tightening values shall be used when manufacturer's published tightening values are not available.

3.3 TESTING

- A. All electrical connections shall be tested to ensure electrical continuity and compliance with these Specifications.
- B. The Contractor shall demonstrate to the Owner or Engineer that a random selection of electrical connections has been tightened in accordance with the manufacturer's published torque tightening values.

END OF SECTION 26 27 36

SECTION 26 28 16 - DISCONNECTS, SWITCHES AND CONTACTORS**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. The Drawings and Division-26 Section, "Basic Electrical Materials and Methods", apply to this Section.

1.2 SUMMARY

- A. The Contractor shall furnish and install circuit and motor disconnect switches, remote control switches and magnetic contactors where indicated on the Drawings and where required by the National Electrical Code, local codes and the authority having jurisdiction.

1.3 SUBMITTALS

- A. Provide product data for each type and rating of circuit and motor disconnect switch.

1.4 QUALITY ASSURANCE

- A. Circuit disconnects and motor disconnect switches and the installation of same shall comply with the requirements of NFPA 70, "National Electrical Code."
- B. Circuit and motor disconnect switches shall be listed and labeled by UL.

PART 2 - PRODUCTS**2.1 CIRCUIT AND MOTOR DISCONNECT SWITCHES**

- A. Switches shall be constructed in accordance with the latest editions and revisions of NEMA Standard KS-1, Federal Specification W-S-685C, and Underwriters' Laboratories Standard 98.
- B. Switches shall be fusible or non-fusible as indicated on the Drawings, or as required by the equipment served, horse-power rated, quick-make, quick-break, heavy-duty type with integral arc suppressors. The handle shall be part of the enclosure, not the cover.
- C. Fused switches and fuses shall have a minimum integrated interrupting rating of 100,000 amperes RMS symmetrical.
- D. Switches used for service entrance shall be service rated and bear the U.L. service entrance label.
- E. Switches shall have general purpose surface mounted NEMA type 1 or 3R enclosures as indicated or required by locations. All enclosures shall be designed to permit padlocking in the "open/off" position.
- F. Fused switches for motor applications shall be furnished with UL listed dual-element Class RK-1 time delay fuses rated 600 volts. Fuse current ratings shall be as indicated on the Drawings or in accordance with the motor manufacturer's recommendations when specific sizes are not specified on the Drawings.

2.2 REMOTE CONTROL SWITCHES

- A. Remote control switches shall be electrically operated, mechanically held. The main contacts shall be power driven to both the open and closed positions. Operating mechanisms which rely on gravity or permanent magnets shall not be used.
- B. The contacts and operating mechanism shall be enclosed by an insulated cover. A safe manual operator shall be provided to either open or close the switch.

- C. The main contacts shall be silver alloy composition and shall be protected by arcing contacts on sizes 600 amperes and above. Auxiliary contacts shall be rated 10A, 120 VAC. Provide one normally open and one normally closed auxiliary contact.
- D. Contacts, power and control connections, coils, and arc chutes shall be accessible and serviceable from the front.
- E. The remote control switches shall be rated in amperes for a total system load including motors, lighting ballasts, and resistive and tungsten filament lamp loads.
- F. Remote control switches shall be individually enclosed or panelboard mounted as indicated on the drawings. Enclosures shall comply with the requirements of Division-26 Section, "Boxes, Fittings and Cabinets."
- G. Remote control switches shall have a UL listed withstand current rating equal to or exceeding the available short-circuit current at the location where the switch is to be installed.
- H. The remote control switch shall be arranged for two-wire control from a maintained type control switch. All controls and modules, with the exception of the control switch, shall be located in the same enclosure with the remote control switch.

2.3 MAGNETIC CONTACTORS

- A. Magnetic contactors shall be electrically operated, mechanically held.
- B. The contacts and operating mechanism shall be enclosed by an insulated cover.
- C. The main contacts shall be silver alloy composition and shall be protected by arcing contacts on sizes 600 amperes and above. Auxiliary contacts shall be rated 10A, 120 VAC. Provide one normally open and one normally closed auxiliary contact.
- D. Contacts, power and control connections, coils, and arc chutes shall be accessible and serviceable from the front.
- E. Contactors shall be rated in amperes for a total system load including motors, lighting ballasts, and resistive and tungsten filament lamp loads.
- F. Contactors shall be individually enclosed or panelboard mounted as indicated on the Drawings. Enclosures shall comply with the requirements of Division-26 Section, "Boxes, Fittings and Cabinets."
- G. Contactors shall have a UL listed withstand current rating equal to or exceeding the available short-circuit current at the location where the switch is to be installed.
- H. The contactor shall be arranged for two-wire control. All controls and modules, with the exception of control switches, push buttons and pilot lights shall be located in the same enclosure with the contactor.

2.4 CONTROLS

- A. Push buttons shall be momentary contact, heavy duty, oiltight with legend plate. Buttons shall be fully guarded and shall be red in color.
- B. Selector switches shall be two position, heavy duty, oiltight with legend plate.
- C. Contact blocks shall be provided as required for all push buttons and switches. Contacts shall have a 10 ampere continuous current rating at 120 VAC or 120 VDC except where indicated otherwise.
- D. Pilot lights shall be heavy duty, oiltight with legend plate. Pilot lights shall utilize incandescent lamps designed for high brightness applications. Lens shall be acrylic fresnel type of the color specified.
- E. Control stations shall be recessed with sufficient space to accommodate operators as required. Provide stainless steel NEMA 1 flush cover plates.
- F. Fuel-fired equipment (for boilers, water heaters, etc.) emergency shut-off switches:

1. Provide an empty device box and $\frac{3}{4}$ " empty conduit from each switch location to the equipment control panel.
2. Switch locations shall be at the interior and exterior of the room unless indicated otherwise by the authority having jurisdiction (AHJ). Verify exact locations with the Div.23 contractor prior to installation of boxes and raceway.

2.5 ACCESSORIES

- A. Provide electrical interlocks where indicated on the Drawings.
- B. Provide one normally open and one normally closed auxiliary contact on each switch. Auxiliary contacts shall be rated 10A, 120 VAC.
- C. Fused disconnects and switches shall be provided with integral built-in fuse pullers arranged to facilitate fuse removal.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Switches shall be coordinated with the equipment to provide switches to suit the particular equipment characteristics and requirements.
- B. Provide fusible switches for all equipment labeled for and/or requiring fuse protection.
- C. Switches shall be installed in accordance with manufacturer's published instructions.
- D. Provide three (3) spare fuses of each type and rating furnished for this project. Deliver spare fuses to the Owner's place of storage.

3.2 TESTING

- A. Prior to energizing circuits and switches, test wiring for electrical continuity and short-circuits.

END OF SECTION 26 28 16

SECTION 26 29 13 - MOTOR CONTROLLERS**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. The Drawings and Division-26 Section, Basic Electrical Materials and Methods, apply to this Section.

1.2 SUMMARY

- A. Furnish and install motor controllers where indicated on the Drawings, where required by the Contract Specifications, and where required for the control and protection of motors as necessary for a complete installation. The work of this section also includes the installation of motor controllers provided by Division 23.

1.3 SUBMITTALS

- A. Submit shop drawings and product data for all motor controllers.
- B. Submittals shall include equipment dimensions, power and control wiring diagrams, component descriptions, calculations where required and ratings, and a list of recommended spare parts.
- C. Complete operating and maintenance manuals shall be provided which include technical data sheets, wiring diagrams and information for ordering replacement parts.
- D. The manufacturer shall submit a copy of the specifications with each sub-paragraph noted with the term, "compliance", "deviation", or "alternate".
 - 1. By noting the term "compliance" it shall be understood that the manufacturer is in full compliance with the item specified and will provide exactly the same with no deviations.
 - 2. By noting the term "deviation" it shall be understood that the manufacturer prefers to provide a different component in lieu of that specified. Manufacturer shall indicate all deviations.
 - 3. By noting the term "alternate" it shall be understood that the manufacturer proposes to provide the same operating function but prefers to do it in a different manner. Any alternate shall be fully described as to what the manufacturer proposes to provide.

1.4 QUALITY ASSURANCE

- A. Motor controller components and assemblies shall be furnished and installed in accordance with NFPA 70, National Electrical Code, and shall conform to the requirements of UL 845 and applicable sections of NEMA and ANSI/IEEE standards.
- B. Motor controllers and motor control centers shall be listed and labeled by Underwriters' Laboratories or a Nationally Recognized Testing Laboratory (NRTL).
- C. Source Limitations: Obtain Motor Controllers through one source from a single manufacturer.

PART 2 - PRODUCTS**2.1 FRACTIONAL HORSEPOWER STARTERS**

- A. Fractional horsepower manual starters shall be used for single phase motors except where indicated. Single phase starters shall provide across the line starting and overload protection. Single pole and double pole starters shall be used as required and shall be rated not less than 1 horsepower.
- B. Single phase manual starters shall feature snap action double-break contacts, motor running indicating light and trip free melting alloy overload elements selected for the specific motor application.

- C. Single phase manual starters located in mechanical and electrical rooms shall be installed in NEMA 1 general purpose enclosures. Starters located outdoors or in wet locations shall be installed in NEMA 4 watertight enclosures. Starters located in finished areas shall be installed in a flush outlet box and furnished with a stainless steel plate.
- D. Manual motor starters shall be toggle-type and shall be arranged so they may be locked with a padlock in the OFF position.

2.2 COMBINATION STARTERS

- A. Combination motor starters shall be provided with an integral motor circuit protector specifically designed for motor applications. The MCP shall have a continuous current rating in accordance with NEC Article 430 and shall provide adjustable short-circuit trip settings. The MCP shall have a minimum short-circuit rating of 42,000 amperes at 480 volts.
- B. An external operating handle for the MCP shall be provided. The handle shall clearly indicate the position of the MCP and shall be padlockable in the OFF or OPEN position. Interlocks shall be provided to prevent opening the door when the external operating handle is in the ON or CLOSED position. An interlock defeater shall be provided for use by authorized personnel.
- C. Magnetic-type motor starters shall be used for single phase motors where indicated and for all three phase motors.
- D. Starters shall be full voltage non-reversing (FVNR) or reduced voltage type as indicated on the Drawings. Starters shall utilize three temperature compensated bimetallic overload relays factory set for the specific motor application. Overload relays shall be field adjustable plus or minus 15 percent of the rated trip current. Solid state overload relays are acceptable.
- E. Starters shall be furnished with the following accessories:
 - 1. Hand-off-auto selector switch.
 - 2. Green pilot light to indicate power available to the starter but motor not on.
 - 3. Red pilot light to indicate motor running.
 - 4. Transformer for 120 volt control power (fused primary and secondary).
 - 5. Overload trip indicator and reset.
 - 6. Undervoltage monitor and release.
 - 7. Coils rated 120 volts A.C.
 - 8. Two (2) normally open and two (2) normally closed auxiliary contacts for customer use.
- F. Reduced Voltage Starter:
 - 1. Solid state starters shall be provided with Class 20 electronic overload and phase loss, current unbalance, undervoltage and overtemperature protection.
- G. Starters shall be capable of withstanding the let-through short-circuit current of the protective device. Current limiters shall be provided when required to achieve adequate protection from high short-circuit currents.
- H. Where the Drawings indicate individual enclosures for starters, the starters shall be provided in NEMA type 1 enclosures except when noted otherwise on the Drawings. Outdoor starters shall be in NEMA 3R enclosures.
- I. Starters to be installed in motor control centers shall conform to these specifications and the section pertaining to motor control centers.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install motor starters, controllers and motor control centers as indicated on the Drawings, in strict accordance with the manufacturer's written instructions, and in compliance with recognized industry practices.
- B. Install fuses or current limiters when required by the equipment specifications.

- C. Tighten connections and terminations in accordance with the manufacturer's published torque tightening values or in accordance with UL Standard 486A and B when manufacturer's values are not indicated.
- D. Prior to energizing equipment, check power and control wiring for correct installation. After energizing equipment, check each motor for proper phase rotation, correct where necessary, and demonstrate operation of starter and accessories.
- E. Set all MCPs in accordance with manufacturer's instructions. Set all overloads in accordance with motor manufacturer instructions.

END OF SECTION 26 29 13

SECTION 26 51 00 - LIGHTING FIXTURES (LED)**PART 1 - GENERAL****1.1 SUMMARY**

- A. This section provides general requirements for a complete and fully operational lighting system including:
 - 1. Interior lighting fixtures
 - 2. Exterior lighting fixtures
 - 3. LED modules
 - 4. Drivers
 - 5. Accessories
 - 6. Light fixture support

1.2 RELATED SECTIONS

- A. Basic Materials and Methods
- B. Wiring Devices
- C. Grounding
- D. Supporting Devices

1.3 REFERENCES

- A. The Work under this section is subject to requirements of the Contract Documents including the General Conditions, Supplementary Conditions, and Sections under Division-01 General Requirements.
- B. Conform to Reference Standards by date of issue current on date of Contract Documents, except where a specific date is established by code.
 - 1. ANSI/NFPA 70 National Electrical Code
 - 2. NFPA 101 Life Safety Code
 - 3. UL 57 Electrical Luminaires
 - 4. UL 496 Lampholders
 - 5. UL 924 Emergency Lighting and Power Equipment
 - 6. UL 1472 Solid-State Dimming Controls
 - 7. UL 773 Plug-In Locking Type Photo controls for Use with Area Lighting
 - 8. UBC Standard Section 47.1813 Luminaires
 - 9. IES LM-79 Electrical and Photometric Measurements of Solid State Lighting
 - 10. IES LM-80 Method for Measuring Lumen Maintenance for SSL Light Sources

1.4 SYSTEM DESCRIPTION

- A. The Lighting Fixture Schedule and catalog numbers indicated are a design series reference and do not necessarily represent the exact catalog number, size, voltage, wattage, lumen output, Color Rendering Index (CRI), color temperature (CCT), driver, finish trim, ceiling type, mounting hardware, or special requirements as specified or as required by the particular installations. Provide complete fixture to correspond with the features, accessories, lumen output, wattage and/or size specified in the text description of each fixture type. Additional features, accessories and options specified shall also be included to provide a complete and operable system.

- B. Provide all frames, supplementary support structures, hangers, spacers, stems, aligner canopies, auxiliary junction boxes and other hardware as required for a complete and proper installation. Recessed fixtures shall have frames that are compatible with the ceiling systems.
- C. Light fixture voltage shall match the voltage of the circuit serving the light fixture.

1.5 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.
- B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.
- C. Comply with applicable requirements of local codes and NEC Articles 220 and 410 as applicable to construction and installation of lighting fixtures.
- D. Comply with applicable NEMA, IES and UL standards. Lighting fixtures and components shall be UL listed and labeled.
- E. Comply with NFPA 70.
- F. Factory Mutual Global (FMG) Compliance: Lighting fixtures for hazardous locations shall be listed and labeled for indicated class and division of hazard by FMG.
- G. Luminaires, drivers, LED modules/sources and other components and controls shall equal or exceed the requirements of all applicable state and/or municipal energy codes.
- H. Designated manufacturers are listed to define the requirements for quality and function of the specified product. Equivalent or better products of other, unnamed manufacturers may be proposed for consideration by adhering to procedures set forth in this section and in other Division-01 specification sections.

1.6 SUBMITTALS

- A. Comply with requirements of specification section describing Submittal Procedures. Also, refer to the electrical specification section, Basic Materials and Methods, for re-submittal requirements.
- B. The authorized manufacturer's representative for the project area shall prepare submittals for each lighting fixture type. In addition to the fixture submittals, a list shall be provided identifying the manufacturer representative for each fixture type. Provide manufacturers' names, addresses, and telephone numbers.
- C. Light fixture submittals shall include the total fixture maximum input wattage, including driver and/or power supply losses for each and every fixture in one submittal package. This information shall be clearly indicated in the submittal. The lighting fixture submittal package will not be reviewed until this information is submitted as required. Input wattage shall not exceed the maximum allowable total input watt value shown in the lighting fixture schedule.
- D. Light fixtures shall be coordinated with project specific lighting control system devices. Provide a letter/statement in the lighting fixture submittal confirming that all lighting fixtures have been coordinated with the specific lighting control system devices that will be used on this project.
- E. Product Data shall indicate that light fixture, lumen output, CCT, CRI, driver, input watts, and controls fully comply with contract documents. Data shall be submitted for each type of light fixture indicated, arranged in order of fixture designation. For standard catalog fixtures provide original product catalog sheets indicating data on features, accessories, finishes, and the following:
 - 1. Materials and dimensions of luminaires.
 - 2. Photometric data, in IES format, based on certified results of laboratory tests of each light fixture type, outfitted with LED modules/sources, drivers, and accessories identical to those indicated for the light fixture as applied in the Project.

- a. Photometric data shall be certified by a qualified independent testing agency.
 - b. Photometric data shall be certified by a manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program (NVLAP) for Energy Efficient Lighting Products.
 3. Emergency lighting unit battery and charger.
 4. Low voltage transformers.
 5. LED drivers and power supplies.
 6. LED modules, including manufacturer, drive current, CRI, and CCT.
 7. Air and Thermal Performance Data: For air-handling light fixtures, furnish data required in "Submittals" Article in Division-23 Section "Air Outlets and Inlets."
 8. Sound Performance Data: For air-handling light fixtures, indicate sound power level and sound transmission class in test report certified according to standards specified in Division-23 Section "Air Outlets and Inlets."
 - F. Shop Drawings shall:
 1. Show details of nonstandard or custom fixtures.
 2. Indicate dimensions, weights, method of field assembly, components, features, and accessories.
 3. For custom fixtures, modified fixtures, or linear fixtures mounted in continuous rows, submit scaled drawings prepared by the manufacturer showing all details of construction, lengths of runs, pendant and power feed locations, accessories, finishes, and lists of materials.
 4. Contractor to provide the manufacturer with accurate field dimensions where required.
 5. Include wiring diagrams, power and control wiring.
 - G. Wiring Diagrams shall detail wiring for fixtures and differentiate between manufacturer-installed and field-installed wiring.
 - H. Product Certificates shall be signed by manufacturers of lighting fixtures certifying that products comply with requirements.
 - I. Dimming Driver Compatibility Certificates shall be signed by the manufacturer of driver certifying that drivers are compatible with dimming systems, equipment and controls with which they are used. Product certificates signed by the product manufacturer shall be provided for each type of driver for bi-level and dimmer controlled fixtures.
 - J. Provide confirmation of approval by both the manufacturer of dimming LED fixtures and manufacturer of dimming control components that their products will meet specified performance criteria and warranty when used together.
 - K. Maintenance Data shall be provided for lighting fixtures and equipment to include in emergency, operation, and maintenance manuals specified in specifications section describing Operations and Maintenance Data.
 - L. Field quality control test reports.
 - M. Special Warranties specified in this Section.
 - N. Review of luminaire submittals which indicate voltage, mounting condition, or quantities shall not be considered to be approval of said voltage, mounting condition, or quantities. Contractor shall field verify voltage and actual mounting condition and method.
 - O. Product samples, complete with housing, trim, LEDs, and 8' cord with plug wired for 120V operation shall be submitted if requested.
- 1.7 SUBSTITUTIONS
- A. Substitutions shall include all information required under in paragraph 1.06 - SUBMITTALS. Provide the name of at least one installation where each proposed substitute has been installed for at least six months. Provide the name and telephone number of the Architect, Owners' Representative, and Lighting Designer or Engineer of record.

