PROJECT MANUAL
ADDITIONS AND RENOVATIONS TO THE JACKSON COUNTY CORRECTIONAL INSTITUTION

Jackson County, Georgia

ISSUED FOR PERMIT / CONSTRUCTION
August 20, 2026

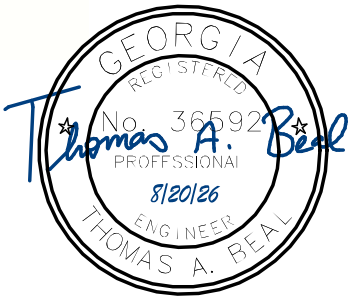


HUSSEY GAY BELL

Established 1958







HUSSEY GAY BELL
ARCHITECTS/ENGINEERS

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BID CONTROL NUMBER ITB 260009

BID CONTROL NUMBER ITB 260009
Jackson County Correctional Institution, Additions and Renovations

(JCCI Additions and Renovations)

Jackson County Board of Commissioners

Publish Date: September 16, 2026

Bid Opening Date & Time: Tuesday, October 20, 2026 at 10:00 am, local time (EST)
Pre-Bid Date & Time: Thursday, September 24, 2026 at 10:00 am, local time (EST)
Questions Deadline Date & Time: Friday, October 9, 2026 at 5:00 pm, local time (EST)

Jackson County Board of Commissioners
4965 Jackson Parkway
Jefferson, GA 30549

DATE: September 16, 2026

TO: General Contractors

SUBJECT: Request for Bid for JCCI Additions and Renovations

INQUIRIES REGARDING REQUEST FOR BID SHOULD BE MADE IN WRITING BY EMAIL TO JOHN KERSWELL, PURCHASING, BIDOPPORTUNITIES@JACKSONCOUNTYGOV.COM, BARRY VICKERY, PROJECT MANAGER, BVICKERY@JACKSONCOUNTYGOV.COM, AND JENNY PARK, PROJECT CONSULTANT, JPARK@HUSSEYGAYBELL.COM

Jackson County Board of Commissioners (hereafter referred to as Jackson County) is requesting bids for construction of a new 5,900 SF Correctional Dorm building and a new 500 SF Sally Port building at the Jackson County Correctional Institution, located at 265 I W Davis Road in Jefferson, Georgia. Work will include site and some minor renovations to the existing facility.

Each bidder must deposit with his bid a Bid Bond for 5% of the total bid. Performance and Payment Bonds in the amount for 100% of the contract price will be required if the contract is awarded.

Bids shall be submitted with 1 (one) hard copy and 1 (one) copy on a flash drive placed in an envelope, Labeled: **ITB 260009, "JCCI Additions and Renovations "** and delivered to

Jackson County Board of Commissioners Administrative Building
Finance Department
Attention: John Kerswell, Purchasing
4965 Jackson Parkway Jefferson,
Georgia 30549

No later than October 20, 2026 at 10:00 AM EST.

A qualified interpreter for the hearing impaired is available upon request at least 10 (ten) days in advance of the bid opening date. Please call (706)367-6312 for more information. This service is in compliance with the American with Disabilities Act (ADA).

Jackson County reserves the right to reject any and all bid submittals, to waive any technicalities or irregularities and to award the bid based on the highest and best interest of Jackson County.

GENERAL INSTRUCTIONS FOR BIDDERS

I. PURPOSE:

The intent and purpose of this Bid Request is to request services for the Jackson County Board of Commissioners, hereinafter referred to as Jackson County for renovations and additions to the Jackson County Correctional Institution located at 265 I W Davis Road in Jefferson, Georgia.

II. SCOPE OF SERVICE:

A. WORK INCLUDED: A digital copy of the plan set can be obtained upon request by emailing Jenny Park at jpark@husseygaybell.com.

1.01. Bidder shall submit all questions about the meaning or intent of the Bidding Documents to Engineer in writing. Contact information and submittal procedures for such questions are as follows:

A. Questions by email should be sent to jpark@husseygaybell.com and ccaudle@husseygaybell.com with a copy to bidopportunities@jacksoncountygov.com and should include company name, contact name, email address, and phone number.

1.02. Interpretations or clarifications considered necessary by Engineer in response to such questions will be issued by Addenda delivered to all registered planholders. Questions received after October 9, 2026 at 5 pm will not be answered.

1.03. Only responses set forth in an Addendum will be binding. Oral and other interpretations or clarifications will be without legal effect. Responses to questions are not part of the Contract Documents unless set forth in an Addendum that expressly modifies or supplements the Contract Documents.

B. QUALITY OF WORKMANSHIP: All work shall be quality work performed according to the standards of the industry, and to the complete satisfaction of Jackson County.

C. PERSONNEL QUALIFICATIONS:

Jackson County reserves the right to refuse to accept services from any personnel deemed by Jackson County to be unqualified, disorderly, or otherwise unable to perform assigned work.

D. DETAILED SPECIFICATIONS: See attached. This project will be under the supervision of the County Capital Project Manager and the architect who will be inspecting all work completed under this contract.

1. Upon being awarded the contract by Jackson County, the approved contractor will execute a contract with Jackson County to provide services. The contractor agrees to perform all work in accordance with the bid schedule and set bid prices as outlined in their signed proposal. The prices

submitted in the bid proposal will be valid until the completion of all projects originally listed in the bid proposal.

2. The approved contractor agrees to commence work within thirty (30) days of receiving the Notice to Proceed and will complete all the original work as outlined in this Bid Request within the time specified. Any additional work will be discussed and a reasonable start and completion date will be negotiated.

3. Jackson County will only pay invoices that have been reviewed and approved by the architect for the quantities submitted for payment.

E. MATERIAL SPECIFICATIONS: All material used in the performance of this contract must meet state and local requirements for use by an approved vendor. The contractor will be responsible for verifying this information with the architect.

F. SCHEDULING AND COORDINATION: It is the responsibility of the contractor to coordinate all work schedules and inspections with the Jackson County Project Manager and the architect. Failure to do so may result in the delay of processing invoices for payment.

G. **OTHER REQUIREMENTS: A Bid Bond for 5% of the base bid on the bid form must be submitted with the bid. Performance and Payment Bonds in the amount of 100% of the contract price will be required if the contract is awarded.**

III. MANDATORY PRE-BID CONFERENCE: There will be a mandatory pre-bid conference held on Thursday, September 24, 2026 at 10:00 am, local time (EST) in the Jackson County Correctional Institution, located at 265 I W Davis Road in Jefferson, Georgia. Prospective prime bidders who do not attend will not be considered for the job award. There will be a site walkthrough at this meeting.

Questions concerning this bid package or the bid process should be directed in writing by email to bidopportunities@jacksoncountygov.com, with the Bid Control number (260009) identified in the email title. Technical questions concerning the work being requested in this BID REQUEST should be submitted to Jenny Park, jpark@husseygaybell.com and Project Manager, Barry Vickery, bvickery@jacksoncountygov.com with a copy to bidopportunities@jacksoncountygov.com All questions should be submitted in writing no later than Friday, October 9, 2026 at 5:00 pm, local time (EST).

IV. GENERAL TERMS AND CONDITIONS:

A. PURCHASING ORDINANCE: This Invitation to Bid (ITB) is subject to the provisions of the Jackson County Purchasing Ordinance and any revisions thereto, which are hereby incorporated into this contract in their entirety except as amended or superseded herein.

B. MANDATORY USE OF JACKSON COUNTY FORM AND TERMS AND CONDITIONS: Failure to submit a bid on the official Jackson County form provided for that purpose shall be a cause for rejection of the bid. Return of the complete document is required. Modification of or additions to any portion of the invitation may be cause for rejection of the bid; however, Jackson County reserves the right to decide, on a case by case basis, in its sole discretion, whether or not to reject such a bid as non-responsive.

C. PRECEDENCE OF TERMS: Except for paragraphs A, B, C, J, K and N of the General Terms and Conditions, which shall apply in all instances, in the event there is a conflict between the General Terms and Conditions and any Special Terms and Conditions for use in a particular procurement, the Special Terms and Conditions shall prevail.