- B. Equipment delivery lead time shall not be held as a valid reason for submitting a luminaire substitution. It shall be the sole responsibility of the Contractor to determine necessary equipment lead times, deliver submittals for review in a timely fashion, and place orders accordingly to ensure timely delivery.
- C. Submittal for Product Substitutions: All products submitted which are other than the make and model called out in the Construction Documents are considered "Substitutions". The Contractor must submit the following for all substitutions:
 - 1. Provide cut sheet/product data for substitute item, including list price.
 - 2. Provide cut sheet/product data for specified item, including list price.
 - 3. Provide point-by-point photometric calculations using the substitute light fixture(s) for the entire project area or portions thereof as directed by the Engineer. The Contractor is responsible for contacting the Engineer to obtain the required calculation parameters. Point spacing, total light loss, work plane height, and other parameters shall be provided upon request in order to match the Engineer's photometric model. Submittal review will be withheld until photometric calculations for substitutions are received.
 - 4. When requested by the Engineer, provide a light fixture sample of the specified fixture and the substitute fixture for comparison. Samples shall be complete with cord/plug for 120V operation.
 - 5. It is the Contractor's responsibility to prove that substitutes are "equal".
 - 6. Confirm that controls are compatible with substitute light fixtures.
 - 7. Confirm that energy code requirements are met when using the substitute fixtures.
 - 8. Redesign is the responsibility of the contractor.
- D. A maximum of one substitution requests shall be reviewed for any single fixture type. If a substitution has not been approved following this process, the Contractor shall provide the specified fixture.

1.8 COORDINATION

- A. Coordinate layout and installation of light fixtures with ceiling system and other construction that penetrates ceilings or is supported by them including mechanical system, fire suppression, AV, and partition assemblies.
- B. Provide all frames, supplementary support structures, hangers, spacers, stems, aligner canopies, auxiliary junction boxes and other hardware as required for a complete and proper installation. Recessed fixtures shall have frames that are compatible with the ceiling systems.
- C. Coordination Meetings: Meet at least twice with the ceiling installer. Hold first meeting before submittal of shop drawings to coordinate each light fixture mounting condition with ceiling type. During second meeting, coordinate fixture layout in each area. Meet at least twice with the mechanical systems installer prior to fabrication and installation of ductwork. Coordinate depth and location of all light fixtures and ductwork in all areas.

1.9 WARRANTY

- A. General Warranty: Special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Special Warranty for LED Lighting Fixtures: A warranty must be provided by the manufacturer made out to Owner for luminaires, covering repair or replacement of defective electrical parts (including light engine, driver and power supplies) within specified warranty period indicated below.
 - 1. Warranty Period: Five years from date of Substantial Completion.

1.10 EXTRA MATERIALS

- A. Contractor shall include 2 exit light fixtures, in addition to the fixtures shown on the drawings, inclusive of associated labor and material to install after final walk-thru. Devices shall be installed in locations as directed by Fire Marshal, or any AHJ, or the owner, or the Architect/Engineer, and shall include all cutting, patching and finishing of walls. All unused fixtures shall be turned over to the owner for use as spares.
- B. Contractor shall include 2 emergency light fixtures inclusive of associated labor and material to install after final walk-thru. Devices shall be installed in locations as directed by Fire Marshal, or any AHJ, or the owner, or the Architect/Engineer, and shall include all cutting, patching and finishing of walls. All unused fixtures shall be turned over to the Owner for use as spares.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Catalog series numbers shown on the Lighting Fixture Schedule on the drawings represent the type and style of fixture. The fixture size shall correspond with the actual length of the fixture as indicated on the drawings.
- B. Numbers are a design series reference and do not necessarily represent the exact catalog number, size, voltage, wattage, CCT, CRI, type of driver, finish trim, ceiling type, mounting hardware or special requirements as specified as required by the particular installations. Acceptable manufacturers and series numbers are listed. The manufacturer listed shall provide complete fixtures equaling or exceeding the written specifications. Verify these requirements and order fixtures as required for a complete and fully operational installation per the contract documents and per code.

2.2 GENERAL MATERIAL REQUIREMENTS

- A. Fixtures shall be free of light leaks while providing sufficient ventilation of LED sources to provide the required photometric performance. Drivers and transformers/power supplies shall be adequately vented.
- B. Lampholders shall hold lamps securely against normal vibration and maintenance handling.
- C. Light fixtures which require protective shielding shall be furnished with a tempered glass lens or approved unbreakable lens UL listed for the application.
- D. Metal parts shall be free from burrs, sharp corners, and edges. Metal work shall be free from tool marks and dents and shall have accurate angles bent as sharply as compatible with the gauges of the required metal. Intersections and joints shall be formed true and of adequate strength and structural rigidity to prevent any distortion after assembly. All miters shall be in accurate alignment with abutting intersection members.
- E. Sheet metal components shall be steel, unless otherwise indicated. Components shall be formed and supported to prevent warping and sagging. Luminaires to be painted after fabrication. Finish ferrous mounting hardware and accessories to prevent corrosion and discoloration to adjacent materials.
- F. Fixture hardware to comply with the following material standards: For steel and aluminum fixtures, all screws, bolts, nuts and other fastening and latching hardware shall be cadmium or equivalent plated. For stainless steel fixtures, all hardware shall be stainless steel. For bronze fixtures, all hardware shall be stainless steel or bronze.
- G. Doors, frames, and other internal access shall be smooth operating, and free from light leaks under normal operating conditions.
- H. Provide supplemental safety device or arrange doors, frames, lenses, diffusers, and other pieces to prevent accidental falling during maintenance and when secured in operating position. Safety devices shall be detachable if necessary and shall not interfere with fixture performance,

maintenance, or the seating of any fixture element. Safety device shall not be visible during normal fixture operation and from normal viewing angles.

- I. Luminaires provided must have means for disconnection from power during service, as required in the NEC Article 410.
- J. Reflecting Surfaces: Minimum reflectance as follows, unless otherwise indicated:
 - 1. White Surfaces: 90 %.
 - 2. Specular Surfaces: 90 %.
 - 3. Diffusing Specular Surfaces: 75 %.
 - 4. Laminated Silver Metalized Film: 90 %.
- K. Reflector cones shall adhere to the following criteria:
 - 1. Plastic material shall not be used for reflector cones, unless otherwise specified.
 - 2. Unless otherwise specified, cones shall not be permanently fastened to the housing or ceiling and shall be removable without tools. Retention devices shall not deform the cone or be visible from normal viewing angles.
 - 3. Trim shall be flush to the finished ceiling without gaps or light leaks. Where the flange trim is separate from the cone, it shall have the same finish as the reflector cone.
 - 4. Reflector cones shall be of uniform gauge, not less than 0.032" thick, high purity aluminum Alcoa 3002 alloy. Cones shall be free of spin marks or other defects.
 - 5. Manufacture cone using the Alzak process. Refer to the fixture schedule for cone color and finish (i.e. specular or diffuse) requirements.
- L. Lenses, Diffusers, Covers, and Globes shall be 100 % virgin acrylic plastic or annealed crystal glass, unless otherwise indicated.
 - 1. Plastic, polycarbonate and acrylic shall be UV stabilized and shall have high resistance to yellowing and other changes due to aging, exposure to heat and ultraviolet radiation.
 - 2. Lens Thickness shall be 0.125" (3 mm) unless other thickness is indicated.
 - 3. Lenses shall have uniform brightness throughout the entire visible area.
- M. Adjustable light fixtures shall have positive locking devices to fix the aiming angle.
- N. Each lighting fixture having an oval shape beam pattern or a spread lens that defines beam orientation shall contain locking devices to insure that orientation is not disturbed during future maintenance or cleaning.
- O. All fixtures and drivers must operate within the temperature limits of their design and as specified by Underwriters' Laboratories, Inc. in the applications and mounting conditions herein specified.
- P. Fixtures recessed in suspended ceilings where the space above the ceiling is either an air supply or return plenum shall conform to NEC Article 300-22.
- Q. Provide plaster frame for recessed light fixtures mounted in other than T-bar ceilings. Verify mounting with architectural reflected ceiling plan before ordering light fixtures.
- R. Provide wire guards where specified.
- S. For weatherproof or vaportight installations, painted finishes of fixtures and accessories shall be weather resistant enamel using proper primers or galvanized and bonded epoxy, so that the entire assembly is completely corrosion resistant for the service intended. Exterior finishes shall have an outdoor life expectancy of not less than 20 years without any visible rust or corrosion. Where aluminum parts come into contact with bronze or steel parts, apply a coating material to both surfaces to prevent corrosion.
- T. Fixtures for use outdoors or in areas designated as damp locations shall be suitably gasketed to prevent the entrance of moisture. Provide approved wire mesh screens for ventilation openings. Dissimilar metals shall be separated by non-conductive material to prevent galvanic action.
- U. Welding shall be done with electrodes and/or methods recommended by the manufacturers of the metals being welded. Welds shall be continuous, except where spot welding is specifically permitted. Welds exposed to view shall be ground flush and dressed smooth. All welds on or

behind surfaces which will be exposed to view shall be done so that finished surface will be free of imperfections such as pits, runs, splatter, cracks, warping, dimpling, depressions or other forms of distortion or discoloration. Remove weld spatter and welding oxides from all welded surfaces.

- V. Electromagnetic-Interference Filters shall be factory installed to suppress conducted electromagnetic-interference as required by MIL-STD-461E. Fabricate light fixtures with one filter on each driver indicated to require a filter.

2.3 LIGHT EMITTING DIODE (LED) FIXTURES

A. All Luminaires:

1. Comply with IES LM79 and IES LM80 LED product testing procedures, and DOE Energy Star criteria.
2. Luminaires shall not draw power in the off state. Luminaires with integral occupancy, motion, photo-controls, or individually addressable fixtures with external control and intelligence are exempt from this requirement. The power draw for such luminaires shall not exceed 0.5 watts when in the off state.
3. Color spatial uniformity shall be within .004 of CIE 1976 diagram.
4. Color maintenance over rated life shall be within .007 of CIE 1976.
5. White LED luminaires shall achieve a minimum CRI of 80, and R9 value above 24, and Binning of white LEDs used in the luminaires shall fall within a 3-step MacAdam ellipse minimum, or as indicated in the Lighting Fixture Schedule.
6. Luminaire manufacturers shall adhere to device manufacturer guidelines, certification programs, and test procedures for thermal management
7. LED package(s)/module(s)/array(s) used in qualified luminaires shall deliver at least 70% of initial lumens, when installed in-situ, for a minimum of 50,000 hours.

B. Power Supplies and Drivers:

1. Power Factor 0.90 or higher
2. Operating temperature: minimum of -20°C or below when used in luminaires intended for outdoor use.
3. Maximum driver case temperature not to exceed driver manufacturer recommended in-situ operation.
4. Output operating frequency: 120Hz.
5. Interference: EMI and RFI compliant with FCC 47 CFR Part 15.
6. Total Harmonic Distortion Rating: Less than 3%, or as specified in the Light Fixture Schedule.
7. Meet electrical and thermal conditions as described in LM-80 Section 5.0.
8. Primary Current: Confirm primary current with Electrical Drawings.
9. Secondary Current: Confirm secondary current specified by individual luminaire manufacturers.
10. Compatibility: Certified by manufacturer for use with individually specified luminaire and individually specified control components.
11. Solid-state control components to be integral or external per each specified luminaire. Remote control gear to be enclosed in Class 1, Class 2, or NEMA 3R enclosures as required.

C. Controller and Control System:

1. System electronics driver / controller to use coordinated communication protocols: DMX512, 0-10V, DALI, or proprietary as required
2. Contractor to ensure that external control equipment is compatible with LED control requirements
3. Provide connector types and wiring as appropriate for un-interrupted communication between devices, considering distance maximums, field obstructions, and accessibility. Ensure that connection points are optically isolated for system noise reduction.
4. For control components that are part of overall area control system see Electrical Dimming Controls specification.
5. For stand-alone controlled LED systems see the Lighting Fixture Schedule.

6. Compatibility: Certified by manufacturer for use with individually specified luminaire and individually specified power supplies and/or drivers.

2.4 EMERGENCY LIGHTING

- A. Provide self-contained battery inverter units where indicated on the Drawings and in the schedules. Emergency inverter units shall be internal, factory-mounted except where specifically noted otherwise.
- B. Batteries shall be sealed, spillproof, rechargeable, maintenance-free nickel cadmium or pure lead type.
- C. A solid state constant-current charger shall recharge batteries within twenty-four (24) hours of discharge and shall maintain batteries at a fully charged state during normal operation. A low-voltage disconnect shall prevent deep discharge of the batteries.
- D. The inverter unit shall operate for a period of no less than ninety (90) minutes upon a sustained drop in line voltage to 80 percent of nominal or below.
- E. A test switch and AC "ON" or unit-ready indicator shall be provided.
- F. Emergency light fixture shall have a minimum lumen output of 1000 lumens.
- G. Exit Signs: Clear or see-through, single-face exit signs, where lettering is visible from the reverse, shall be provided with mirror background inserts.

2.5 SELF-BALLASTED LED LAMPS

- A. Provide products manufactured by one of the following: Osram/Sylvania, General Electric, Philips, Ushio, Venture, or approved equal.
- B. All lamps of the same type are to be provided by the same manufacturer.
- C. Lamp each fixture with the proper quantity of lamps of the type specified in the Lighting Fixture Schedule.

2.6 WIRING

- A. All wiring shall be as required by code for fixture wiring.
- B. All flexible cord wiring between fixture components or to electrical receptacles and not in wireways shall have a minimum temperature rating of 105 degrees Celsius.
- C. Cords shall be fitted with proper strain reliefs and watertight entries where required by application.
- D. No internal wiring shall be visible at normal viewing angles.

2.7 FIXTURE SUPPORT COMPONENTS

- A. Comply with specification sections describing Basic Materials and Methods and Supporting Devices for fixture support and bracing.
- B. Where the ceiling is of insufficient strength to support the weight of the lighting fixtures, provide additional framing from building structure to support luminaires as required. Do not support fixtures from ceiling T-Bar system.
- C. Single-Stem Hangers shall be 1/2-inch steel tubing with swivel ball fitting and ceiling canopy. Finish shall be the same as the luminaire.
- D. Twin-Stem Hangers shall be two, 1/2-inch steel tubes with single canopy arranged to mount a single fixture. Finish shall be the same as the luminaire.
- E. Rod Hangers shall be 3/16-inch minimum diameter, cadmium-plated threaded steel rod.
- F. Wires shall be ASTM A 641/A 641M, Class 3, soft temper, zinc coated steel, 12 gauge.
- G. Wires for humid spaces shall be ASTM A 580/A 580M, composition 302 or 304, annealed stainless steel, 12 gauge.

- H. Hook Hangers shall be integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.
- I. Aircraft Cable Support shall use cable, anchorages, and intermediate supports recommended by fixture manufacturer.
- J. Hangers for Pendant Industrial Fixtures shall be heavy duty No. 8 jack chain with hangers, "S" hooks, mounting, straps, and all required accessories for complete installation.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Fixtures: Set level, plumb, and square with ceiling and walls, and secure according to manufacturer's written instructions and approved submittal materials.
- B. Mounting height indicated in drawings from finished floor to bottom of pendant light fixture or to the center of the outlet box for wall mounted light fixtures unless otherwise noted. Verify mounting heights with Architect and Engineer.
- C. Mounting height may also be indicated as the length of the pendant below finished ceiling.
- D. Verify weight and mounting method of all fixtures prior to ordering and provide suitable support. Coordinate with General Contractor for fixtures that require additional blocking or support and provide required support. Fixture mounting assemblies shall comply with all local seismic codes and regulations.
- E. Refer to architectural reflected ceiling plans for coordination of light fixture locations with mechanical and fire safety equipment. Where conflicts occur, coordinate with Architect and Engineer prior to installing any of the systems.
- F. In accessible suspended ceilings, fixture wiring connection, including equipment grounding conductor, shall be through use of 72-inch (max. length) flexible conduit from a rigidly supported junction box, unless noted otherwise.
- G. Wire per requirements of branch circuit installation. Properly ground each fixture.
- H. Light fixtures located in recessed ceilings with a fire resistive rating of 1 hour or more shall be enclosed in an approved fire resistive rated box equal to that of the ceiling.
- I. Install fixtures with vent holes free of air blocking obstacles.
- J. Contractor shall be responsible for adjusting aperture flanges or rings on all recessed fixtures to be flush with the finished ceiling. Fixture trim shall completely conceal ceiling opening.
- K. Adjust variable position lampholders for proper lamp position prior to fixture installation.

3.2 FIXTURE SUPPORT

- A. Comply with specification sections describing Basic Materials and Methods and Supporting Devices for fixture support and bracing.
- B. Provide all necessary hanging or mounting devices for all fixtures, verify the type needed for various ceiling conditions. Plaster rings shall be provided where required.
- C. Ceiling Fixture Support: Where ceiling is of insufficient strength to support weight of light fixtures installed, provide additional framing from building structure to support as required.
- D. Provide a minimum of two safety wire hangers or threaded rods for each recessed mounted fixture. Secure from opposite corners of each fixture and fasten to structure above, independent of ceiling system. Locate supports not more than 6 inches from fixture corners.
- E. Fixtures which are of a size smaller than the ceiling grid shall be located as indicated on the reflected ceiling plans. Fixtures shall be supported independently of the grid ceiling with at least two ¾ inch metal channels spanning and secured to the ceiling tees.
- F. Metal decking shall not be pierced for luminaire support.

- G. Where pendants or rods are longer than 48 inches, brace to limit luminaire swinging.
- H. Brace suspended luminaires installed near ducts or other elements so that they do not swing into obstructions.
- I. Wall mounted light fixtures shall be supported from four-square outlet box plaster ring and from wall at non-feed end with two 1/4-inch toggle bolts for gypsum board walls or 1/4-inch bolts to pre-set inserts for concrete wall.

3.3 LED FIXTURES

- A. Adhere to manufacturers installation guidelines regarding proper thermal management.

3.4 LIGHTING CONTROL

- A. Provide branch circuiting in coordination with lighting control requirements of specification section describing lighting control equipment and as indicated on Electrical Drawings.

3.5 CLEANING AND ADJUSTING

- A. Remove protective plastic covers from light fixtures and fixture diffusers only after construction work, painting and clean-up are completed. Remove, clean, and reinstall all dirty lamps, reflectors and diffusers.
- B. Clean fixtures internally and externally after installation. Use methods and materials recommended by manufacturer for cleaning Alzak reflectors, anti-microbial finishes, and other surfaces.
- C. Make final adjustment of aimable light fixtures and adjustable light settings under the direction of the Engineer during a scheduled period of time prior to the completion of the project, after normal business hours if required. Include all equipment and personnel expenses including overtime required for focusing.
- D. Fixtures, reflectors, and accessories which are damaged, blemished, or impregnated with fingerprints shall be replaced at the contractor's expense. All finishes shall be unmarred upon project completion.