D. CLARIFICATION OF TERMS: If any prospective bidder has questions about the specifications or other bid documents, the prospective bidder should contact Jenny Park, jpark@husseygaybell.com and Project Manager, Barry Vickery, bvickery@jacksoncountygov.com with copy to bidopportunities@jacksoncountygov.com All questions should be submitted in writing no later than Friday, October 9, 2026 at 5:00 pm, local. Any revisions to the invitation will be made only by addendum issued by the Purchasing Manager.

E. TESTING/INSPECTION: Jackson County reserves the right to conduct any test or inspection it may deem advisable to assure materials and services conform to the specification.

F. PAYMENT TERMS: Any payment terms requiring payment in less than 30 days will be regarded as requiring payment 30 days after invoice or delivery, whichever occurs last. This shall not affect offers of discounts for payment in less than 30 days, however.

G. INVOICES: Invoices for services ordered, delivered and accepted by Jackson County shall be submitted by the contractor direct to the payment address shown on the contract.

H. DEFAULT: In case of failure to deliver goods or services in accordance with the contract terms and conditions, Jackson County, after due oral or written notice, may procure substitute goods or services from other sources and hold the contractor responsible for any resulting additional purchasing and administrative costs. This remedy shall be in addition to any other remedies, which Jackson County may have.

I. ASSIGNMENT OF CONTRACT: A contract shall not be assignable by the contractor in whole or in part without the written consent of Jackson County.

J. ETHICS IN PUBLIC CONTRACTING: By submitting their bids, all bidders certify that their bids are made without collusion or fraud and that they have not offered or received any kickbacks or inducements from any other bidder, supplier, manufacturer or subcontractor in connection with their bid, and that they have not conferred on any public employee having official responsibility for this

procurement transaction any payment, loan, subscription, advance, deposit or money, services or anything of more than nominal value, present or promised, unless consideration of substantially equal or greater value was exchanged.

K. DEBARMENT STATUS: By submitting their bids, all bidders certify that they are not currently debarred from bidding on contracts by any agency of the State of Georgia, nor are they an agent of any person or entity that is currently debarred from submitting bids on contracts by any agency of the State of Georgia.

L. NON-COLLUSION CERITFICATION: Bidder declares that the bid is not made in connection with any other bidder submitting a bid for the same project, and that the bid is bona fide and is in all respects fair and without collusion or fraud.

M. APPLICABLE LAW AND COURTS: Any contract resulting from this BID REQUEST shall be governed in all respects by the laws of the State of Georgia and any litigation with respect thereto shall be brought in the courts of the State of Georgia. The contractor shall comply with applicable federal, state and local laws and regulations.

N. QUALIFICATION OF BIDDERS: Jackson County may make such reasonable investigations as deemed proper and necessary to determine the ability of the bidder to perform the work/furnish the items and the bidder shall furnish to Jackson County all such information and data for this purpose as may be requested. Jackson County reserves the right to inspect bidder's physical plant prior to award to satisfy questions regarding the bidder's capabilities. Jackson County further reserves the right to reject any bid if the evidence submitted by, or investigations of, such bidder fails to satisfy Jackson County that such bidder is properly qualified to carry out the obligations of the contract and to complete the work/furnish the items contemplated therein.

O. WITHDRAWAL OF BID DUE TO ERRORS:

1. The bidder shall give notice in writing of his claim of right to withdraw his bid without penalty due to an error within two (2) business days after the conclusion of the bid opening procedure. Bids may be withdrawn from consideration if the price was substantially lower than the other bids due solely to a mistake therein, provided the bid was submitted in good faith, and the mistake was a clerical mistake as opposed to a judgment mistake, and was actually due to an unintentional arithmetic error or an unintentional omission of a quantity of work, labor or material made directly in the compilation of the bid, which unintentional arithmetic error or unintentional omission can be clearly shown by objective evidence drawn from inspection of original work papers, documents and material used in the preparation of the bide sought to be withdrawn. The bidder’s original work papers shall be the sole acceptable evidence of error and mistake if he elects to withdraw his bid. If a bid is withdrawn under the authority of this provision, the lowest remaining responsive bid shall be deemed low bid.

2. No bidder who is permitted to withdraw a bid shall, for compensation, supply any material or labor or perform any subcontract or other work agreement for the person

of firm to whom the contract is awarded or otherwise benefit, directly or indirectly, from the performance of the project for which the withdrawn bid was submitted.

3. Supplier has up to forty-eight (48) hours to notify the Jackson County Purchasing Office of an obvious clerical error made in calculation of a bid in order to withdraw a bid after bid opening. Withdrawal of bid for this reason must be done in writing within the forty-eight (48) hour period. Suppliers who fail to request withdrawal of bid by the required forty-eight (48) hours shall automatically forfeit bid bond (if one was required). Bid may not be withdrawn otherwise.

4. Bid withdrawal is not automatically granted and will be allowed solely at Jackson County's discretion.

P. LATE OFFERS: Jackson County will not be responsible for or consider late receipt of bids.

Q. EO/AA STATEMENT: Jackson County, an Equal Opportunity Affirmative Action institution covered by Presidential Executive Order 11246 as amended, advises all contractors, subcontractors, vendors and suppliers that direct or indirect receipt of federal funds may require appropriate action on their part.

R. ILLEGAL IMMIGRATION REFORM AND ENFORCEMENT ACT OF 2011
Vendors submitting a response to this RFP must complete the Contractor Affidavit under O.C.G.A. §13-10-91(b)(1) which is provided with the RFP package to verify compliance with the Illegal Immigration Reform and Enforcement Act of 2011.

A. The form must be signed by an authorized officer of the contractor or their authorized agent.

B. The form must be notarized.

C. The contractor will be required to have all subcontractors and sub-subcontractors who are engaged to complete physical performance of services under the final contract executed between the County and the contractor complete the appropriate subcontractor and sub-subcontractor affidavits and return them to the County a minimum of five (5) days prior to any work being accomplished by said subcontractor or sub-subcontractor. Format for this affidavit can be provided to the contractor if necessary.

V. SPECIAL TERMS AND CONDITIONS:

A. AVAILABILITY OF FUNDS: It is understood and agreed between the parties herein that Jackson County shall be bound hereunder only to the extent of the funds available or which may hereafter become available for the purpose of this agreement.

B. AWARD OF CONTRACT: Jackson County will make award to the lowest responsive and responsible bidders unless there is a case for exception as listed in Section 2-155(j) of Jackson County's Purchasing Ordinance. Due consideration will be given to price, quality as judged by tests and previous experience, and the ability of the bidders to render required services. Jackson County reserves the right to conduct any test it may deem advisable and to make all evaluations. Jackson County also reserves the right to reject any or all bids, in whole or in part, to waive informalities and to delete items prior to making the award, whenever it is deemed in the sole opinion of Jackson County to be in its best interest.

C. BID ACCEPTANCE PERIOD: This bid shall be binding upon the bidder for 60 calendar days following the bid opening date. Any bid on which the bidder shortens the acceptance period may be rejected.

D. BID PRICES: Bid prices submitted by the Contractor must remain firm for the entire length of the initial bid period and/or until the original list of projects as outlined in the specifications are completed.

E. CANCELLATION OF CONTRACT: Jackson County reserves the right to cancel and terminate any resulting contract, in part or in whole, without penalty, upon 60 days written notice to the contractor. Any contract cancellation notice shall not relieve the contractor of the obligation to deliver and/or perform on all outstanding orders issued prior to the effective date of cancellation.

F. CHANGES: By written notice to the contractor, Jackson County may from time to time make changes, within the general scope of the contract, in the goods or services to be provided by the contractor.

G. CONTRACT DOCUMENTS: The contract entered into by the parties shall consist of this Invitation To Bid, the signed bid submitted by the contractor, the Jackson County Contract Form, General Terms and Conditions, Special Terms and Conditions, Specifications and Attachments, including all modifications thereof, all of which shall be referred to collectively as the Contract Documents.