3.6 FIELD QUALITY CONTROL

- A. Coordinate all testing procedures and schedule with the specification section describing Inspections, Testing and Start-up. All testing is to be documented with test procedures, results and initials of witnessing personnel and submitted to the Engineer and included in the O&M Manual.
- B. Coordinate inspection and testing of Lighting Fixtures with specification section for lighting control equipment.
- C. Inspect each installed fixture for damage. Replace damaged fixtures and components.
- D. Replace all inoperative LED modules and/or sources at the end of construction prior to Owner occupancy.
- E. Advance Notice: Give dates and times for field tests.
- F. Provide instruments to make and record test results.
- G. Test as follows:
 - 1. Verify proper operation, switching and phasing of each fixture after installation.
 - 2. Emergency Lighting: Interrupt electrical supply to demonstrate proper operation. Verify normal transfer to generator and retransfer to normal.
 - 3. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to the lighting system, retest to demonstrate compliance with standards.

- H. Malfunctioning Fixtures and Components: Replace or repair, then retest. Repeat procedure until units operate properly.

END OF SECTION 26 51 00

SECTION 31 10 00 - 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.

1.2 SUMMARY**A. Section Includes:**

1. Protecting existing vegetation to remain.
2. Clearing and grubbing.
3. Stripping and stockpiling topsoil.
4. Removing above- and below-grade site improvements.
5. Disconnecting, capping or sealing, and removing site utilities and/or abandoning site utilities in place.
6. Temporary erosion- and sedimentation-control measures.

B. Related Sections:

1. Division 31 Section "Earth Moving" for soil materials, excavating, backfilling and site grading.
2. Division 32 Section "Turf and Grasses" for finish grading including preparing and placing planting soil mixes and testing of topsoil material.

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. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction and indicated on Drawings.
- E. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction and indicated on Drawings and indicated according to requirements in Section 015639 "Temporary Tree and Plant Protection."
- F. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.4 MATERIAL OWNERSHIP

- A. Except for materials indicated to remain on Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

SITE CLEARING
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1.5 SUBMITTALS

- A. Pre-clearing photograph or videotape, sufficiently detailed, of existing trees and plantings, adjoining construction, and site improvements that might be misconstrued as damage caused by site clearing.
- B. Topsoil stripping and stockpiling program.
- C. Record Drawings, according to Division 01 Section "Project Record Documents," identifying and accurately showing locations of capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.6 QUALITY ASSURANCE

- A. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."
 - 1. Identify and accurately locate utilities and other substructure structural, electrical and mechanical conditions.
- B. 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.

1.7 PROJECT CONDITIONS

- A. Traffic: Minimize interference with adjoining roads, walks, and other adjacent occupied or used facilities during site-clearing operations.
 - 1. Do not close or obstruct roads, walks, or other adjacent occupied or used facilities without permission from Owner.
 - 2. Provide alternate routes around closed or obstructed traffic ways if required by Owner.
- B. Salvageable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated.
- C. Utility Locator Service: Notify utility locator service for area where Project is located before site clearing.
- D. Do not commence site clearing operations until temporary erosion- and sedimentation-control measures and plant-protection measures are in place.
- E. Tree- and Plant-Protection Zones: Protect according to requirements in Section 015639 "Temporary Tree and Plant Protection."
- F. Do not direct vehicle or equipment exhaust towards tree protection zones.
- G. Prohibit heat sources, flames, ignition sources and smoking within or near tree protection zones.
- H. Soil Stripping, Handling, and Stockpiling: Perform only when the soil is dry or slightly moist.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Division 31 Section "Earth Moving."

1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.

2.2 PREPARATION

- A. Protect and maintain benchmarks and survey control points from disturbance during construction.
- B. Verify that trees, shrubs, and other vegetation to remain or to be relocated have been flagged and that protection zones have been identified and enclosed according to requirements in Section 015639 "Temporary Tree and Plant Protection".
- C. Protect existing site improvements to remain from damage during construction.
 1. Restore damaged improvements to their original condition, as acceptable to Owner.

2.3 TEMPORARY EROSION AND SEDIMENTATION CONTROL

- A. Provide temporary erosion- and sedimentation-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to Baltimore County Soil Conservation District (BCSCD) approved erosion- and sedimentation-control drawings.
- B. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross tree protection zones.
- C. Inspect, maintain, and repair erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
- D. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

2.4 TREE AND PLANT PROTECTION

- A. Protect trees and plants remaining on-site according to requirements in Section 015639 "Temporary Tree and Plant Protection."
- B. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations according to requirements in Section 015639 "Temporary Tree and Plant Protection."

2.4 UTILITIES.

- A. Locate, identify, disconnect, and seal or cap utilities indicated to be removed or abandoned in place.
- B. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others, unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
 1. Notify Architect not less than two weeks in advance of proposed utility interruptions.
 2. Do not proceed with utility interruptions without Architect's written permission.
- C. Excavate for and remove underground utilities indicated to be removed.
- D. Removal of underground utilities is included in earthwork sections; in applicable fire suppression, plumbing, HVAC, electrical, communications, electronic safety and security, and utilities sections; and in Section 024116 "Structure Demolition" and Section 024119 "Selective Demolition."

2.5 CLEARING AND GRUBBING

- A. Remove obstructions and other vegetation to permit installation of new construction as indicated on the Site Plan.
- B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.
 - 1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches, and compact each layer to a density equal to adjacent original ground.
- C. Grind down stumps and remove roots larger than 2 inches (50 mm) in diameter, obstructions, and debris to a depth of 18 inches (457 mm) below exposed subgrade in proposed turf areas and to a depth of 36 inches (915 mm) below exposed subgrade in proposed paved or hardscape areas

2.6 TOPSOIL STRIPPING

- A. Remove sod and grass before stripping topsoil.
- B. Strip topsoil to depth of 6 inches in a manner to prevent intermingling with underlying subsoil or other waste materials.
 - 1. Remove subsoil and nonsoil materials from topsoil, including clay lumps, gravel, and other objects larger than 2 inches (50 mm) in diameter; trash, debris, weeds, roots, and other waste materials.
- C. Stockpile topsoil away from edge of excavations without intermixing with subsoil or other materials. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.
 - 1. Limit height of topsoil stockpiles to 72 inches (1800 mm).
 - 2. Do not stockpile topsoil within protection zones.
 - 3. Dispose of surplus topsoil. Surplus topsoil is that which exceeds quantity indicated to be stockpiled or reused.
 - 4. Stockpile surplus topsoil to allow for respreading deeper topsoil.

2.6 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Remove all excavated material, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.

END OF SECTION 31 10 00

SECTION 31 20 00 - 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.

1.2 SUMMARY

- A. This Section includes the following:
1. Excavating and filling for rough grading the Site.
 2. Preparing subgrades for turf and grasses and plants.
 3. Excavating and backfilling for buildings and structures.
 4. Excavating and backfilling for utility trenches.
 5. Excavating and backfilling trenches for utilities and pits for buried utility structures.
- B. Related Sections include the following:
1. Division 01 Section "Unit Prices" for unit-price authorized additional excavation provisions.
 2. Division 01 Sections "Submittal Procedures" for recording pre-excavation and earthwork progress.
 3. Division 01 50 00 Section "Temporary Facilities and Controls" for temporary controls, utilities, and support facilities.
 4. Division 01 Section "Temporary Tree and Plant Protection" for protecting and trimming vegetation remaining on-site that are affected by site operations.
 5. Section 31 10 00 "Site Clearing" for temporary erosion and sedimentation control measures, site stripping, grubbing, stripping topsoil, and removal of above- and below-grade improvements and utilities.
 6. Section 31 23 19 "Dewatering" for lowering and disposing of ground water during construction.
 7. Section 31 50 00 "Excavation Support and Protection" for shoring, bracing, and sheet piling of excavations.
 8. Division 32 Section "Turf and Grasses" for finish grading, including preparing and placing topsoil and planting soil for lawns.

1.3 UNIT PRICES

- A. Work of this section is affected by unit prices for earth moving specified in Division 01 Section "Unit Prices."
- B. Rock Measurement: Volume of rock actually removed, measured in original position, but not to exceed the following. Unit prices for rock excavation include replacement with approved materials.
1. 24 inches outside of concrete forms other than at footings.
 2. 12 inches outside of concrete forms at footings.
 3. 6 inches outside of minimum required dimensions of concrete cast against grade.
 4. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
 5. 6 inches beneath bottom of concrete slabs-on-grade.
 6. 6 inches beneath pipe in trenches, and the greater of 24 inches wider than pipe or 42 inches wide.

1.4 DEFINITIONS

- A. Backfill: Soil material used to fill an excavation.
 - 1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
 - 2. Final Backfill: Backfill placed over initial backfill to fill a trench.
- B. Base Course: Course placed between the subbase course and hot-mix asphalt paving.
- C. Bedding Course: Course placed over the excavated subgrade in a trench before laying pipe.
- D. Borrow Soil: Satisfactory soil (Select Borrow) imported from off-site for use as fill or backfill.
- E. Excavation: Removal of material encountered above subgrade elevations.
 - 1. Authorized Additional Excavation: Excavation below subgrade elevations as directed by the Geotechnical Engineer. Authorized additional excavation and replacement material will be paid for according to Contract provisions for unit prices.
 - 2. Bulk Excavation: Excavation more than 10 feet in width and more than 30 feet in length.
 - 3. Unauthorized Excavation: Excavation below subgrade elevations without direction by the Geotechnical Engineer. Unauthorized excavation, as well as remedial work directed by the Geotechnical Engineer, shall be without additional compensation.
- F. Fill: Soil materials approved by the Geotechnical Engineer to be used to raise existing grades.
- G. Recycled Material: Recycled Material shall contain a minimum of 90% post consumer material.
- H. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material that exceed 1 cu. yd. for bulk excavation or 3/4 cu. yd. for footing, trench, and pit excavation that cannot be removed by rock excavating equipment equivalent to the following in size and performance ratings, without systematic drilling, ram hammering, ripping, or blasting, when permitted:
 - 1. Excavation of Trenches, and Pits: Late-model, track-mounted hydraulic excavator; equipped with a 42-inch-wide, maximum, short-tip-radius rock bucket; rated at not less than 138-hp flywheel power with bucket-curling force of not less than 28,090 lbf and stick-crowd force of not less than 18,650 lbf; measured according to SAE J-1179.
 - 2. Bulk Excavation: Late-model, track-mounted loader; rated at not less than 210-hp flywheel power and developing a minimum of 48,510-lbf breakout force with a general-purpose bare bucket; measured according to SAE J-732.
- I. Structures: Buildings, footings, retaining walls, slabs, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
- J. Subbase Course: Course placed between the subgrade and base course for hot-mix asphalt pavement, or course placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.
- K. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.
- L. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt and clay particles; friable and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches in diameter; and free of subsoil and weeds, roots, toxic materials, or other non-soil materials.
- M. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.5 SUBMITTALS

- A. Product Data: For the following:
 - 1. Detectable warning tape.
 - 2. Geotextile fabric.
 - 3. Recycled Materials.
 - 4. Requirements for local material source.
- B. Qualification Data: For qualified testing agency.
- C. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated:
 - 1. Classification according to ASTM D 2487 of each borrow soil material proposed for fill and backfill.
 - 2. Laboratory compaction curve according to ASTM D 1557 for each on-site and borrow soil material proposed for fill and backfill.
- D. Pre-excavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as damage caused by earthwork operations. Submit before earthwork begins.

1.6 QUALITY ASSURANCE

- A. Geotechnical Testing Agency Qualifications: An independent testing agency qualified according to ASTM E 329 to conduct soil materials and rock-definition testing, as documented according to ASTM D 3740 and ASTM E 548.
- B. Contractor shall follow all OSHA requirements and all local, State and Federal regulations for soil excavation.
- C. Pre-excavation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management, Schedules and Coordination."

1.7 PROJECT CONDITIONS

- A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Engineer and then only after arranging to provide temporary utility services according to requirements indicated.
 - 1. Notify Owner and Architect not less than 72 hours in advance of proposed utility interruptions.
 - 2. Do not proceed with utility interruptions without Owner's written permission.
 - 3. Contact utility-locator service for area where Project is located before excavating.
 - 4. Verify existing utility services for area where Project is located before excavation.
- B. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies to shut off services if lines are active.
- C. 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.
 - 2. Provide alternate routes around closed or obstructed traffic ways if required by Owner.
- D. Utility Locator Service: Notify utility locator service for area where Project is located before beginning earth moving operations.

- E. Do not commence earth moving operations until temporary erosion- and sedimentation-control measures, specified in Division 31 Section "Site Clearing," are in place.
- F. Do not commence earth moving operations until plant-protection measures specified in Division 01 56 39 Section "Temporary Tree and Plant Protection" are in place.
- G. 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.
- H. Do not direct vehicle or equipment exhaust towards protection zones.
- I. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

- A. Refer to Section 916 of SHA Standard Specifications for Construction and Materials.
- B. General: Provide select borrow soil materials for replacement of all excavated material removed from the pipe trench. All excavated material removed from the trench excavations shall be hauled and disposed off-site. Provide test results or certification that borrow material meets the requirements for the specified material.
- C. Recycled Content of Backfill: Provide recycled concrete (RC-6) for temporary roads, subbase, pipe bedding, and fill material, except under the building slab. Recycled aggregates shall contain a minimum of 90% post-consumer aggregate content.
- D. Regional Materials: Provide aggregate and sand products manufactured and of primary raw materials extracted or recovered within 300 mile radius of Project Site.
- E. Satisfactory Soils: Select Borrow as Per Section 916.01.01 of the MSHA Standard Specifications for Construction and Materials.
- F. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve per Section 901 of the MSHA Standard Specifications for Construction and Materials .
- G. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 95 percent passing a 1-1/2-inch sieve and not more than 8 percent passing a No. 200 sieve per Section 901 of the MSHA Standard Specifications for Construction and Materials.
- H. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.
- I. Bedding Course and Initial Backfill: Washed #8 Pea Gravel Per ASTM - D-448, 1/8" to 3/8" size.
- J. Topsoil: Loam, without stones or debris larger than 1/2 inch in diameter, without roots, vegetation, and without harmful materials or other debris which may be harmful to plant life. The

topsoil shall contain a minimum of 5% of organic matter by weight when tested in accordance with AASHTO T 194. Other components shall be within the following percentages:

Silt	25 – 50%
Clay	10 – 30 %
Sand	20 – 35 %
pH	6 – 7.5
Soluble Salts	600 ppm maximum

1. Off-Site Topsoil: Topsoil furnished by the Contractor shall meet the requirements specified above, as tested by the Contractor and approved by the Geotechnical Engineer.
- K. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch sieve and 0 to 5 percent passing a No. 4 sieve.
- L. Sand: ASTM C 33; fine aggregate, natural, or manufactured sand.
- M. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.
- N. Structural Fill: All fills placed directly below or within the zone of influence of any bearing foundation or structural slab. Structural fill material shall consist of soils meeting Unified Soil Classification System (USCS) of SC or greater (i.e. SC through GW) with a Liquid Limit no greater than 30 and a maximum Plasticity Index of 10. All soil materials that fall within the USCS type ML, CL, CL-ML, OL, MH, CH, OH, PT, as well as material containing organic matter, ashes, cinders, refuse, frozen or other unsuitable materials are prohibited for use as Structural Fill.

2.2 GEOTEXTILES

- A. Subsurface Drainage Geotextile: Woven; manufactured for subsurface drainage applications, made from fibers consisting of long chain synthetic polymers, composed of a minimum 95 percent by weight of polyolefins or polyesters; with 15 percent minimum elongation; complying with Maryland State Highway Administration type ST per SHA Standard Specifications for Construction and Materials.

2.3 CONTROLLED LOW-STRENGTH MATERIAL

- A. Controlled Low-Strength Material: Self-compacting, low-density, flowable concrete material produced from the following:
 1. Portland Cement: ASTM C 150, Type I Type II or Type III.
 2. Fly Ash: ASTM C 618, Class C or F.
 3. Normal-Weight Aggregate: ASTM C 33, 3/8-inch nominal maximum aggregate size.
 4. Foaming Agent: ASTM C 869.
 5. Water: ASTM C 94.
 6. Air-Entraining Admixture: ASTM C 260.

2.4 ACCESSORIES

- A. Detectable Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility, with a metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches. Color shall be as follows.
 1. Red: Electric.
 2. Yellow: Gas, oil, steam and dangerous materials.

3. Orange: Telephone and other communications.
4. Blue: Water systems.
5. Green: Sewer systems.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
- B. Prepare subgrade for earthwork operations including removal of vegetation, topsoil, debris, obstructions, and deleterious materials from ground surface as specified in Division 31 Section "Site Clearing."
- C. Protect and maintain erosion and sedimentation controls, which are specified in Division 31 Section "Site Clearing," during earthwork operations.
- D. Provide protective insulating materials to protect subgrades and foundation soils against freezing temperatures or frost.

3.2 DEWATERING

- A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.
- B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.
 1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.
 2. Install a dewatering system to keep subgrades dry and convey ground water away from excavations. Maintain until dewatering is no longer required.

3.3 EXPLOSIVES

- A. Explosives: Do not use explosives on this project.

3.4 EXCAVATION, GENERAL

- A. All excavations and trenching shall be accomplished in strict accordance with applicable OSHA regulations.
- B. Do not excavate within twelve (12) inches of any building wall, column, pier, etc. Where excavation is required next to an existing building, excavate up to twenty-four (24) inches and allow the balance of soil to "fall away". Take care to not damage the existing waterproofing systems.
- C. 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. 24 inches (600 mm) outside of concrete forms other than at footings.
 - b. 12 inches (300 mm) outside of concrete forms at footings.
 - c. 6 inches (150 mm) outside of minimum required dimensions of concrete cast against grade.
 - d. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
 - e. 6 inches (150 mm) beneath bottom of concrete slabs-on-grade.
 - f. 6 inches (150 mm) beneath pipe in trenches and the greater of 24 inches (600 mm)] wider than pipe or 42 inches (1065 mm) wide.

3.5 EXCAVATION FOR STRUCTURES

- A. Excavate to the indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.
 1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
 2. Excavation for Underground Basins and Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch. Do not disturb bottom of excavations intended as bearing surfaces.
- B. Excavations at Edges of Tree- and Plant-Protection Zones:
 1. Excavate by hand to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
 2. Cut and protect roots according to requirements in Section 01 56 39 "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.

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: As indicated.
- C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes. Shape subgrade to provide continuous support for bells, joints and barrels of pipes, unless otherwise indicated.

1. For pipes less than 6 inches in nominal diameter, hand-excavate trench bottoms and support pipe on an undisturbed subgrade.
2. For pipes 6 inches or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe circumference. Fill depressions with tamped sand backfill.
3. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

D. Trenches in Tree- and Plant-Protection Zones:

1. Hand-excavate to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
2. Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities.
3. Cut and protect roots according to requirements in Section 015 6 39 "Temporary Tree and Plant Protection."

3.8 SUBGRADE INSPECTION

- A. Notify Geotechnical Engineer when excavations have reached required subgrade.
- B. If Geotechnical Engineer determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.
- C. Proof-roll subgrade below the building slabs and 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 the Geotechnical Engineer, 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 Unit Price Items.
- E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Engineer, without additional compensation.

3.9 UNAUTHORIZED EXCAVATION

- A. Fill unauthorized excavation under foundations by extending bottom elevation of concrete foundation to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi, may be used when approved by the Engineer.
 1. Fill unauthorized excavations under other construction or utility pipe as directed by the Engineer.

3.10 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.