H. CONTRACT PERIOD: The contract period is defined above in paragraph II.D.1.

I. IDENTIFICATION OF BID ENVELOPE: The signed bid and additional copy on thumb drive should be returned via mail or hand delivery in a separate envelope or package, sealed and identified as follows:

BID CONTROL NUMBER ITB 260009
JCCI Additions and Renovations

From: ***Bidder Company Name***

The envelope should be addressed to Jackson County Board of Commissioners, Attention: John Kerswell, Purchasing, 4965 Jackson Parkway, Jefferson, GA, 30549.

If a bid not contained in the special envelope is mailed, the bidder takes the risk that the envelope even if marked as described above, may be inadvertently opened and the information compromised which may cause the bid to be disqualified. Bids may be hand delivered to the Finance Department office at the location given above. No other correspondence or other bids should be placed in the envelope.

J. INDEMNIFICATION: The contractor agrees to indemnify, defend and hold harmless Jackson County and their officers, agents, and employees from any claims, damages and actions of any kind or nature whether at law or in equity, arising from or caused by the use of any materials, goods, or equipment of any kind or nature furnished by the contractor/any services of any kind or nature provided by the contractor.

K. INDEPENDENT CONTRACTOR: The contractor shall not be an employee of Jackson County, but shall be an independent contractor. Nothing in this agreement shall be construed as authority for the contractor to make commitments, which shall bind Jackson County, or to otherwise act on behalf of Jackson County, except as Jackson County may expressly authorize in writing.

L. INSPECTION OF WORK SITE: Contractors desiring to submit a proposal for this BID REQUEST MUST attend the pre-bid meeting and tour the site. Claims, as a result of failure to do so, will not be considered by Jackson County.

M. INSURANCE:

1. The contractor shall provide Jackson County a Certificate of Insurance prior to the start of any work and agrees to maintain such insurance until the completion of the contract. The minimum limits of liability shall be:

    A. Workers' Compensation - In compliance with Georgia State Law

    B. Broad Form Comprehensive General Liability, $1,000,000.00, to include:

        1. Premises – Operations
        2. Products / Completed Operations
        3. Contractual
        4. Personal Injury
        5. Owners and Contractors Protective

2. Jackson County reserves the right to require higher limits on any contract provided notice of such requirements is stated in the proposal for such contract. Included in the certificate of insurance shall be a hold harmless agreement saving Jackson County harmless from any liability from the contractor or from

any subcontractors or by anyone directly or indirectly employed by either. Jackson County is to be named as additional insured.

A 30-day notice of cancellation or non-renewal in writing shall be furnished by certified mail to the certificate holder at the address indicated on the face of this form. Also, when deemed necessary, the contractor will provide explosion, collapse and underground coverage (X, C and U coverage).

The contractor agrees to be responsible for, indemnify and save harmless Jackson County and their representatives from the payment of all sums of money by reason of any claim against Jackson County or their representatives under the Workmen's Compensation Act, and by reason of all or any other occurrences resulting in bodily injury or property damage that may happen to occur upon or about said work. The contractor agrees that it will, at all times, and at least for one year after the completion of the work, indemnify and save harmless Jackson County against liabilities resulting from bodily injury or property damage directly or indirectly arising out of the performance or nonperformance of the contract.

3. ALL BIDDERS PROVIDE THE FOLLOWING INFORMATION:

NAME OF INSURANCE CARRIER:

NAME OF INSURANCE AGENT:

TELEPHONE NUMBER:

BROAD FORM COMPREHENSIVE

GENERAL LIABILITY LIMIT: $

AUTOMOBILE LIABILITY LIMIT: $

POLICY EXPIRATION DATE:

If a bidder fails to provide all the above information or does not indicate an amount of coverage, the bidder's signature on this invitation constitutes certification that, if the bidder is awarded the contract, the bidder shall obtain the necessary coverage as specified within ten days of notification of award of the contract.