3.11 BACKFILL

- A. Place and compact backfill in excavations promptly, but not before completing the following:
 - 1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
 - 2. Surveying locations of underground utilities for Record Documents.
 - 3. Testing and inspecting underground utilities.
 - 4. Removing concrete formwork.
 - 5. Removing trash and debris.
 - 6. Removing temporary shoring and bracing, and sheeting.
 - 7. Installing permanent or temporary horizontal bracing on horizontally supported walls.
- B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.12 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 trenches excavated under structure and within 18 inches of bottom of structure with satisfactory soil; fill with concrete to elevation of bottom of footings. Concrete is specified in Section 03 30 00 "Cast-in-Place Concrete."
- D. Trenches under Roadways: Provide 4-inch-thick, concrete-base slab support for piping or conduit less than 30 inches below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of 4 inches of concrete before backfilling or placing roadway subbase course. Concrete is specified in Section 03 30 00 "Cast-in-Place Concrete"
- E. After installing compacted pipe bedding material, place and compact initial backfill of satisfactory soil, free of particles larger than 1 inch in any dimension, to a height of 12 inches over the utility pipe or conduit.
 - 1. Carefully compact initial bedding material under pipe haunches and compact evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.
- F. 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.
- G. Backfill voids with satisfactory soil while installing and removing shoring and bracing.
- H. Place and compact final backfill of satisfactory soil to final subgrade elevation.
- I. Install detectable warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs. Detectable warning tape is not required for storm drains.

3.13 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.

3.14 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.

3.15 COMPACTION OF SOIL BACKFILLS AND FILLS

- A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
- B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.
- C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 698:
 1. Under structures and pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 95 percent.
 2. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 95 percent.
 3. Under lawn or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 92 percent. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 95 percent.
 4. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 92 percent.
 5. Under turf or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 85 percent.
 6. For utility trenches, compact each layer of initial and final backfill soil material at 85 percent.

3.16 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 Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
 1. Lawn or Unpaved Areas: Plus or minus 1 inch.
 2. Walks: Plus or minus 1/2 inch.

3. Pavements: Plus or minus 1/2 inch.
4. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

3.17 SUBBASE AND BASE COURSES

- A. Place subbase and base course on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place subbase and base course under pavements and walks as follows:
 1. Install separation geotextile fabric 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 and base course to required crown elevations and cross-slope grades.
 4. Place subbase and base course 6 inches or less in compacted thickness in a single layer.
 5. Place subbase 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 and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

3.18 FIELD QUALITY CONTROL

- A. Testing Agency: The Contractor shall engage a qualified independent geotechnical engineering testing agency to perform field quality-control testing.
- B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.
- C. 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 Geotechnical Engineer.
- D. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:
 1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2000 sq. ft. or less of paved area or building slab, but in no case fewer than three tests.
 2. Foundation Wall Backfill: At each compacted backfill layer, at least one test for every 100 feet or less of wall length, but no fewer than two tests.
 3. Trench Backfill: At each compacted initial and final backfill layer, at least one test for every 150 feet or less of trench length, but no fewer than two tests.
- E. 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 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 Engineer; reshape and recompact.
- C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
 - 1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.20 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION 31 20 00

SECTION 31 23 19 - DEWATERING**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 construction dewatering.
- B. Related Requirements:
 - 1. Section 01 32 33 "Photographic Documentation" for recording preexisting conditions and dewatering system progress.
 - 2. Section 31 20 00 "Earth Moving" for excavating, backfilling, site grading, and controlling surface-water runoff and ponding.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Verify availability of Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 2. Review condition of site to be dewatered including coordination with temporary erosion-control measures and temporary controls and protections.
 - 3. Review proposed site clearing and excavations.
 - 4. Review existing utilities and subsurface conditions.
 - 5. Review observation and monitoring of dewatering system.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer that has specialized in design of dewatering systems and dewatering work.
- B. Regulatory Requirements: Comply with governing EPA notification regulations before beginning dewatering. Comply with hauling and disposal regulations of the Owner.

1.5 FIELD CONDITIONS

- A. Project-Site Information: A geotechnical report has been prepared for this project, refer to report for additional detail.

PART 2 - PRODUCTS**2.1 PERFORMANCE REQUIREMENTS**

- A. Dewatering Performance: Design, furnish, install, test, operate, monitor, and maintain dewatering system of sufficient scope, size, and capacity to control hydrostatic pressures and to lower, control, remove, and dispose of ground water and permit excavation and construction to proceed on dry, stable subgrades.
 - 1. Design dewatering system, including comprehensive engineering analysis by a qualified professional engineer.

2. Continuously monitor and maintain dewatering operations to ensure erosion control, stability of excavations and constructed slopes, prevention of flooding in excavation, and prevention of damage to subgrades and permanent structures.
 3. Prevent surface water from entering excavations by grading, dikes, or other means.
 4. Accomplish dewatering without damaging existing buildings, structures, and site improvements adjacent to excavation.
 5. Remove dewatering system when no longer required for construction.
- B. Regulatory Requirements: Comply with governing EPA notification regulations before beginning dewatering. Comply with water- and debris-disposal regulations of authorities having jurisdiction.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by dewatering operations.
1. Prevent surface water and subsurface or ground water from entering excavations, from ponding on prepared subgrades, and from flooding site or surrounding area.
 2. Protect subgrades and foundation soils from softening and damage by rain or water accumulation.
- B. Install dewatering system to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.
1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
- C. Provide temporary grading to facilitate dewatering and control of surface water.
- D. Protect and maintain temporary erosion and sedimentation controls, which are specified on the MDE approved plans.

3.2 INSTALLATION

- A. Install dewatering system utilizing wells, well points, or similar methods complete with pump equipment, standby power and pumps, filter material gradation, valves, appurtenances, water disposal, and surface-water controls.
1. Space well points or wells at intervals required to provide sufficient dewatering.
 2. Use filters or other means to prevent pumping of fine sands or silts from the subsurface.
- B. Place dewatering system into operation to lower water to specified levels before excavating below ground-water level.
- C. Provide sumps, sedimentation tanks, and other flow-control devices as required by authorities having jurisdiction.
- D. Provide standby equipment on-site, installed and available for immediate operation, to maintain dewatering on continuous basis if any part of system becomes inadequate or fails.

3.3 OPERATION

- A. Operate system continuously until drains, sewers, and structures have been constructed and fill materials have been placed or until dewatering is no longer required.

- B. Operate system to lower and control ground water to permit excavation, construction of structures, and placement of fill materials on dry subgrades. Drain water-bearing strata above and below bottom of foundations, drains, sewers, and other excavations.
 - 1. Do not permit open-sump pumping that leads to loss of fines, soil piping, subgrade softening, and slope instability.
 - 2. Reduce hydrostatic head in water-bearing strata below subgrade elevations of foundations, drains, sewers, and other excavations.
 - 3. Maintain piezometric water level a minimum of 24 inches below bottom of excavation.
- C. Dispose of water removed by dewatering in a manner that avoids endangering public health, property, and portions of work under construction or completed. Dispose of water and sediment in a manner that avoids inconvenience to others.
- D. Remove dewatering system from Project site on completion of dewatering. Plug or fill well holes with sand or cut off and cap wells a minimum of 36 inches below overlying construction.

3.4 FIELD QUALITY CONTROL

- A. Provide continual observation to ensure that subsurface soils are not being removed by the dewatering operation.

3.5 PROTECTION

- A. Protect and maintain dewatering system during dewatering operations.
- B. Promptly repair damages to adjacent facilities caused by dewatering.

END OF SECTION 31 23 19

SECTION 31 50 00 - EXCAVATION SUPPORT AND PROTECTION**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 temporary excavation support and protection systems.
- B. Related Requirements:
 - 1. Section 01 32 33 "Photographic Documentation" for recording preexisting conditions and excavation support and protection system progress.
 - 2. Section 31 20 00 "Earth Moving" for excavating and backfilling and for controlling surface-water runoff and ponding.
 - 3. Section 31 23 19 "Dewatering" for dewatering excavations.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review existing utilities and subsurface conditions.
 - 2. Review coordination for interruption, shutoff, capping, and continuation of utility services.
 - 3. Review proposed excavations.
 - 4. Review proposed equipment.
 - 5. Review monitoring of excavation support and protection system.
 - 6. Review coordination with waterproofing.
 - 7. Review abandonment or removal of excavation support and protection system.

1.4 SUBMITTALS

- A. Shop Drawings: For excavation support and protection system, prepared by or under the supervision of a qualified professional engineer.
 - 1. Include plans, elevations, sections, and details.
 - 2. Show arrangement, locations, and details of soldier piles, piling, lagging, tiebacks, bracing, and other components of excavation support and protection system according to engineering design.
 - 3. Indicate type and location of waterproofing.
 - 4. Include a written plan for excavation support and protection, including sequence of construction of support and protection coordinated with progress of excavation.
- B. Qualification Data: For Installer and Professional Engineer.
- C. Contractor Calculations: For excavation support and protection system. Include analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- D. Existing Conditions: Using photographs or video recordings, show existing conditions of adjacent construction and site improvements that might be misconstrued as damage caused by inadequate performance of excavation support and protection systems. Submit before Work begins.
- E. Record Drawings: Identify locations and depths of capped utilities, abandoned-in-place support and protection systems, and other subsurface structural, electrical, or mechanical conditions.

1.5 FIELD CONDITIONS

- A. Interruption of Existing Utilities: Do not interrupt any utility serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility according to requirements indicated:
 - 1. Notify Architect and Owner no fewer than two days in advance of proposed interruption of utility.
 - 2. Do not proceed with interruption of utility without Owner's written permission.
- B. Project-Site Information: A geotechnical report has been prepared for this project. See report for additional detail.
- C. Survey Work: Engage a qualified land surveyor or professional engineer to survey adjacent existing buildings, structures, and site improvements; establish exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Geotechnical Testing Agency: An independent testing agency qualified according to ASTM E 329 to conduct soil materials and rock-definition testing, as documented according to ASTM D 3740 and ASTM E 548.
- B. Provide, design, monitor, and maintain excavation support and protection system capable of supporting excavation sidewalls and of resisting earth and hydrostatic pressures and superimposed and construction loads.
 - 1. Contractor Design: Design excavation support and protection system, including comprehensive engineering analysis by a qualified professional engineer.
 - 2. Prevent surface water from entering excavations by grading, dikes, or other means.
 - 3. Install excavation support and protection systems without damaging existing buildings, structures, and site improvements adjacent to excavation.
 - 4. Continuously monitor vibrations, settlements, and movements to ensure stability of excavations and constructed slopes and to ensure that damage to permanent structures is prevented.

2.2 MATERIALS

- A. General: Provide materials that are either new or in serviceable condition.
- B. Structural Steel: ASTM A 36, ASTM A 690, or ASTM A 992.
- C. Steel Sheet Piling: ASTM A 328, ASTM A 572, or ASTM A 690; with continuous interlocks.
 - 1. Corners: Site-fabricated mechanical interlock.
- D. Wood Lagging: Lumber, mixed hardwood, nominal rough thickness of size and strength required for application.
- E. Tiebacks: Steel bars, ASTM A 722.

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 that could develop during excavation support and protection system operations.

1. Shore, support, and protect utilities encountered.
 - B. Install excavation support and protection systems to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.
 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner. Provide alternate routes around closed or obstructed traffic ways if required by Owner.
 - C. Locate excavation support and protection systems clear of permanent construction so that construction and finishing of other work is not impeded.
- 3.2 SOLDIER PILES AND LAGGING
- A. Install steel soldier piles before starting excavation. Extend soldier piles below excavation grade level to depths adequate to prevent lateral movement. Space soldier piles at regular intervals not to exceed allowable flexural strength of wood lagging. Accurately align exposed faces of flanges to vary not more than 2 inches from a horizontal line and not more than 1:120 out of vertical alignment.
 - B. Install wood lagging within flanges of soldier piles as excavation proceeds. Trim excavation as required to install lagging. Fill voids behind lagging with soil, and compact.
 - C. Install wales horizontally at locations indicated on Drawings and secure to soldier piles.
- 3.3 SHEET PILING
- A. Before starting excavation, install one-piece sheet piling lengths and tightly interlock vertical edges to form a continuous barrier.
 - B. Accurately place the piling, using templates and guide frames unless otherwise recommended in writing by the sheet piling manufacturer. Limit vertical offset of adjacent sheet piling to 60 inches. Accurately align exposed faces of sheet piling to vary not more than 2 inches from a horizontal line and not more than 1:120 out of vertical alignment.
 - C. Cut tops of sheet piling to uniform elevation at top of excavation.
- 3.4 TIEBACKS
- A. Drill, install, grout, and tension tiebacks.
 - B. Test load-carrying capacity of each tieback and replace and retest deficient tiebacks.
 1. Have test loading observed by a qualified professional engineer responsible for design of excavation support and protection system.
 - C. Maintain tiebacks in place until permanent construction is able to withstand lateral earth and hydrostatic pressures.
- 3.5 BRACING
- A. Bracing: Locate bracing to clear columns, floor framing construction, and other permanent work. If necessary to move brace, install new bracing before removing original brace.
 1. Do not place bracing where it will be cast into or included in permanent concrete work unless otherwise approved by Architect.
 2. Install internal bracing if required to prevent spreading or distortion of braced frames.
 3. Maintain bracing until structural elements are supported by other bracing or until permanent construction is able to withstand lateral earth and hydrostatic pressures.

3.6 FIELD QUALITY CONTROL

- A. Survey-Work Benchmarks: Resurvey benchmarks regularly during installation of excavation support and protection systems, excavation progress, and for as long as excavation remains open. Maintain an accurate log of surveyed elevations and positions for comparison with original elevations and positions. Promptly notify Architect if changes in elevations or positions occur or if cracks, sags, or other damage is evident in adjacent construction.
- B. Promptly correct detected bulges, breakage, or other evidence of movement to ensure that excavation support and protection system remains stable.
- C. Promptly repair damages to adjacent facilities caused by installation or faulty performance of excavation support and protection systems.

3.7 REMOVAL AND REPAIRS

- A. Remove excavation support and protection systems when construction has progressed sufficiently to support excavation and earth and hydrostatic pressures. Remove in stages to avoid disturbing underlying soils and rock or damaging structures, pavements, facilities, and utilities.
 - 1. Remove excavation support and protection systems to a minimum depth of 48 inches below overlying construction and abandon remainder.
 - 2. Fill voids immediately with approved backfill compacted to density specified in Section 31 20 00 "Earth Moving."
 - 3. Repair or replace, as approved by Architect, adjacent work damaged or displaced by removing excavation support and protection systems.
- B. Leave excavation support and protection systems permanently in place.

END OF SECTION 31 50 00

SECTION 32 12 16 - ASPHALT PAVING**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Hot-mix asphalt paving.
 - 2. Hot-mix asphalt patching.
 - 3. Pavement-marking paint.
 - 4. Cold milling of existing hot-mix asphalt pavement.
- B. Related Sections include the following:
 - 1. Division 01 Section Submittal Procedures" for review methods and procedures.
 - 2. Division 02 Section "Selective Demolition" for demolition and removal of existing asphalt pavements, and for geotextiles.
 - 3. Division 31 Section "Earth Moving" for aggregate subbase and base courses and for aggregate pavement shoulders.
 - 4. Division 32 Section "Pavement Joint Sealants" for joint sealants and fillers at paving terminations.

1.3 DEFINITIONS

- A. Hot-Mix Asphalt Paving Terminology: Refer to ASTM D 8 for definitions of terms.
- B. DOT: Department of Transportation.

1.4 SYSTEM DESCRIPTION

- A. Provide hot-mix asphalt paving according to materials, workmanship, and other applicable requirements of Maryland State Highway standard specifications.
 - 1. Standard Specification: 2021 Maryland State Highway Administration Standard Specification for Construction and Materials.
 - 2. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated. Include technical data and tested physical and performance properties.
- B. Job-Mix Designs: Certification, by authorities having jurisdiction, of approval of each job mix proposed for the Work.
- C. Material Test Reports: For each paving material.
- D. Material Certificates: For each paving material, signed by manufacturers.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: manufacturer shall be registered with and approved by Maryland State Highway Administration.
- B. Testing Agency Qualifications: Qualified according to ASTM D 3666 for testing indicated, as documented according to ASTM E 548.
- C. Regulatory Requirements: Comply with Maryland State Highway standard specifications for asphalt paving work.
- D. Asphalt-Paving Publication: Comply with AI MS-22, "Construction of Hot Mix Asphalt Pavements," unless more stringent requirements are indicated.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pavement-marking materials to Project site in original packages with seals unbroken and bearing manufacturer's labels containing brand name and type of material, date of manufacture, and directions for storage.
- B. Store pavement-marking materials in a clean, dry, protected location within temperature range required by manufacturer. Protect stored materials from direct sunlight.

1.8 PROJECT CONDITIONS

- A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp or if the following conditions are not met:
 - 1. Prime and Tack Coats: Minimum surface temperature of 60 deg F.
 - 2. Slurry Coat: Comply with weather limitations of ASTM D 3910.
 - 3. Asphalt Base Course: Minimum surface temperature of 40 deg F and rising at time of placement.
 - 4. Asphalt Surface Course: Minimum surface temperature of 60 deg F at time of placement.
- B. Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 50 deg F and not exceeding 100 deg F in a 24 hour period.

PART 2 - PRODUCTS

2.1 AGGREGATES

- A. General: Use materials and gradations that have performed satisfactorily in previous installations.
- B. Recycled Content: Provide maximum reclaimed asphalt pavement (RAP) as feasible.
- C. Regional Materials: Provide aggregate products manufactured and of primary raw materials extracted or recovered within 500 mile radius of Project Site.
- D. Coarse Aggregate: In accordance with Maryland State Highway standards and specifications.
- E. Fine Aggregate: In accordance with Maryland State Highway standards and specifications.
- F. Mineral Filler: In accordance with Maryland State Highway standards and specifications.

2.2 ASPHALT MATERIALS

- A. Asphalt Binder: AASHTO MP 1, PG 64-22.
- B. Asphalt Cement: ASTM D 3381 for viscosity-graded material; ASTM D 946 for penetration-graded material.
- C. Prime Coat: Asphalt emulsion prime complying with Maryland State Highway Administration requirements.
- D. Tack Coat: ASTM D 977 or AASHTO M 140, emulsified asphalt or ASTM D 2397 or AASHTO M 208, cationic emulsified asphalt, slow setting, diluted in water, of suitable grade and consistency for application.
- E. Undersealing Asphalt: ASTM D 3141 or AASHTO M 238, pumping consistency.

2.3 AUXILIARY MATERIALS

- A. Herbicide: Commercial chemical for weed control, registered by the EPA. Provide in granular, liquid, or wettable powder form.
- B. Paving Geotextile: AASHTO M 288, nonwoven polypropylene; resistant to chemical attack, rot, and mildew; and specifically designed for paving applications.
- C. Pavement-Marking Paint: Low-VOC alkyde traffic marking paint, with drying time of less than 45 minutes.
 - 1. Color: White
 - 2. Color: Yellow
 - 3. Color: Green
 - 4. Color: Blue

2.4 MIXES

- A. Hot-Mix Asphalt: Dense, hot-laid, hot-mix asphalt plant mixes approved by Maryland State Highway Administration; and complying with the following requirements:
 - 1. Provide mixes with a history of satisfactory performance in geographical area where Project is located.
 - 2. Base Course: Superpave 19.0 mm.
 - 3. Surface Course: Superpave 9.5 mm.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that subgrade is dry and in suitable condition to support paving and imposed loads.
- B. Proceed with paving only after unsatisfactory conditions have been corrected.

3.2 COLD MILLING

- A. Clean existing pavement surface of loose and
 - 1. Mill to a depth of as indicated on plans.

2. Mill to a uniform finished surface free of gouges, grooves, and ridges. deleterious material immediately before cold milling. Remove existing asphalt pavement by cold milling to grades and cross sections indicated.
3. Control rate of milling to prevent tearing of existing asphalt course.
4. Repair or replace curbs, manholes, and other construction damaged during cold milling.
5. Excavate and trim unbound-aggregate base course, if encountered, and keep material separate from milled hot-mix asphalt.
6. Transport milled hot-mix asphalt to asphalt recycling facility.
7. Keep milled pavement surface free of loose material and dust.

3.3 PATCHING

- A. Hot-Mix Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new subgrade.
- B. Tack Coat: Apply uniformly to vertical surfaces abutting or projecting into new, hot-mix asphalt paving at a rate of 0.05 to 0.15 gal./sq. yd..
 1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
 2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.
- C. Patching: Fill excavated pavements with hot-mix asphalt base mix and, while still hot, compact flush with adjacent surfaces.

3.4 REPAIRS

- A. Leveling Course: Install and compact leveling course consisting of hot-mix asphalt surface course to level sags and fill depressions deeper than 1 inch in existing pavements.
 1. Install leveling wedges in compacted lifts not exceeding 3 inches thick.
- B. Crack and Joint Filling: Remove existing joint filler material from cracks or joints to a depth of 1/4 inch.
 1. Clean cracks and joints in existing hot-mix asphalt pavement.
 2. Use hot-applied joint sealant to seal cracks and joints more than 1/4 inch wide. Fill flush with surface of existing pavement and remove excess.

3.5 SURFACE PREPARATION

- A. Proof-roll subbase using heavy, pneumatic-tired rollers to locate areas that are unstable or that require further compaction.
- B. Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.
 1. Sweep loose granular particles from surface of unbound-aggregate base course. Do not dislodge or disturb aggregate embedded in compacted surface of base course.
- C. Herbicide Treatment: Apply herbicide according to manufacturer's recommended rates and written application instructions. Apply to dry, prepared subgrade or surface of compacted-aggregate base before applying paving materials.

1. Mix herbicide with prime coat if formulated by manufacturer for that purpose.
- D. Prime Coat: Apply uniformly over surface of compacted unbound-aggregate base course at a rate of 0.15 to 0.50 gal./sq. yd. Apply enough material to penetrate and seal but not flood surface. Allow prime coat to cure for 72 hours minimum.
 1. If prime coat is not entirely absorbed within 24 hours after application, spread sand over surface to blot excess asphalt. Use enough sand to prevent pickup under traffic. Remove loose sand by sweeping before pavement is placed and after volatiles have evaporated.
 2. Protect primed substrate from damage until ready to receive paving.
- E. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq. yd.
 1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
 2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

3.6 PAVING GEOTEXTILE INSTALLATION

- A. Apply tack coat uniformly to existing pavement surfaces at a rate of 0.20 to 0.30 gal./sq. yd.
- B. Place paving geotextile promptly according to manufacturer's written instructions. Broom or roll geotextile smooth and free of wrinkles and folds. Overlap longitudinal joints 4 inches and transverse joints 6 inches.
 1. Protect paving geotextile from traffic and other damage and place hot-mix asphalt paving overlay the same day.

3.7 HOT-MIX ASPHALT PLACING

- A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand to areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.
 1. Spread mix at minimum temperature of 250 deg F.
 2. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.
- B. Place paving in consecutive strips not less than 8 feet wide unless infill edge strips of a lesser width are required.
- C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.8 JOINTS

- A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions with same texture and smoothness as other sections of hot-mix asphalt course.
 1. Clean contact surfaces and apply tack coat to joints.
 2. Offset longitudinal joints, in successive courses, a minimum of 6 inches.
 3. Offset transverse joints, in successive courses, a minimum of 24 inches.

4. Construct transverse joints as described in AI MS-22, "Construction of Hot Mix Asphalt Pavements."
5. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.
6. Compact asphalt at joints to a density within 2 percent of specified course density.

3.9 COMPACTION

- A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or vibratory-plate compactors in areas inaccessible to rollers.
 1. Complete compaction before mix temperature cools to 185 deg F.
- B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.
- C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:
 1. Average Density: 92 percent of reference maximum theoretical density according to ASTM D 2041, but not less than 90 percent nor greater than 96 percent.
- D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.
- E. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.
- F. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.10 INSTALLATION TOLERANCES

- A. Thickness: Compact each course to produce the thickness indicated within the following tolerances:
 1. Base Course: Plus or minus 1/2 inch.
 2. Surface Course: Plus 1/4 inch, no minus.
- B. Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:
 1. Base Course: 1/8 inch.
 2. Surface Course: 1/8 inch.

3.10 PAVEMENT MARKING

- A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.
- B. Allow paving to age for 30 days before starting pavement marking.
- C. Sweep and clean surface to eliminate loose material and dust.

- D. Prime asphalt surfaces with sealer, as recommended by thermoplastic material manufacturer based on surface conditions. Include adhesive or adhesion promoter when asphaltic surfaces exhibit polished aggregate.
- E. 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 35 mils.

3.12 FIELD QUALITY CONTROL

- A. Testing Agency: Contractor will engage a qualified independent testing and inspecting agency to perform field tests and inspections and to prepare test reports.
- B. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- C. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D 3549.
- D. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.
- E. In-Place Density: Testing agency will take samples of uncompacted paving mixtures and compacted pavement according to ASTM D 979 or AASHTO T 168.
 - 1. Reference maximum theoretical density will be determined by averaging results from four samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D 2041, and compacted according to job-mix specifications.
 - 2. In-place density of compacted pavement will be determined by testing core samples according to ASTM D 1188 or ASTM D 2726.
 - a. One core sample will be taken for every 1000 sq. yd. or less of installed pavement, with no fewer than 3 cores taken.
 - b. Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D 2950 and correlated with ASTM D 1188 or ASTM D 2726.
- F. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.13 DISPOSAL

- A. All excavated and demolished material shall be removed from Project site and legally dispose of them in an EPA-approved landfill.

END OF SECTION 32 12 16

SECTION 32 13 13 – CONCRETE PAVING**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

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

1.2 SUMMARY

- A. This Section includes exterior cement concrete pavement for the following:
 - 1. Curbs
 - 2. Sidewalks
- B. Related Sections include the following:
 - 1. Section 312000 "Earth Moving" for subgrade preparation, grading, and subbase course.
 - 2. Section 321373 "Pavement Joint Sealants" for joint sealants of joints in concrete pavement and at isolation joints of concrete pavement with adjacent construction.

1.3 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash and other pozzolans, and ground granulated blast-furnace slag.

1.4 SUBMITTALS

- A. Product Data: For each type of manufactured material and product indicated.
- B. LEED Submittals: Comply with Section 018113. (Record Only)
 - 1. MR Credit 2: Environmental Product Declarations
 - a. Cement, slag, steel reinforcement
 - 2. MR Credit 3: Sourcing of Raw Materials
 - a. Recycled content: Slag, steel
 - b. Regionally sourced recycled content: Slag
 - 3. MR Credit 4: Material Ingredients
 - a. Report: Concrete curing compounds and sealers
- C. Design Mixtures: For each concrete pavement mixture. Include alternate mixture designs when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
- D. Qualification Data: For manufacturer.
- E. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated, based on comprehensive testing of current materials:
 - 1. Aggregates. Include service record data indicating absence of deleterious expansion of concrete due to alkali-aggregate reactivity.

- F. Material Certificates: Signed by manufacturers certifying that each of the following materials complies with requirements:
 - 1. Cementitious materials.
 - 2. Steel reinforcement and reinforcement accessories.
 - 3. Admixtures.
 - 4. Curing compounds.
 - 5. Joint fillers.
- G. Pavement joint pattern and locations of expansion joints. (For review and approval)

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Manufacturer of ready-mixed concrete products who complies with ASTM C 94/C 94M requirements for production facilities and equipment.
 - 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
- B. Testing Agency Qualifications: An independent agency qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.
 - 1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-01 or an equivalent certification program.
- C. ACI Publications: Comply with ACI 301, "Specification for Structural Concrete," unless modified by requirements in the Contract Documents.
- D. Concrete Testing Service: Contractor will engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.
- E. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from one source, and obtain admixtures through one source from one manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

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

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.

2.2 FORMS

- A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, smooth exposed surfaces.
 - 1. Use flexible or curved forms for curves with a radius 100 feet or less.

- B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

2.3 STEEL REINFORCEMENT

- A. Reinforcing Steel Bars: ASTM A 615, Grade 60, deformed billet steel bars, unfinished.
 - 1. Recycled Content: Provide steel with minimum 90 percent total recycled content, including at least 60 percent post-consumer recycled content.
- B. Plain Steel Wire: ANSI/ASTM A82, unfinished.
- C. Welded Steel Wire Fabric: ASTM A185 in flat sheets galvanized.

2.4 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source throughout the Project:
 - 1. Portland Cement: ASTM C150, Type II, White. Supplement with the following:
 - a. Ground Iron Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.
- B. Normal-Weight Aggregates: ASTM C 33, Class 4S coarse aggregate, uniformly graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar pavement applications and service conditions using similar aggregates and cementitious materials.
 - 1. Maximum Coarse-Aggregate Size: 1-1/2 inches nominal.
 - 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
 - 3. Regional Materials: Provide aggregate manufactured and of primary raw materials extracted or recovered within 500 mile radius of Project Site.
- C. Solar Reflectance Index (SRI) of Concrete Paving: Minimum value of 64.

2.5 ADMIXTURES

- A. Air-Entraining Admixture: ASTM C 260.
- B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.
 - 1. Water-Reducing Admixture: ASTM C 494, Type A.
 - 2. Retarding Admixture: ASTM C 494, Type B.
 - 3. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.
 - 4. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.
 - 5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494, Type G.
 - 6. Plasticizing and Retarding Admixture: ASTM C 1017, Type II.

2.6 CURING MATERIALS

- A. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- B. Water: Potable.
- C. Evaporation Retarder: Waterborne, monomolecular film forming; manufactured for application to fresh concrete.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following, or approved equal:
 - a. Axim Concrete Technologies; Cimfilm.
 - b. Burke by Edeco; BurkeFilm.
 - c. ChemMasters; Spray-Film.
 - d. Conspec Marketing & Manufacturing Co., Inc.; Aquafilm.
 - e. Dayton Superior Corporation; Sure Film.
 - f. Euclid Chemical Company (The); Eucobar.
 - g. Kaufman Products, Inc.; Vapor Aid.
 - h. Lambert Corporation; Lambco Skin.
 - i. L&M Construction Chemicals, Inc.; E-Con.
 - j. MBT Protection and Repair, ChemRex Inc.; Confilm.
 - k. Meadows, W. R., Inc.; Sealtight Evapre.
 - l. Metalcrete Industries; Waterhold.
 - m. Nox-Crete Products Group, Kinsman Corporation; Monofilm.
 - n. Sika Corporation, Inc.; SikaFilm.
 - o. Symons Corporation; Finishing Aid.
 - p. Vexcon Chemicals, Inc.; Certi-Vex EnvioAssist.
- D. Clear Waterborne Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following, or approved equal:
 - a. Anti-Hydro International, Inc.; AH Curing Compound #2 DR WB.
 - b. Burke by Edoko; Aqua Resin Cure.
 - c. ChemMasters; Safe-Cure Clear.
 - d. Conspec Marketing & Manufacturing Co., Inc.; W.B. Resin Cure.
 - e. Dayton Superior Corporation; Day Chem Rez Cure (J-11-W).
 - f. Euclid Chemical Company (The); Kurez DR VOX.
 - g. Kaufman Products, Inc.; Thinfilm 420.
 - h. Lambert Corporation; Aqua Kure-Clear.
 - i. L&M Construction Chemicals, Inc.; L&M Cure R.
 - j. Meadows, W. R., Inc.; 1100 Clear.
 - k. Nox-Crete Products Group, Kinsman Corporation; Resin Cure E.
 - l. Symons Corporation; Resi-Chem Clear.
 - m. Tamms Industries Inc.; Horncure WB 30.
 - n. Unitex; Hydro Cure 309.
 - o. Vexcon Chemicals, Inc.; Certi-Vex Enviocure 100.

2.7 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork.
- B. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
- C. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:
 1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

2.8 CONCRETE MIXTURES

- A. Prepare design mixtures, proportioned according to ACI 301, for each type and strength of normal-weight concrete determined by either laboratory trial mixes or field experience.
 - 1. Use a qualified independent testing agency for preparing and reporting proposed concrete mixture designs for the trial batch method.
- B. Proportion mixtures to provide normal-weight concrete with the following properties:
 - 1. Compressive Strength (28 Days): 4000 psi.
 - 2. Maximum Water-Cementitious Materials Ratio at Point of Placement: 0.45.
 - 3. Slump Limit: 4 inches, plus or minus 1 inch. Slump may not be 2" or less.
- C. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:
 - 1. Air Content: 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.
- D. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.
- E. Admixtures: Use admixtures according to manufacturer's written instructions.
 - 1. Use water-reducing admixture in concrete, as required, for placement and workability.
 - 2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
 - 3. Use water-reducing admixture in pumped concrete, concrete required to be watertight and concrete with a water-cementitious materials ratio below 0.50.
- F. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement according to ACI 301 requirements for concrete exposed to deicing chemicals. as follows:
- G.
 - 1. Ground Iron Blast-Furnace Slag: 25 PERCENT MAX.

2.9 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. Furnish batch certificates for each batch discharged and used in the Work.
 - 1. When air temperature is between 85 deg F 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.

PART 3 - EXECUTION**3.1 EXAMINATION**

- A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.
- B. Proceed with concrete pavement operations only after nonconforming conditions have been corrected and subgrade is ready to receive pavement.

3.2 PREPARATION

- A. Remove loose material from compacted subbase surface immediately before placing concrete.

3.3 EDGE FORMS AND SCREED CONSTRUCTION

- A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides for pavement 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. Construct forms tight enough to prevent loss of concrete mortar.
- C. Clean forms and adjacent surfaces to receive concrete.
- D. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, to ensure separation from concrete without damage.
- E. Clean and repair surfaces of forms to be reused in the Work.

3.4 STEEL REINFORCEMENT

- 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. Accurately position, support and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
- D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- E. Install welded wire reinforcement in 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.

3.5 JOINTS

- A. General: Form construction, isolation, and contraction joints and tool edgings 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 pavement, place transverse joints to align with previously placed joints, unless otherwise indicated.
- B. Construction Joints: Set construction joints at side and end terminations of pavement and at locations where pavement operations are stopped for more than one-half hour unless pavement terminates at isolation joints.
 - 1. Continue steel reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of pavement strips, unless otherwise indicated.
 - 2. Provide tie bars at sides of pavement strips where indicated.
 - 3. Butt Joints: Use bonding agent or epoxy bonding adhesive at joint locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
 - 4. Keyed Joints: Provide preformed keyway-section forms or bulkhead forms with keys, unless otherwise indicated. Embed keys at least 1-1/2 inches into concrete.

5. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt-coat 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 18 feet, unless otherwise indicated.
 2. Extend joint fillers full width and depth of joint.
 3. Terminate joint filler not less than 1/4 inch or more than 1/2 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. Protect top edge of joint filler during concrete placement 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 concrete pavement:
 1. Tooled Joints: Form contraction joints with tool. Tool 3/8-inch-wide joints 1/2-inch into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks. Repeat tooling of joints after applying surface finishes. Eliminate tool marks on concrete surfaces.
- E. Edging: Tool edges of pavement, gutters, curbs, and joints in concrete after initial floating with an edging tool to a 1/4-inch radius. Repeat tooling of edges after applying surface finishes. Eliminate tool marks on concrete surfaces.

3.6 CONCRETE PLACEMENT

- A. Inspection: Before placing concrete, inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast in. Notify other trades to permit installation of their work.
- B. Remove snow, ice, or frost from subbase surface and 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.
- F. Do not add water to fresh concrete after testing.
- G. 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.
- H. Consolidate concrete according to ACI 301 by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.

1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating reinforcement, dowels, and joint devices.
- I. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
 1. When 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 mix designs.
- J. Hot-Weather 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 to 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.

3.7 CONCRETE 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.
 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.

3.8 CONCRETE PROTECTION AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.
- D. Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound as follows:

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

3.9 JOINT FILLING

- A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
 1. Defer joint filling until concrete has aged at least one month or as recommended by manufacturer, whichever is longer. Do not fill joints until construction traffic has permanently ceased.
- B. Remove dirt, debris, saw cuttings, curing compounds and sealers from joints; leave contact faces of joint clean and dry.

3.10 PAVEMENT TOLERANCES

- A. Comply with tolerances of ACI 117 and as follows:
 1. Elevation: 1/4 inch.
 2. Thickness: Plus 3/8 inch, minus 1/4 inch.
 3. Surface: Gap below 10-foot-long, unleveled straightedge not to exceed 1/4 inch.
 4. Lateral Alignment and Spacing of Tie Bars and Dowels: 1 inch.
 5. Vertical Alignment of Tie Bars and Dowels: 1/4 inch.
 6. Alignment of Tie-Bar End Relative to Line Perpendicular to Pavement Edge: 1/2 inch.
 7. Alignment of Dowel-Bar End Relative to Line Perpendicular to Pavement Edge: Length of dowel 1/4 inch per 12 inches.
 8. Joint Spacing: 3 inches.
 9. Contraction Joint Depth: Plus 1/4 inch, no minus.
 10. Joint Width: Plus 1/8 inch, no minus.

3.11 FIELD QUALITY CONTROL

- A. Testing Agency: Owner shall engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
 1. Testing Frequency: Obtain at least 1 composite sample for each 100 cu. yd. or fraction thereof of each concrete mix placed each day.
 - a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
 2. Slump: ASTM C 143; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mix. Perform additional tests when concrete consistency appears to change.
 3. Air Content: ASTM C 231, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.
 4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
 5. Compression Test Specimens: ASTM C 31; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.

- 6. Compressive-Strength Tests: ASTM C 39; test 1 specimen at 7 days and 2 specimens at 28 days.
 - a. A compressive-strength test shall be the average compressive strength from 2 specimens obtained from same composite sample and tested at 28 days.
 - C. Strength of each concrete mix will be satisfactory if average of any 3 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 A/E, 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 A/E 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 A/E.
 - G. Remove and replace concrete pavement where test results indicate that it does not comply with specified requirements.
 - H. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- 3.12 REPAIRS AND PROTECTION
- A. Remove and replace concrete pavement that is broken, damaged, or defective or that does not comply with requirements in this Section.
 - B. Drill test cores, where directed by A/E, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement areas with portland cement concrete bonded to pavement with epoxy adhesive.
 - C. Protect concrete from damage. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials as they occur.
 - D. Maintain concrete pavement free of stains, discoloration, dirt, and other foreign material. Sweep concrete pavement not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 32 13 13

SECTION 32 13 73 - PAVEMENT JOINT SEALANTS**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Expansion and contraction joints within cement concrete and masonry pavement.
 - 2. Joints between cement concrete and asphalt pavement.
- B. Related Sections include the following:
 - 1. Division 32 Section "Asphalt Paving" for constructing joints between concrete and asphalt pavement.
 - 2. Division 32 Section "Concrete Paving" for concrete paving, cast-in-place concrete curbs and mow strip.