If at any time or times any claim or claims shall be made to Jackson County by a subcontractor or other persons for any money due for any work, labor or material done upon or supplied upon the work herein contracted for, done for, furnished, or supplied, to the party of the first part, Jackson County may retain such amount as may be due, or may thereafter become due under this contract, or may pay the same when said claim shall thereafter be finally established in court, and such amount is hereby assigned to Jackson County to pay such claim or claims, such payment to be done when so established, but the contractor shall not be entitled to demand or receive payment of this agreement until all disputes, disagreements, and questions between the parties herein affecting the right to any portion of the amount claimed, shall have been settled as above provided for, and Jackson County is hereby authorized to deduct from the said amount any money due it upon any account or claim.

N. PROTECTION OF PERSONS AND PROPERTY:

1. The contractor shall take every precaution at all times for the protection of persons and property, including Jackson County's employees and property and its own.

2. The contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the work under this contract.

3. The contractor shall continuously maintain adequate protection of all work from damage and shall protect Jackson County property from injury or loss arising in connection with this contract. The contractor shall make good any such damage, injury or loss.

O. SAFETY: The contractor shall maintain an adequate safety program to insure the safety of contractor employees, subcontractor employees, and all other individuals working under this contract. In addition, the contractor must also provide Jackson County with a written safety program that he intends to follow in pursuing work under this contract. No work under this contract will be permitted until Jackson County is assured that the contractor has an adequate safety program in effect.

P. SUBCONTRACTS: No portion of the work shall be subcontracted without prior written consent of Jackson County. In the event that the contractor desires to subcontract some part of the work specified herein, the contractor shall furnish Jackson County the names, qualifications and experience of their proposed subcontractors. The contractor will, however, remain fully liable and responsible for the work to be done by his subcontractor(s) and shall assure compliance with all requirements of the contract.

Nothing in the agreement shall be constructed as authority for the contractor to make commitments, which shall bind Jackson County, or to otherwise act on behalf of Jackson County, except as Jackson County may expressly authorize in writing.

Q. SUPERINTENDENCE BY CONTRACTOR: The contractor shall be responsible for all work means, methods, techniques, sequences and procedures and for coordinating all portions of the work under the contract except where otherwise specified herein. The contractor shall, at all times, enforce strict discipline and good order among the workers, and shall not employ any unfit person or anyone not skilled in their work.

R. WORK SITE DAMAGES: Any damage, including damage to finished surfaces, resulting from the performance of this contract shall be repaired to Jackson County's satisfaction at the contractor's expense.

S. OTHER SPECIAL INSTRUCTIONS/TERMS: See Section II G – Other requirements concerning bid and bid award.

VI. METHOD OF PAYMENT: Jackson County will authorize payment to the contractor after providing satisfactory service and receipt of the contractor's invoice for services rendered. Payment will be made on a monthly basis at the prices as bid, Net 30.

Illegal Immigration Reform and Enforcement Act of 2011

CONTRACTOR AFFIDAVIT UNDER O.C.G.A. §13-10-91(b)(1)

The Jackson County Board of Commissioners and Contractor agree that compliance with the Illegal Immigration Reform and Enforcement Act of 2011 are conditions of this Agreement for the physical performance of services. By executing this affidavit, the undersigned contractor verifies its compliance with O.C.G.A. §13-10-91, stating affirmatively that the individual, firm, or corporation which is engaged in the physical performance of services on behalf of the Jackson County Board of Commissioners has registered with, is authorized to use and uses the federal work authorization program commonly known as E-Verify or any subsequent replacement program, in accordance with the applicable provisions and deadlines established in O.C.G.A. §13-10-91. Furthermore, the undersigned contractor will continue to use the federal work authorization program throughout the contract period and the undersigned contractor will contract for the physical performance of services in satisfaction of such contract only with subcontractors who present and affidavit to the contractor with the information required by O.C.G.A. §13-10-91(b).

Contractor hereby attests that its federal work authorization user identification number and date of authorization are as follows:

_____

E-Verify Employment Eligibility Verification User Identification Number

_____

Date of Authorization to Use Federal Work Authorization Program

_____

NAME OF CONTRACTOR

_____

Name of Project

Jackson County Board of Commissioners
Name of Public Employer

I hereby declare under penalty of perjury that the foregoing is true and correct.
Executed on _____, _____, 20___ in _____ (City), _____ (State).