1.3 SUBMITTALS

- A. Product Data: For each joint-sealant product indicated.
- B. Pavement-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.
- C. Product Certificates: For each type of joint sealant and accessory, signed by product manufacturer.
- D. Qualification Data: For Installer.
- E. Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:
 - 1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
 - 2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.
- F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for sealants.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by manufacturer.
- B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.
- C. Preconstruction Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.

1. Use ASTM C 1087 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
 2. Submit not fewer than three pieces of each type of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.
 3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
 4. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures including use of specially formulated primers.
 5. Testing will not be required if joint-sealant manufacturers submit joint preparation data that are based on previous testing of current sealant products for adhesion to, and compatibility with, joint substrates and other materials matching those submitted.
- D. Product Testing: Obtain test results for "Product Test Reports" Paragraph in Division 1 "Submittal Procedures" Article from a qualified testing agency based on testing of current sealant products within a 36-month period preceding the commencement of the Work.
1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 for testing indicated, as documented according to ASTM E 548.
- 1.5 DELIVERY, STORAGE, AND HANDLING
- A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multi-component materials.
 - B. Store and handle materials to comply with manufacturer's written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.
- 1.6 PROJECT 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 or covered with frost.
 3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
 4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in other Part 2 articles.

2.2 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealants, backing materials, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer based on testing and field experience.
- B. Coal-Tar sealants shall not be used in parking or paved areas.
- C. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.3 COLD-APPLIED JOINT SEALANTS

- A. Type SL Silicone Sealant for Concrete and Asphalt: Single-component, low-modulus, neutral-curing, self-leveling silicone sealant complying with ASTM D 5893 for Type SL.
 - 1. Available Products:
 - a. Crafc0 Inc.; RoadSaver Silicone SL.
 - b. Dow Corning Corporation; 890-SL.
 - c. Meadows, W. R., Inc.; SOF-Seal.

2.4 JOINT-SEALANT BACKER MATERIALS

- A. General: Provide joint-sealant backer materials that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by joint-sealant manufacturer based on field experience and laboratory testing.
- B. Round Backer Rods for Cold- and Hot-Applied Sealants: ASTM D 5249, Type 1, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.

2.5 PRIMERS

- A. Primers: Product recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions.
- B. Joint Priming: Prime joint substrates where indicated or where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install backer materials of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - 1. Do not leave gaps between ends of backer materials.
 - 2. Do not stretch, twist, puncture, or tear backer materials.

3. Remove absorbent backer materials that have become wet before sealant application and replace them with dry materials.
 - D. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
 1. Place sealants so they directly contact and fully wet joint substrates.
 2. Completely fill recesses provided for each joint configuration.
 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
 - E. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
 1. Remove excess sealants from surfaces adjacent to joint.
 2. Use tooling agents that are approved in writing by joint-sealant manufacturer and that do not discolor sealants or adjacent surfaces.
 - F. Provide joint configuration to comply with joint-sealant manufacturer's written instructions, unless otherwise indicated.
 - G. Provide recessed joint configuration for silicone sealants of recess depth and at locations indicated.
- 3.4 CLEANING
- A. Clean off excess sealants or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved by manufacturers of joint sealants and of products in which joints occur.
- 3.5 PROTECTION
- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately and replace with joint sealant so installations with repaired areas are indistinguishable from the original work.

END OF SECTION 32 13 73

SECTION 32 17 23 - 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.

1.2 SUMMARY

- A. Section includes painted markings applied to asphalt and concrete pavement.
- B. Related Sections include the following:
 - 1. Division 32 Section "Asphalt Paving" for constructing joints between concrete and asphalt pavement.
 - 2. Division 32 Section "Concrete Paving" for concrete paving, cast-in-place concrete curbs and mow strip.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review methods and procedures related to marking pavement including, but not limited to, the following:
 - a. Pavement 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: For each type of product.
 - 1. Include technical data and tested physical and performance properties.
- B. LEED Submittals: (Record Only)
 - 1. Product Data for Credit IEQ 4.2: For interior, field-applied, pavement-marking paints, documentation including printed statement of VOC content.
- C. Shop Drawings: For pavement markings.
 - 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.
- D. Samples: For each exposed product and for each color and texture specified; on rigid backing, 8 inches square.

1.5 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of MDSHA 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. 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:
- B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
1. Aexcel Inc.
 2. Benjamin Moore & Co.
 3. Color Wheel Paints & Coatings.
 4. Columbia Paint & Coatings.
 5. Conco Paints.
 6. Coronado Paint; Division of INSL-X Products Corporation.
 7. Diamond Vogel Paints.
 8. Dunn-Edwards Corporation.
 9. Ennis Traffic Safety Solutions, Inc.
 10. Frazee Paint.
 11. General Paint.
 12. Kwal Paint.
 13. M.A.B. Paints.
 14. McCormick Paints.
 15. Miller Paint.
 16. Parker Paint Mfg. Co. Inc.
 17. PPG Industries.
 18. Pratt & Lambert.
 19. Rodda Paint Co.
 20. Rohm and Haas Company; a subsidiary of The Dow Chemical Company.
 21. Scott Paint Company.
 22. Sherwin-Williams Company (The).

2.2 PAVEMENT-MARKING PAINT

- A. Pavement-Marking Paint: Latex, waterborne emulsion, lead and chromate free, ready mixed, complying with FS TT-P-1952, Type II, with drying time of less than 45 minutes.
1. Color: Yellow, White, Blue, Green
- B. Glass Beads: AASHTO M 247, Type 1 made of 100 percent recycled glass.
1. Roundness: Minimum 75 percent true spheres by weight.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that pavement is dry and in suitable condition to begin pavement marking according to 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 paving 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 **35 mils**.
 - 1. Apply graphic symbols and lettering with paint-resistant, die-cut stencils, firmly secured to pavement. Mask an extended area beyond edges of each stencil to prevent paint application beyond the stencil. Apply paint so that it cannot run beneath the 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 32 17 23

SECTION 33 05 00 - 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.

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. Flowable fill.
 - 8. Piped utility demolition.
 - 9. Piping system common requirements.
 - 10. Equipment installation common requirements.
 - 11. Painting.
 - 12. Concrete bases.
 - 13. Metal supports and anchorages.

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. PVC: Polyvinyl chloride plastic.

1.4 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Steel Piping Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
 - 1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
 - 2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
- C. Comply with ASME A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.

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 required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- B. Coordinate installation of identifying devices after completing covering and painting if devices are applied to surfaces.
- C. Coordinate size and location of concrete bases. Formwork, reinforcement, and concrete requirements are specified in Section 033000 "Cast-in-Place Concrete."

PART 2 - PRODUCTS

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. Solvent Cements for Joining Plastic Piping:
 - 1. ABS Piping: ASTM D 2235.
 - 2. CPVC Piping: ASTM F 493.
 - 3. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
 - 4. PVC to ABS Piping Transition: ASTM D 3138.

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.
 - 2. Aboveground Piping: Specified piping system fitting.
- C. AWWA Transition Couplings NPS 2 and Larger:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following, or comparable equal:
 - a. Cascade Waterworks Mfg. Co.
 - b. Dresser, Inc.; DMD Div.
 - c. Ford Meter Box Company, Inc. (The); Pipe Products Div.

- d. JCM Industries.
 - e. Smith-Blair, Inc.
 - f. Viking Johnson.
 - 3. Description: AWWA C219, metal sleeve-type coupling for underground pressure piping.
 - D. Plastic-to-Metal Transition Fittings:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following or comparable equal:
 - a. Spears Manufacturing Co.
 - b. PolyCam, Inc.
 - c. GF Piping Systems
 - 3. Description: CPVC and PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint or threaded end.
 - E. Plastic-to-Metal Transition Unions:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following, or comparable equal:
 - a. Colonial Engineering, Inc.
 - b. NIBCO INC.
 - c. Spears Manufacturing Co.
 - 3. Description: MSS SP-107 CPVC and PVC four-part union. Include brass or stainless-steel threaded end, solvent-cement-joint or threaded plastic end, rubber O-ring, and union nut.
 - F. Flexible Transition Couplings for Underground Nonpressure Drainage Piping:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following, or comparable equal:
 - a. Cascade Waterworks Mfg. Co.
 - b. Fernco, Inc.
 - c. Mission Rubber Company.
 - d. Plastic Oddities.
 - 3. Description: ASTM C 1173 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. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following, or comparable equal:
 - a. Capitol Manufacturing Co.
 - b. Central Plastics Company.
 - c. Epcos Sales, Inc.
 - d. Hart Industries, International, Inc.
 - e. Watts Water Technologies, Inc.
 - f. Zurn Plumbing Products Group; Wilkins Div.
3. Description: Factory fabricated, union, NPS 2 and smaller.
 - a. Pressure Rating: 250 psig at 180 deg F .
 - b. End Connections: Solder-joint copper alloy and threaded ferrous; threaded ferrous.

C. Dielectric Flanges:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following, or comparable equal:
 - a. Capitol Manufacturing Co.
 - b. Central Plastics Company.
 - c. Epcos Sales, Inc.
 - d. Watts Water Technologies, Inc.
3. Description: Factory-fabricated, bolted, companion-flange assembly, NPS 2-1/2 to NPS 4 and larger.
 - a. Pressure Rating: 175 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. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following, or comparable equal:
 - a. Advance Products & Systems, Inc.
 - b. Calpico, Inc.
 - c. Central Plastics Company.
 - d. Pipeline Seal and Insulator, Inc.
3. 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. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following, or comparable equal:
 - a. Calpico, Inc.
 - b. Lochinvar Corporation.
3. 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. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following, or comparable equal:
 - a. Perfection Corporation.
 - b. Precision Plumbing Products, Inc.
 - c. Victaulic Company.
3. 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. Mechanical sleeve seals for pipe penetrations are specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- B. Galvanized-Steel Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- C. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized, plain ends.
- D. Cast-Iron Sleeves: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- E. Molded PVC Sleeves: Permanent, with nailing flange for attaching to wooden forms.
- F. PVC Pipe Sleeves: ASTM D 1785, Schedule 40.
- G. 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. Stencils: Standard stencils prepared with letter sizes complying with recommendations in ASME A13.1. Minimum letter height is 1-1/4 inches for ducts, and 3/4 inch for access door signs and similar operational instructions.
1. Material: Fiberboard or Brass.
 2. Stencil Paint: Exterior, oil-based, alkyd-gloss black enamel, unless otherwise indicated. Paint may be in pressurized spray-can form.
 3. Identification Paint: Exterior, oil-based, alkyd enamel in colors according to ASME A13.1, unless otherwise indicated.
- D. Snap-on Plastic Pipe Markers: Manufacturer's standard preprinted, semirigid, snap-on type. Include color-coding according to ASME A13.1, unless otherwise indicated.
- E. Pressure-Sensitive Pipe Markers: Manufacturer's standard preprinted, color-coded, pressure-sensitive-vinyl type with permanent adhesive.
- F. Pipes with OD, Including Insulation, Less Than 6 Inches: Full-band pipe markers, extending 360 degrees around pipe at each location.
- G. Pipes with OD, Including Insulation, 6 Inches and Larger: Either full-band or strip-type pipe markers, at least three times letter height and of length required for label.
- H. Lettering: Manufacturer's standard preprinted captions as selected by Architect.
- I. Lettering: Use piping system terms indicated and abbreviate only as necessary for each application length.
1. Arrows: Either integrally with piping system service lettering to accommodate both directions of flow, or as separate unit on each pipe marker to indicate direction of flow.
- J. Plastic Tape: Manufacturer's standard color-coded, pressure-sensitive, self-adhesive vinyl tape, at least 3 mils thick.
1. Width: 1-1/2 inches on pipes with OD, including insulation, less than 6 inches; 2-1/2 inches for larger pipes.
 2. Color: Comply with ASME A13.1, unless otherwise indicated.
- K. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch sequenced numbers. Include 5/32-inch hole for fastener.
1. Material: 0.032-inch- thick, polished brass or aluminum.
 2. Material: 0.0375-inch- thick stainless steel.
 3. Material: 3/32-inch- thick plastic laminate with 2 black surfaces and a white inner layer.
 4. Material: Valve manufacturer's standard solid plastic.
 5. Size: 1-1/2 inches in diameter, unless otherwise indicated.
 6. Shape: As indicated for each piping system.
- L. Valve Tag Fasteners: Brass, wire-link or beaded chain; or brass S-hooks.
- M. Engraved Plastic-Laminate Signs: ASTM D 709, 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: 1/8 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.
- N. Plastic Equipment Markers: Manufacturer's standard laminated plastic, in the following color codes:
1. Green: Cooling equipment and components.
 2. Yellow: Heating equipment and components.
 3. Brown: Energy reclamation equipment and components.
 4. Blue: Equipment and components that do not meet criteria above.
 5. Hazardous Equipment: Use colors and designs recommended by ASME A13.1.
 6. Terminology: Match schedules as closely as possible. Include the following:
 - a. Name and plan number.
 - b. Equipment service.
 - c. Design capacity.
 - d. Other design parameters such as pressure drop, entering and leaving conditions, and speed.
 7. Size: 2-1/2 by 4 inches for control devices, dampers, and valves; 4-1/2 by 6 inches for equipment.
- O. Plasticized Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with mat finish suitable for writing.
1. Size: 3-1/4 by 5-5/8 inches.
 2. Fasteners: Brass grommets and wire.
 3. Nomenclature: Large-size primary caption such as DANGER, CAUTION, or DO NOT OPERATE.
- P. Lettering and Graphics: Coordinate names, abbreviations, and other designations used in piped utility identification with corresponding designations indicated. Use numbers, letters, and terms indicated for proper identification, operation, and maintenance of piped utility systems and equipment.
1. Multiple Systems: Identify individual system number and service if multiple systems of same name are indicated.
- 2.6 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.
- 2.7 FLOWABLE FILL
- A. Description: Low-strength-concrete, flowable-slurry mix.
1. Cement: ASTM C 150, Type I, portland.
 2. Density: 115- to 145-lb/cu. ft. .
 3. Aggregates: ASTM C 33, natural sand, fine and crushed gravel or stone, coarse.
 4. Aggregates: ASTM C 33, natural sand, fine.
 5. Admixture: ASTM C 618, fly-ash mineral.
 6. Water: Comply with ASTM C 94/C 94M.
 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. Dry Piping Systems: Connect piping of dissimilar metals with the following:
 - 1. NPS 2 and Smaller: Dielectric unions.
 - 2. NPS 2-1/2 to NPS 12: Dielectric flanges or dielectric flange kits.
- B. Wet Piping Systems: Connect piping of dissimilar metals with the following:
 - 1. NPS 2 and Smaller: Dielectric [couplings 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. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.
 - 1. Cut sleeves to length for mounting flush with both surfaces.
 - a. Exception: Extend sleeves installed in floors of equipment areas or other wet areas 2 inches above finished floor level.
 - 2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
 - a. Steel Pipe Sleeves: For pipes smaller than NPS 6.
 - b. Steel Sheet Sleeves: For pipes NPS 6 and larger, penetrating gypsum-board partitions.
- L. Verify final equipment locations for roughing-in.
- M. Refer to equipment specifications in other Sections for roughing-in requirements.

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 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 (0.20 percent maximum lead content) complying with ASTM B 32.
- 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 F 402 for safe-handling practice of cleaners, primers, and solvent cements.
 - 2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 appendixes.
 - 3. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
 - 4. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
 - 5. PVC Nonpressure Piping: Join according to ASTM D 2855.
 - 6. PVC to ABS Nonpressure Transition Fittings: Join according to ASTM D 3138 Appendix.
- L. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.
- M. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.
- N. Plastic Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
 - 1. Plain-End 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 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
 - 2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
 - 3. Install dielectric fittings at connections of dissimilar metal pipes.

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 PAINTING

- A. Painting of piped utility systems, equipment, and components is specified in Section 099113 "Exterior Painting," Section 099123 "Interior Painting," and Section 099600 "High-Performance Coatings."
- B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.8 IDENTIFICATION

- A. Piping Systems: Install pipe markers on each system. Include arrows showing normal direction of flow.
 - 1. Stenciled Markers: According to ASME A13.1.

2. Plastic markers, with application systems. Install on insulation segment if required for hot noninsulated piping.
3. Locate pipe markers on exposed piping according to the following:
 - a. Near each valve and control device.
 - b. Near each branch, excluding short takeoffs for equipment and terminal units. Mark each pipe at branch if flow pattern is not obvious.
 - c. Near locations where pipes pass through walls or floors or enter inaccessible enclosures.
 - d. At manholes and similar access points that permit view of concealed piping.
 - e. Near major equipment items and other points of origination and termination.
- B. Equipment: Install engraved plastic-laminate sign or equipment marker on or near each major item of equipment.
 1. Lettering Size: Minimum 1/4 inch high for name of unit if viewing distance is less than 24 inches, 1/2 inch high for distances up to 72 inches, and proportionately larger lettering for greater distances. Provide secondary lettering two-thirds to three-fourths of size of principal lettering.
 2. Text of Signs: Provide name of identified unit. Include text to distinguish among multiple units, inform user of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.
- C. Adjusting: Relocate identifying devices that become visually blocked by work of this or other Divisions.

3.9 CONCRETE BASES

- A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
 1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
 2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of base.
 3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
 4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 5. Install anchor bolts to elevations required for proper attachment to supported equipment.
 6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
 7. Use 3000-psi, 28-day compressive-strength concrete and reinforcement as specified in Section 033000 "Cast-in-Place Concrete."

3.10 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Refer to Section 055000 "Metal Fabrications" for structural steel.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor piped utility materials and equipment.
- C. Field Welding: Comply with AWS D1.1/D1.1M.

3.11 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 33 05 00

SECTION 33 05 10 - UTILITY STRUCTURES**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Precast Structures.
 - 2. Utility Structure Accessories.

1.3 SUBMITTALS

- A. Product Data: For the following:
 - 1. Accessories for structures.
- B. Shop Drawings for Precast or Factory-Fabricated Underground Utility Structures: Include plans, elevations, sections, details, attachments to other work, and accessories, including the following:
 - 1. Reinforcement details.
 - 2. Frame and cover design and structure frame support rings.
 - 3. Ladder details.
 - 4. Grounding details.
 - 5. Dimensioned locations and sizes of all openings and sumps.
 - 6. Joint details.
- C. Product Certificates: For concrete and steel used in precast concrete structures, comply with ASTM C 858.
- D. Qualification Data: For qualified professional engineer and testing agency.
- E. Source quality-control reports.
- F. Field quality-control reports.

1.4 QUALITY ASSURANCE

- A. Comply with IEEE C2.
- B. Comply with NFPA 70.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store precast concrete underground utility structures at Project site as recommended by manufacturer to prevent physical damage. Arrange so identification markings are visible.
- B. Store precast plastic underground utility structures at Project site out of direct sunlight as recommended by manufacturer to prevent damage. Arrange so identification markings are visible.
- C. Lift and support precast concrete units only at designated lifting or supporting points.

1.6 COORDINATION

- A. Coordinate layout and installation of structures with final arrangement of other utilities, site grading, and surface features as determined in the field.
- B. Coordinate elevations of pipe and conduit entrances into structures with final locations and profiles of those utilities as determined by coordination with other utilities, underground obstructions, and surface features. Revise locations and elevations from those indicated as required to suit field conditions and to ensure that pipe and conduit runs drain to structures, and as approved by Architect.

PART 2 - PRODUCTS

2.1 PRECAST STRUCTURES

- 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. Christy Concrete Products.
 - 2. Cretex Concrete Products West, Inc.; Riverton Division.
 - 3. Oldcastle Precast Group.
 - 4. Oldcastle Precast Inc.; Utility Vault Division.
 - 5. Utility Concrete Products, LLC.
 - 6. Advanced Drainage Systems - Nyloplast
 - 7. ACO, Inc.
- B. Comply with ASTM C 858, with structural design loading as specified on the drawings, and with interlocking mating sections, complete with accessories, hardware, and features.
 - 1. Openings: Precast openings in walls, arranged to match dimensions and elevations of approaching pipes and conduits with the manufacturer's standard allowance, vertically and horizontally, to accommodate alignment variations.
 - a. Openings shall be framed with at least two additional No. 4 steel reinforcing bars in concrete around each opening.
- C. Joint Sealant: Asphaltic-butyl material with adhesion, cohesion, flexibility, and durability properties necessary to withstand maximum hydrostatic pressures at the installation location with the ground-water level at grade.

2.2 UTILITY STRUCTURE ACCESSORIES

- 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. Bilco Company (The).
 - 2. Campbell Foundry Company.
 - 3. McKinley Iron Works.
 - 4. Neenah Foundry Company.
 - 5. Oldcastle Precast Group.
 - 6. Oldcastle Precast Inc.; Utility Vault Division.
 - 7. Advanced Drainage Systems - Nyloplast
 - 8. ACO, Inc.
- B. Ferrous metal hardware, where indicated, shall be hot-dip galvanized complying with ASTM A 153 and A 123.

- C. Structure Frames, Covers, and Chimney Components: Comply with structural design loading specified for structure.
 - 1. Frame and Cover: Weatherproof, gray cast iron complying with ASTM A 48/A 48M, Class 30B with milled cover-to-frame bearing surfaces; diameter as indicated on the drawings.
 - a. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
 - 2. Cover Legend: Cast in. Retained to suit system.
 - 3. Structure Chimney Components: Precast concrete rings with dimensions matched to those of roof opening.
 - a. Mortar for Chimney Ring and Frame and Cover Joints: Comply with ASTM C 270, Type M, except for quantities less than 2.0 cu. ft. where packaged mix complying with ASTM C 387/C 387M, Type M, may be used.
 - D. Expansion Anchors for Installation after Concrete Is Cast: Zinc-plated, carbon-steel-wedge type with stainless-steel expander clip with 1/2-inch bolt, 5300-lbf rated pullout strength, and minimum 6800-lbf rated shear strength.
 - E. Sealing Compound: Nonhardening, safe for contact with human skin and workable at temperatures as low as 35 deg F. Capable of withstanding temperature of 300 deg F without slump and adhering to clean surfaces of plastic ducts, metallic conduits, conduit coatings, concrete, masonry, lead, cable sheaths, cable jackets, insulation materials, and common metals.
 - F. Fixed Structure Ladders: Arranged for attachment to wall and floor of structure. Ladder and mounting brackets and braces shall be fabricated from hot-dip galvanized steel.
 - G. Cover Hooks: Heavy duty, designed for lifts 60 lbf required.
- 2.3 SOURCE QUALITY CONTROL
- A. Test and inspect precast concrete utility structures according to ASTM C 1037.

PART 3 - EXECUTION

3.1 CORROSION PROTECTION

- A. Aluminum shall not be installed in contact with earth or concrete.

3.2 UNDERGROUND ENCLOSURE APPLICATION

- A. Structures: Precast concrete.
 - 1. Units Located in Roadways and Other Deliberate Traffic Paths by Heavy or Medium Vehicles: H-20 structural load rating according to AASHTO HB 17.
 - 2. Units Not Located in Deliberate Traffic Paths by Heavy or Medium Vehicles: H-10 load rating according to AASHTO HB 17.

3.3 EARTHWORK

- A. Excavation and Backfill: Comply with Division 2 Section "Earthwork," but do not use heavy-duty, hydraulic-operated, compaction equipment.
- B. Restore surface features at areas disturbed by excavation and reestablish original grades unless otherwise indicated. Replace removed sod immediately after backfilling is completed.

- C. Restore areas disturbed by trenching, storing of dirt, cable laying, and other work. Restore vegetation and include necessary topsoiling, fertilizing, liming, seeding, sodding, sprigging, and mulching. Comply with Division 2 Sections "Lawns and Grasses" and "Exterior Plants."
- D. Cut and patch existing pavement in the path of underground ducts and utility structures according to Division 2 Section "Cement Concrete Pavement."

3.4 INSTALLATION OF CONCRETE STRUCTURES

- A. Precast Concrete Handhole and Structure Installation:
 - 1. Comply with ASTM C 891 unless otherwise indicated.
 - 2. Install units level and plumb and with orientation and depth coordinated with connecting ducts to minimize bends and deflections required for proper entrances.
 - 3. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.
- B. Elevations:
 - 1. Structure Roof: Install with rooftop at least 15 inches below finished grade.
 - 2. Structure Frame: In paved areas and trafficways, set frames flush with finished grade. Set other structure frames 1 inch above finished grade.
- C. Drainage: Install drains in bottom of structures where indicated. Coordinate with drainage provisions indicated.
- D. Structure Access: Circular opening in structure roof; sized to match cover size.
 - 1. Structures with Fixed Ladders: Offset access opening from structure centerlines to align with ladder.
 - 2. Install chimney, constructed of precast concrete collars and rings to support frame and cover and to connect cover with structure roof opening. Provide moisture-tight masonry joints and waterproof grouting for cast-iron frame to chimney.
- E. Fixed Structure Ladders: Arrange to provide for safe entry with maximum clearance from other items in structures.
- F. Field-Installed Bolting Anchors in Structures: Do not drill deeper than 3-7/8 inches for anchor bolts installed in the field.
- G. Warning Sign: Install "Confined Space Hazard" warning sign on the inside surface of each structure cover.

3.5 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Demonstrate capability and compliance with requirements on completion of installation of underground utility structures.
 - 2. Test structure grounding to ensure electrical continuity of grounding and bonding connections. Measure and report ground resistance as specified in Division 16 Section "Grounding and Bonding."
- B. Correct deficiencies and retest as specified above to demonstrate compliance.
- C. Prepare test and inspection reports.

3.6 CLEANING

- A. Clean internal surfaces of structures, including sump. Remove foreign material.

END OF SECTION 33 05 10

SECTION 33 41 00 - STORM UTILITY DRAINAGE PIPING**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Pipe and fittings.
- B. Related Sections include the following:
 - 1. Section 01 "Temporary Facilities" for temporary utilities, temporary construction and support facilities, temporary security and protection facilities, and temporary erosion and sedimentation control procedures.
 - 2. Section 01 "Project Record Documents" for preparation of record documents identifying and accurately locating final storm drainage infrastructure.
 - 3. Section 31 "Earth Moving" for soil materials, excavating, backfilling, and site grading.

1.3 DEFINITIONS

- A. HDPE: High Density Polyethylene Pipe

1.4 PERFORMANCE REQUIREMENTS

- A. Gravity-Flow, Non-pressure, Drainage-Piping Pressure Rating: At least equal to system test pressure. Pipe joints shall be water tight.

1.5 SUBMITTALS

- A. Product Data: For each type, not size, of product indicated.
- B. Product Certificates: For each type of pipe, not size, and fitting, from manufacturer.
- C. Field quality-control reports.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Do not store plastic pipe and fittings in direct sunlight.
- B. Protect pipe, pipe fittings, and seals from dirt and damage.

PART 2 - PRODUCTS**2.1 HIGH DENSITY POLYETHYLENE PIPE AND FITTINGS**

- A. HDPE Pipe and Fittings, NPS 6 and Larger: Corrugated and smooth lined pipe and fittings manufactured in accordance with requirements of ASTM F 2306, latest edition. Pipe shall be type S with a full circular cross section, with an outer corrugated pipe wall and a smooth inner wall. Fittings shall be water-tight.
- B. HDPE corrugated and smooth lined pipe shall be manufactured from virgin PE compounds which conform with the requirements of cell classification 335444C as defined and described in ASTM D 3350.

- C. Minimum pipe stiffness at five percent deflection shall be as described in ASTM F 2306, Section 6.3 when tested in accordance with ASTM D 2412.
- D. HDPE pipe and fittings shall be supplied by the same Manufacturer. Pipe and fittings from different Manufacturers shall not be interchanged.

2.2 CONCRETE

- A. General: Cast-in-place concrete according to ACI 318, ACI 350/350R, and the following:
 - 1. Cement: ASTM C 150, Type II.
 - 2. Fine Aggregate: ASTM C 33, sand.
 - 3. Coarse Aggregate: ASTM C 33, crushed gravel.
 - 4. Water: Potable.
- B. Portland Cement Design Mix: 3500 psi minimum, with 0.45 maximum water/cementitious materials ratio.
 - 1. Reinforcing Fabric: ASTM A 185, steel, welded wire fabric, plain.
 - 2. Reinforcing Bars: ASTM A 615, Grade 60 deformed steel.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Excavation, trenching, and backfilling are specified in Section 31 20 00 "Earth Moving."

3.2 PIPING INSTALLATION

- A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.
- B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
- C. Install gravity-flow, nonpressure drainage piping according to the following:
 - 1. Install piping pitched down in direction of flow.
 - 2. Install piping NPS 6 and larger with restrained joints at tee fittings and at changes in direction. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place concrete supports or anchors.
 - 3. Install piping with 36-inch minimum cover, unless noted otherwise on the plans.
 - 4. Install PVC water-service piping according to ASTM D 2321 and ASTM F 1668.
- D. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.
- E. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

3.3 PIPE JOINT CONSTRUCTION

- A. Join gravity-flow, nonpressure drainage piping according to the manufacturer specifications.
- B. Joints shall be soil tight.

3.4 CONCRETE PLACEMENT

- A. Place cast-in-place concrete according to ACI 318.

3.5 CONNECTIONS

- A. Connect non-pressure, gravity-flow drainage piping in building's storm building drains specified in Section 22 14 13 "Facility Storm Drainage Piping."
- B. Make connections to existing piping and underground manholes.
 - 1. Make connections into existing piping, NPS 4 to NPS 20. Remove section of existing pipe, install utility structure, and encase pipe connection with not less than 6 inches of concrete with 28-day compressive strength of 3500 psi.
 - 2. Protect existing piping, manholes, and structures to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

3.6 CLOSING ABANDONED STORM DRAINAGE SYSTEMS

- A. Abandoned Piping: Close open ends of abandoned underground piping indicated to remain in place. Include closures strong enough to withstand hydrostatic and earth pressures that may result after ends of abandoned piping have been closed. Use either procedure below:
 - 1. Close open ends of piping with at least 8-inch thick, brick masonry bulkheads.
 - 2. Close open ends of piping with threaded metal caps, plastic plugs, or other acceptable methods suitable for size and type of material being closed. Do not use wood plugs.
- B. Backfill to grade according to Section 312000 "Earth Moving."

3.7 IDENTIFICATION

- A. Materials and their installation are specified in Section 31 20 00 "Earth Moving." Arrange for installation of green warning tape directly over piping and at outside edge of underground structures.
 - 1. Use detectable warning tape over nonferrous piping.

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 reports for each system inspection.
 - 2. Defects requiring correction include the following:
 - a. Alignment: Less than full diameter of inside of pipe is visible between structures.
 - b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
 - c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
 - d. Infiltration: Water leakage into piping.
 - e. Exfiltration: Water leakage from or around piping.
 - 3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
 - 4. Reinspect and repeat procedure until results are satisfactory.
- B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
 - 1. Do not enclose, cover, or put into service before inspection and approval.

2. Test completed piping systems according to requirements of MDE.
 3. Schedule tests and inspections by the Owner with at least 24 hours' advance notice.
 4. Submit separate report for each test.
 5. Gravity-Flow Storm Drainage Piping: Test according to requirements of MDE, UNI-B-6, and the following:
 - a. Exception: Piping with soiltight joints unless required by the University.
 - b. Test plastic piping according to ASTM F 1417.
- C. Leaks and loss in test pressure constitute defects that must be repaired.
- D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.
- 3.9 CLEANING
- A. Clean interior of piping of dirt and superfluous materials. Flush with water.

END OF SECTION 33 41 00

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: CEN24-000078

Permit Type: Commercial Environmental

Sub Type: Grading

Date Issued: 01/23/2025

Expiration Date: 01/22/2027

Property Information

Property Address: 4419 A BUCKS SCHOOLHOUSE RD

City, State, Zip: ROSEDALE, MD, 21237

Tax ID: 1600011107

District: 14

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 MARYLAND

Owner Address: 01-G---165-31 COURT HOUSE, BALTIMORE, MD, 21204

Tenant:

Applicant: Mark Mahan, PE

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 inquiries.



Baltimore County, Maryland
Department of Permits, Approvals, and Inspections
BUILDING PERMIT

Permit Number: CEN24-000078

Permit Type: Commercial Environmental

Sub Type: Grading

Date Issued: 01/23/2025

Expiration Date: 01/22/2027

Building Permit Contractor

Name of Contractor: OWNER ACTING AS GENERAL CONTRACTOR

Phone Number:

Address:

City, State, Zip: , ,

Is Owner Contractor?:

Building Permit Information

Description of Work: Grade 19,532SF for facility. 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 inquiries.



Baltimore County, Maryland
Department of Permits, Approvals, and Inspections
BUILDING PERMIT

Permit Number: CEN24-000079

Permit Type: Commercial Environmental

Sub Type: Storm Water

Date Issued: 12/18/2024

Expiration Date: 12/17/2026

Property Information

Property Address: 4419 A BUCKS SCHOOLHOUSE RD

City, State, Zip: ROSEDALE, MD, 21237

Tax ID: 1600011107

District: 14

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 MARYLAND

Owner Address: 01-G---165-31 COURT HOUSE, BALTIMORE, MD, 21204

Tenant:

Applicant: Mark Mahan, PE

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 inquiries.



Baltimore County, Maryland
Department of Permits, Approvals, and Inspections
BUILDING PERMIT

Permit Number: CEN24-000079

Permit Type: Commercial Environmental

Sub Type: Storm Water

Date Issued: 12/18/2024

Expiration Date: 12/17/2026

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 1.54 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 inquiries.

SECTION I V

Proposal

**This Section to be
Completed by Time of Bid**

SECTION - IV
PROPOSAL

DESCRIPTION OF WORK

Bid Opening via Teleconference WebEx: Thursday, May 22, 2025 @ 10:45 a.m. EST.
WebEx Phone Number 1-415-655-0001, Access Code Number 2317 816 1549##.

Begin Work Within Fifteen (15) Days After NOTICE TO PROCEED

Calendar Days for Completion: One Hundred Forty-Seven (147)

Liquidated and Other Damages: FIFTEEN HUNDRED DOLLARS (\$1500.00 PER CALENDAR DAY)

Cost Group “D” (\$1,000,001 to \$2,500,000) (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: Construction of new facility; building enclosure to be delegated design metal building system. **Rosedale - District 14c5.**

The following listed Drawing Number(s) are collectively the “Drawings”, and are hereby incorporated in the Contract.

<u>Workday Number</u>	<u>Drawing Number(s)</u>
10000718	2024-2763 thru 2812

A pre-bid meeting will be held on Wednesday, May 7, 2025 at 1:00 p.m. EST via WebEx. *Phone-In (Audio Only)* – 1-415-655-0001, Meeting Number 2303 856 9370##. *Video Conference* – Meeting Number 2303 856 9370 ,**Password: nNeVAeSN339**, go to <https://signin.webex.com/join>, or for the WebEx link go to www.baltimorecountymd.gov/departments/public-works/engineering/contracts/current-solicitations

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 Construction”, 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

Fullerton Utilities New Truck Garage - 4419A Buck Schoolhouse Road, Rosedale, MD. 21237
 CONTRACT NUMBER: 24167 PO0
 WORKDAY NUMBER: PROJ-10000718
 CALENDAR DAYS: 147

CONTRACTOR: _____
ADDRESS: _____
PHONE: _____

BID ITEM	COMM. CODE		DESCRIPTION	UNIT	ESTIMATED QUANTITY	UNIT PRICE	TOTAL AMOUNT
1	0	0000	CONSTRUCTION OF NEW 7 (SEVEN) BAY GARAGE	LS	1		\$
TOTAL COST FOR CONTRACT							\$

 TOTAL COST FOR CONTRACT IN WORDS

 OFFICER SIGNATURE

 TITLE

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.

10. 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: _____
Date: _____	Name: _____
	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.)]

Fullerton Utilities New Truck Garage
Contract Name

24167 PO0
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: _____

Corporate Principal

In Presence of:

(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

**BALTIMORE COUNTY
PREVAILING WAGE AND LOCAL HIRING**

AFFIDAVIT

(Project Name) _____

Proposal No.: _____

Project No.: _____

On behalf of _____, I do solemnly declare and affirm,
(Contractor)
under penalty of perjury, that to the best of my knowledge, information, and belief:

1. I have submitted all documentation in accordance with Baltimore County Code § 10-2- 506 and § 10-2-507 regarding the prevailing wage and local hiring laws and requirements of the prevailing wage guidelines located at ([Prevailing Wage and Local Hire Laws](#)), and acknowledge that I have read and agree to all provisions of said law, as amended, and have a continuing obligation to be compliant with the law and any changes to the law.

2. I shall not knowingly provide any false information relating to payroll documentation and/or hiring of local employees for capital improvement contracts that are subject to the prevailing wage and/or local hiring laws of Baltimore County. I further attest and certify that all documentation relating to the same will be accurate and complete and will remain accurate and complete on an ongoing basis, and will reflect the payroll and/or local hiring status of contractors, subcontractors, apprentices, and independent contractors performing work for the Contract (contract number _____). I acknowledge that I have been informed and am aware of the foregoing requirements and that I am authorized to make this certification on behalf of myself and all subcontractors and parties performing work pursuant to this Contract.

3. I certify and attest that I am an officer or agent of the Contractor or subcontractor who supervises the payment of employees. I understand and agree that all documentation related to prevailing wages and/or local hiring required by law shall be submitted to Baltimore County's Prevailing Wage Administrator or designee before any surety is released or final payment due under the terms of the Contract is made.

4. I further certify and attest that I will have personal knowledge of the wages paid to all employees of _____ for work performed on the Contract and of all of the hours worked, and that I am an authorized agent of the Contractor and assume responsibility for my actions.

5. I further certify and attest that _____ will comply with prevailing wage rates set by the State of Maryland as the same apply to the Contract and are a part of the bid documents and Contract, and that _____ will comply with applicable local hiring requirements.

6. I attest and certify that, if the Contract is subject to the local hiring requirement under §10-2-507 of the Baltimore County Code, _____ will make best efforts to ensure that residents of Baltimore County constitute at least 51% of the new hires made for the Contract, subject to all exceptions allowable by law.

7. I certify and attest that, if the Contract is subject to prevailing wage requirements, no rebates or deductions will be made, directly or indirectly, from any wages paid in connection with the Contract, other than those provided for by law.

8. I certify and attest that, if awarded the Contract and if the Contract is subject to prevailing wage law, I will submit certified payroll to the County through its electronic compliance system or as instructed by the Prevailing Wage and Local Hire Unit.