_____

Signature of Authorized Officer or Agent

_____

Printed Name and Title of Authorized Officer or Agent

SUBSCRIBED AND SWORN BEFORE ME ON THIS THE _____ DAY OF_____, 20____

_____

Notary Public

My Commission Expires: _____

This form must be returned with the bid package submitted.

The following pages include a sample contract that will become finalized based on selection by Jackson County Board of Commissioners. Please execute as part of your bid package submission

CONTRACT

This Agreement made and entered into this _____ Day of _____ , Two Thousand and Twenty Six,

BETWEEN

The Owner: The Jackson County Board of Commissioners
Jackson County, Georgia
4965 Jackson Parkway
Jefferson, GA 30549

And the Contractor: _____
(Co. Name & Address) _____
_____

PROJECT: ITB 260009 Jackson County Correctional Institution Addition and Renovations, Jackson County, GA

==========

WITNESSETH: That said Contractor has agreed, and by these presents does agree, with the said County, for the consideration herein mentioned and under the provisions of the Invitation To Bid (ITB) as required by the Specifications to furnish all equipment, tools, material, skill and labor of every description necessary to carry out and complete in a good, firm and substantial and workmanlike manner, proposal made by the Contractor, the Advertisement, the Instructions to Bid, Special Terms and Conditions and this Agreement, including all work outlined in the Scope of Service and listed in the conditions, provisions and specification to wit:

ARTICLE 1

The Contract Documents

The Contract Documents consist of this Agreement, the Invitation To Bid (ITB) 260009, the Contractor's Response to ITB 260009, Drawings, Specifications, and Addenda issued prior to execution of this Agreement and all Change Orders issued subsequent thereto. These form the Contract, and all are as fully a part of the Contract as if attached to this Agreement or repeated herein.

ARTICLE 2

The Work

The Contractor shall perform all work required by the Contract Documents for:

PROJECT: ITB 260009 Jackson County Correctional Institution Additions and Renovations, Jackson County, GA

All Work performed under this contract is subject to inspection by the Architect and Project Manager of Jackson County, Georgia. It shall be the Contractor's responsibility to coordinate with the above for inspection services. All Work shall be performed in accordance with current state and local laws and regulations for the State of Georgia.

ARTICLE 3

Time of Commencement and Completion

The Work to be performed under this Contract shall begin within thirty (30) days after the Contractor has received the Notice to Proceed (NTP) and will be completed within 12 months of starting the project.

ARTICLE 4

Contract Price

The Owner shall pay the Contractor, for the performance of the Work completed and approved by the architect as provided in the Conditions of the Contract, _____ in current funds, as calculated by the unit prices provided in the Contractor's response to the ITB. This price shall remain fixed during the entire length of the original contact period or until the satisfactory completion of all of the projects listed in the ITB. The Scope of Service as outlined in the ITB shall only be modified by a Change Order approved by all Parties. Each Change Order that is approved by Owner and Contractor will detail any unit price changes that are calculated according to the conditions outlined in the ITB.

ARTICLE 5

Payment

Payment for the Work as described in Article 4 above, shall be made monthly only for the portion of Work that is completed and inspected by the Project Architect during the month. Payment will be made within thirty (30) days after the completion of the Work, provided that the Contractor fully performed in accordance with the Contract Documents. The Contractor shall complete and submit an invoice for the monthly payment to the Jackson County Government, Attention: Accounts Payable, 4965 Jackson Parkway, Jefferson, Georgia 30549. Jackson County reserves the right to request proof of performance of all work completed under this contract.

ARTICLE 6

Georgia Illegal Immigration Reform and Enforcement Act of 2011

Contractor agrees and acknowledges that compliance with the requirements of the Georgia Illegal Immigration Reform and Enforcement Act of 2011 are conditions of this Contract. The Contractor Affidavit and Agreement executed by Contractor pursuant to O.C.G.A. §13-10-91(b)(1) is hereby incorporated into this Agreement by reference and made a part of this Contract. By the execution of this Contract, the Contractor affirms that the Illegal Immigration Reform and Enforcement Act of 2011 Contractor Affidavit submitted with the response to ITB 260009 is still valid, that the Contractor's Federal Work Authorization Number has not changed, that the Contractor will utilize the Federal Work Authorization Program during the duration of this contact, that the Contractor will ensure that all subcontractors and sub-subcontractors working on the Project covered by this Contract are participating in the Federal Work Authorization Program and have completed the Subcontractors and/or Sub-subcontractor Affidavit, and that the Contractor will advise the Owner of hiring a new subcontractor and/or sub-subcontractor and will provide the Owner with a Subcontractor/Sub-subcontractor Affidavit attesting to the subcontractor's/sub-subcontractor's