9. I certify that if awarded the Contract, I will provide a list of subcontractors who will participate as a beneficiary of this project to the agency and the Prevailing Wage and Local Hire Unit at PrevailingWage@baltimorecountymd.gov.

10. I understand that no funds will be dispersed by the County until an Employment Analysis has been issued to the Prevailing Wage and Local Hire Unit in compliance with the local hire law. The Employment Analysis will include how many jobs will be required to complete the project; how many current employees are available to complete the project, and how many of those jobs will require new hires.

Contractor/Bidder/Offeror

By

Printed Name

Printed Title

Date

Phone

License Number

Business Email

BALTIMORE COUNTY, MARYLAND

Prevailing Wage and Local Hiring Contract Requirements and Policies

The Contractor and all Subcontractors must comply with the Prevailing Wage and Local Hiring Laws, contained in Baltimore County Code § 10-2-506 and § 10-2-507, respectively, as amended. Prevailing wage means the wage rate paid by employers that is determined by a governmental authority, based upon a particular geographic area, for a given class of labor and type of project. The County will use the prevailing wage established by the State of Maryland (the "State") Department of Labor for state funded construction contracts in the County at the time of award. These rates include the basic hourly rate and fringe benefits. Apprentices must be paid at least the rate that the State's Apprenticeship and Training Council sets for an apprentice in the trade involved, based on a percentage of the prevailing wage rate in that trade. Any Contractor that is subject to the prevailing wage or local hiring law will be required to agree to the below provisions:

For the purposes of these requirements, an employee means an apprentice, laborer or mechanic employed by a contractor or subcontractor on a capital improvement project with a value of over \$300,000 or a County-subsidized capital project with a value over \$5,000,000.

Capital Improvement Project does not include blanket order or open-end agreements, capital improvement projects subject to a federal or state prevailing wage law, awarded without competition; with another governmental entity; to the extent the contractor is precluded from compliance by the terms of any federal or state law, contract or grant; entered into pursuant to Baltimore County Code § 10-2-310(e); entered into as a joint or cooperative purchase; or entered into as an emergency purchase.

The purpose of a prevailing wage is to ensure that contractors institute local hiring practices for Capital Improvement contracts and Capital Projects under certain circumstances as required by law, and that the Contractor's employees who work on capital improvement contracts are paid the going rate for their services. The prevailing wage rates are established by the State of Maryland Department of Labor and apply to all of the Contractor's employees and any and all Subcontractors. The Contractor and all Subcontractors must comply with all of the requirements of the Prevailing Wage Law including, but not limited to, the following:

1. Pay employees the prescribed rate as annually established by the State's Department of Labor; the prevailing wage rates in effect on the date a solicitation is issued and will apply throughout the term of a contract resulting from that solicitation. Contractor or subcontractors may NOT split or subdivide a capital improvement contract, pay an employee through a third party, treat an employee as a subcontractor or independent contractor to avoid any requirement of the County's prevailing wage law; or employ an individual classified as a helper or trainee to perform direct and measurable work on a capital improvement contract.

2. Pay employees at a rate equal to or more than the prevailing wage rate currently in effect for the type of work performed.

3. Pay employees overtime for work (I) more than eight hours in any single calendar day; (II) more than 40 hours in a work week; or (III) on a Sunday or a legal holiday.

4. Classify employees in their proper work classification in conformance with the schedule established by the State's Department of Labor.

5. May only make fair and reasonable deductions that are (a) required by law; (b) authorized in a written agreement between an employee and contractor or subcontractor signed at the beginning of employment (any deductions taken from employee paychecks including healthcare, pension, 401K, IRA, etc., child/spouse support, or tax levies); and submitted by the contractor or subcontractor to the Director of the County's Prevailing Wage Program; or required or allowed by a collective bargaining agreement between a bona fide labor organization and a contractor or subcontractor.

Electronically submit a certified copy of payroll records through the County's designated certified payroll and compliance system within 14 days after the end of payroll week ending date, to verify that Prevailing Wage rates have been paid to employees.

6. Backup documentation may be required upon demand from the County to be submitted for all 3rd party benefits being claimed, to include, but not limited to: *one month's healthcare transmittal showing employee name and amount company pays on their behalf, company vacation/sick policy, etc. or if Union, a Union transmittal for one month in which work has been performed.*

7. Retain records for a period of five (5) years after the work is completed and permit the Director of the County Prevailing Wage Program, or his/her designee, to inspect the payroll records at a reasonable time and as often as necessary.

8. Payroll records shall contain a statement signed by the contractor or subcontractor (including tiered subcontractors) certifying that the payroll records are complete and correct; the wage rates are not less than required by the Prevailing Wage Law; and the rate of pay and classification for each employee accurately reflects the work the employee performed.

9. All payroll records shall include the name, address, telephone number and email address of the contractor or subcontractor; the name and location of the job; and each employee's name, current address, unless previously reported; specific work classification; daily basic time and overtime hours; total basic time and overtime hours for the payroll period; rate of pay; fringe benefits by type and amount; and gross wages, and any deductions taken from employees' paychecks including, but not limited to, healthcare, pension/401K/IRA. Late submission of copies of any payroll records may be deemed deficient by the County until the required records are provided, and the County may postpone processing payments due under the Contract or under an agreement to finance the Contract.

10. Submit to random or regular audits and investigation of any complaint of a violation of the County's Prevailing Wage and Local Hiring Laws and requirements.
11. Make best efforts to fill at least 51% of new jobs required to complete the capital improvement contract or capital project with Baltimore County residents.
12. Submit monthly reports to the Director of the County's Prevailing Wage Unit relating to local hiring with respect to capital improvement contracts over \$300,00 or County-subsidized capital construction projects receiving assistance over \$5,000,000, that includes (a) the number of new hires needed for the contract or project, (b) the number of County residents hired during the reporting period, (c) the total number of all employees hired during the contract period, (d) best efforts made to fill open positions with County residents, and (e) 5) for new hires: name, last four (4) digits of the social security number, job title, hire date, address and referral source.
13. Agree that any and all disputes will be handled as set forth in the County's Prevailing Wage and Local Hire as a condition of award.
14. In the event the County determines that a provision of the Prevailing Wage and/or Local Hire Law has been violated, the County shall issue a written decision, including appropriate sanctions, and may withhold payment due the Contractor in an amount sufficient to pay each employee of the Contractor or any subcontractors the full amount of wages due under the Prevailing Wage Law, and an amount sufficient to satisfy a liability of the Contractor for liquidated damages as provided under the Prevailing Wage Law, pending a final decision on the violation by the County. The Contractor may appeal a written decision of the Director of the County's Prevailing Wage Unit that the Contractor violated a provision of the Prevailing Wage and/or Local Hire Law, to the Office of Administrative Hearings ("OAH"), within ten (10) working days after receiving a copy of the decision. OAH will conduct a hearing upon the receipt of a timely appeal. If no appeal, the decision of the Director of the County's Prevailing Wage Unit or his/her designee becomes final. A Contractor who is found to have violated the provisions of the Prevailing Wage or Local Hiring Laws intentionally, may not be awarded a County contract or work on any County project for a period of one year from the date of the OAH determination.
15. May not discharge, or otherwise retaliate against, an employee for asserting any right under the Prevailing Wage Law or for filing a complaint of a violation;
16. An aggrieved employee is a third-party beneficiary of the Contract and may by civil action recover the difference between the prevailing wage for the type of work performed and the amount actually received, with interest and a reasonable attorney's fee.
17. Each Contract subject to the Prevailing Wage and Local Hire Laws may specify the payment of liquidated damages to the County by the Contractor for any noncompliance with the Prevailing Wage and Local Law. Liquidated damages are:
 - a. \$10 for each calendar day that the payroll records are late (payrolls are to be submitted no later than 14 days after the week ending date shown on Certified Payroll Record CPR);
 - \$20 for each day that an employee is misclassified and/or paid less than the prevailing

wage rate; and a civil penalty of \$50 per violation of the requirement to post the prevailing wage rates at the work site.

- b. \$50 per month for each month the Local Hire report is not submitted by the last day of the existing month due.

These liquidated damages are solely related to prevailing wage and local hiring compliance and do not negate any other remedies available or set forth in the Contract, including delay damages or actual damages. These remedies are separate from, in addition to, and not in lieu of, any remedies available and set forth in the Contract, or at law, for other breaches or defaults under the Contract.

- 18. Where the initial Contract Sum is \$300,000 or below, but it is subsequently increased and exceeds \$300,000 due to an approved Contract Modification, the amount of any such Contract Modification that causes the Contract Sum to exceed \$300,000 is subject to the Prevailing Wage and Local Hiring Laws.
- 19. The Contractor and all subcontractors must post a clearly legible statement of each prevailing wage rate in a prominent and easily accessible place at the Work Site during the entire time Work is being performed, in English and any other language that is primarily spoken by the employees, at the Work Site.
- 20. A contract may include the actual cost of health and dental insurance, pension or retirement plan, paid time off such as vacation or sick days and life insurance. In calculating the cost per hour, divide the annual cost of benefits by 2,080 hours for each employee. Other benefits such as the use of a company vehicle, cell phones, lodging reimbursement, company owned tools **may not be credited towards the fringe benefit amount.**
- 21. All apprentices must be registered with the Maryland Apprenticeship and Training Council, V.A., or US DOL as well as be currently enrolled in, and attending appropriate classes, to which is considered “actively enrolled”. Only actively enrolled apprentices may be employed on the project at the apprentice prevailing wage rate.

Classification	Modification Reason	Basic Hourly Rate	Borrowed From	Fringe Benefit Payment
BALANCING TECHNICIAN	AD	\$47.92		\$24.44
BRICKLAYER	AD	\$37.50		\$14.78
CARPENTER	AD	\$34.41		\$14.49
CARPENTER - SHORING SCAFFOLD BUILDER	AD	\$34.41		\$14.49
CARPET LAYER	AD	\$34.12		\$14.86
CEMENT MASON	AD	\$25.00	510	\$1.94
COMMUNICATION INSTALLER TECHNICIAN	AD	\$36.37		\$12.89
DRYWALL - SPACKLING, TAPING, & FINISHING	AD	\$34.41		\$14.49
ELECTRICIAN	AD	\$47.13		\$21.94
ELEVATOR MECHANIC	AD	\$56.36		\$45.50
FIRESTOPPER	AD	\$29.81		\$10.08
GLAZIER	AD	\$35.60		\$14.41
INSULATION WORKER	AD	\$40.02		\$19.92
IRONWORKER - FENCE ERECTOR	AD	\$40.02		\$19.92
IRONWORKER - ORNAMENTAL	AD	\$31.17	510	\$24.38
IRONWORKER - REINFORCING	AD	\$29.20	510	\$23.57
IRONWORKER - STRUCTURAL	AD	\$33.12		\$25.63
LABORER - AIR TOOL OPERATOR	AD	\$24.46		\$9.69
LABORER - ASPHALT PAVER	AD	\$24.46		\$9.69
LABORER - ASPHALT RAKER	AD	\$22.63		\$4.88
LABORER - BLASTER - DYNAMITE	AD	\$24.46		\$9.69
LABORER - BURNER	AD	\$24.46		\$9.69
LABORER - COMMON	AD	\$22.63		\$4.88
LABORER - CONCRETE PUDDLER	AD	\$22.63		\$4.88
LABORER - CONCRETE SURFACER	AD	\$24.46		\$9.69
LABORER - CONCRETE TENDER	AD	\$22.63		\$4.88
LABORER - CONCRETE VIBRATOR	AD	\$22.63		\$4.88
LABORER - DENSITY GAUGE	AD	\$22.63		\$4.88
LABORER - FIREPROOFER - MIXER	AD	\$22.63		\$4.88
LABORER - FLAGGER	AD	\$22.63		\$4.88
LABORER - GRADE CHECKER	AD	\$22.63		\$4.88
LABORER - HAND ROLLER	AD	\$22.63		\$4.88
LABORER - HAZARDOUS MATERIAL HANDLER	AD	\$24.46		\$9.69
LABORER - JACKHAMMER	AD	\$22.63		\$4.88
LABORER - LANDSCAPING	AD	\$22.63		\$4.88
LABORER - LAYOUT	AD	\$22.63		\$4.88
LABORER - LUTEMAN	AD	\$22.63		\$4.88
LABORER - MASON TENDER	AD	\$24.46		\$9.69
LABORER - MORTAR MIXER	AD	\$22.63		\$4.88
LABORER - PIPELAYER	AD	\$24.46		\$9.69
LABORER - PLASTERER - HANDLER	AD	\$22.63		\$4.88
LABORER - SCAFFOLD BUILDER	AD	\$24.46		\$9.69
LABORER - TAMPER	AD	\$22.63		\$4.88
MECHANICAL SYSTEMS SERVICE TECH - ELECTRICAL SYSTEMS	AD	\$46.21	510	\$24.90

MECHANICAL SYSTEMS SERVICE TECH-HVAC SYSTEMS	AD	\$46.21		\$24.90
MECHANICAL SYSTEMS SERVICE TECH-PLUMBING SYSTEMS	AD	\$46.21		\$24.90
MECHANICAL SYSTEMS SERVICE TECH - REFRIGERATION SYSTEMS	AD	\$52.27	003	\$24.58
MILLWRIGHT	AD	\$38.61		\$17.21
PAINTER	AD	\$28.55		\$11.87
PAINTER-INDUSTRIAL	AD	\$35.55		\$15.28
PILEDRIIVER	AD	\$36.60		\$16.78
PLUMBER	AD	\$46.21		\$24.90
POWER EQUIPMENT OPERATOR - BACKHOE	AD	\$33.00	510	\$13.55
POWER EQUIPMENT OPERATOR - BROOM / SWEEPER	AD	\$32.23	510	\$14.62
POWER EQUIPMENT OPERATOR - BULLDOZER	AD	\$34.18		\$14.62
POWER EQUIPMENT OPERATOR - CONCRETE PUMP	AD	\$44.35		\$0.00
POWER EQUIPMENT OPERATOR - CRANE	AD	\$41.00		\$18.10
POWER EQUIPMENT OPERATOR - CRANE - TOWER	AD	\$41.00		\$18.10
POWER EQUIPMENT OPERATOR - DRILL - RIG	AD	\$33.16		\$14.15
POWER EQUIPMENT OPERATOR - EXCAVATOR	AD	\$34.18		\$14.62
POWER EQUIPMENT OPERATOR - FORKLIFT	AD	\$34.18		\$14.62
POWER EQUIPMENT OPERATOR - GRADALL	AD	\$34.00	510	\$13.55
POWER EQUIPMENT OPERATOR - GRADER	AD	\$34.18		\$14.62
POWER EQUIPMENT OPERATOR - GUARD RAIL POST DRIVER	AD	\$23.50		\$5.07
POWER EQUIPMENT OPERATOR - LOADER	AD	\$34.18		\$14.62
POWER EQUIPMENT OPERATOR - MECHANIC	AD	\$36.24		\$14.62
POWER EQUIPMENT OPERATOR - MILLING MACHINE	AD	\$30.58	510	\$13.55
POWER EQUIPMENT OPERATOR - PAVER	AD	\$32.10	510	\$13.55
POWER EQUIPMENT OPERATOR - ROLLER - ASPHALT	AD	\$32.10	510	\$13.55
POWER EQUIPMENT OPERATOR - ROLLER - EARTH	AD	\$28.60		\$14.62
POWER EQUIPMENT OPERATOR - SCREED	AD	\$30.00	510	\$11.80
POWER EQUIPMENT OPERATOR - SKID STEER (BOBCAT)	AD	\$32.23		\$14.62
POWER EQUIPMENT OPERATOR-VACUUM TRUCK	AD	\$37.50		\$14.85
RESILIENT FLOOR	AD	\$34.12		\$14.86
SHEETMETAL WORKER (INCLUDING METAL ROOFING)	AD	\$47.92		\$24.44
SPRINKLERFITTER	AD	\$42.32	510	\$26.05
SPRINKLERFITTER/PIPEFITTER	AD	\$46.21		\$24.90
STONE MASON	AD	\$44.30	510	\$21.22
TILE & TERRAZZO FINISHER	AD	\$28.09		\$12.59
TILE & TERRAZZO MECHANIC	AD	\$33.41		\$14.24
TRUCK DRIVER - DUMP	AD	\$17.64	510	\$1.92
TRUCK DRIVER - FLATBED	AD	\$20.94		\$7.63
TRUCK DRIVER - LOWBOY	AD	\$29.68	510	\$10.51
TRUCK DRIVER - TACK/TAR TRUCK	AD	\$27.35	510	\$8.97

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)(1) *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)(1) *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/offers shall submit the following information to the County at the time of bid submission:

1. The name of an employee designated as the bidder/offers'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/Offers. The prime shall submit a list of all subcontractors.
4. For DPW contracts, if the bidder/offers 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/offers intends to use a MWBE joint venture as a subcontractor to meet its MWBE requirements, the affidavit must be submitted through the bidder/offers by the proposed subcontractors and signed by all parties.
5. If the bidder/offers's proposed MWBE participation does not meet the MWBE contract requirements, information sufficient to demonstrate that the bidder/offers has made every effort to meet the requirements must be submitted. (See DETERMINATION OF BID RESPONSIVENESS hereafter)

RECORDS AND REPORTS

Returning Records: The bidder/offers 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/offers, 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/offers, 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 # 24167 PO0 is a minimum of 25 %. 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.

BALTIMORE COUNTY, MARYLAND
Certified MWBE Utilization and Fair Solicitation Affidavit
(FORM A)

- 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
1. Subcontractor Name and Tax ID 	Base Bid \$ _____
Telephone Number _____ Email Address _____ Select One: ☐ MBE ☐ WBE ☐ SBE ☐ N/A Provide if Applicable: ☐ MDOT ☐ Baltimore City # _____	Subcontractor Address Minority Status (If applicable): ☐ African American ☐ Asian American Pacific ☐ Asian American Sub-continent ☐ Supplier, Wholesaler and/or Regular Dealer - 60% Rule ☐ Female ☐ Native American ☐ Hispanic American
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 ☐ Asian American Pacific ☐ Asian American Sub-continent ☐ Supplier, Wholesaler and/or Regular Dealer - 60% Rule ☐ Female ☐ Native American ☐ Hispanic American
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 ☐ Asian American Pacific ☐ Asian American Sub-continent ☐ Supplier, Wholesaler and/or Regular Dealer - 60% Rule ☐ Female ☐ Native American ☐ Hispanic American
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 _____

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 **24167 PO0** "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 **One Hundred Forty-Seven (147) 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 **CALENDAR 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

Rev. 09/2024

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

Rev. 09/2024

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 FEDERAL TAX ID or SS #: _____

By: _____ (Seal)

Name: _____

Type (Print) Name

Title: _____ Date: _____

WITNESS: **BALTIMORE COUNTY, MARYLAND**

Executive Secretary By: _____ Date: _____
D'Andrea L. Walker, County Administrative Officer

Type (Print) Name

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:

Kevin D. Reed, Director
Office of Budget and Finance Date: _____

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

PERFORMANCE BOND

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

\$

Fullerton Utilities New Truck Garage

Contract Name

Date of Contract

24167 PO0

Contract Number

Date Bond Executed

20

20

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

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) _____

Fullerton Utilities New Truck Garage
Contract Name_____ 20 _____
Date of Contract24167 PO0
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, 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



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 542 and General Conditions pages 34-35, Article 33.