name, address, user identification number, and date of authorization to use the Federal Work Authorization Program within five (5) days of hiring before the subcontractor/sub-subcontractor begins working on the Project. The Contractor understands and will ensure that all subcontractors and sub-subcontractors understand that knowingly and willfully making a false, fictitious, or fraudulent statement in an affidavit submitted in compliance with O.C.G.A. §13-10-91 shall be guilty of a violation of Code Section §16-10-20 and, upon conviction, shall be punished as provided for in such Code Section. Additionally, any contractor and/or sub-contractor convicted for false statements based upon a violation of this Code Section shall be prohibited from bidding on or entering into any public contract for twelve (12) months following the conviction

IN WITNESS WHEREOF, the Parties have executed this Contract on the date first written above.

OWNER:
Jackson County Board of Commissioners

_____
Marty Clark, Chairman

ATTEST:

_____
Notary Public

CONTRACTOR:

_____
Company's Legal Name

_____
Representative

ATTEST:

_____
Notary Public

DOCUMENT 002600 - PROCUREMENT SUBSTITUTION PROCEDURES

1.1 DEFINITIONS

A. Procurement Substitution Requests: Requests for changes in products, materials, equipment, and methods of construction from those indicated in the Procurement and Contracting Documents, submitted prior to receipt of bids in accordance with Instructions to Bidders.

B. Procurement Prior Approval Requests: Requests for approval of products or manufacturers from those required by the Contract Documents as defined by product selection procedures in Section 016000 "Product Requirements."

1. Procurement prior approval is required when products or manufacturers are listed in specifications under "Sole Product," "Sole Manufacturer," "Limited List of Products," or "Limited List of Manufacturers" introductory paragraphs.
2. Procurement prior approval is not required when products or manufacturers are listed in specifications under "Non-Limited List of Products" or "Non-Limited List of Manufacturers" introductory paragraphs.
3. Where use of "Sole Product," "Sole Manufacturer," "Limited List of Products," or "Limited List of Manufacturers" introductory paragraphs is not allowed by statute, procurement prior approval request is not required.

C. Substitution Requests: Requests for changes in products, materials, equipment, and methods of construction from those indicated in the Contract Documents, submitted following Contract award. See the General Conditions and Section 012500 "Substitution Procedures" for conditions under which Substitution requests will be considered following Contract award.

1.2 QUALITY ASSURANCE

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

1.3 PROCUREMENT SUBSTITUTIONS

A. Procurement Substitutions, General: By submitting a bid, the Bidder represents that its bid is based on materials and equipment described in the Procurement and Contracting Documents, including Addenda. Bidders are encouraged to request approval of qualifying substitute materials and equipment when the Specifications Sections list materials and equipment by product or manufacturer name.

B. Procurement Substitution Requests will be received and considered by Owner when the following conditions are satisfied, as determined by Architect; otherwise requests will be returned without action:

1. Extensive revisions to the Contract Documents are not required.

2. Proposed changes are in keeping with general intent of the Contract Documents, including level of quality of the Work represented by requirements therein.
3. Request is fully documented and properly submitted.

1.4 SUBMITTALS

A. Procurement Substitution Request: Submit to Architect. Procurement Substitution Request must be made in writing in compliance with the following requirements:

1. Requests for substitution of materials and equipment will be considered if received no later than 10 days prior to date of bid opening.
2. Submittal Format, Electronic: Submit Procurement Substitution Request, using PDF format.

a. Identify the product or the fabrication or installation method to be replaced in each request. Include related Specifications Sections and Drawing numbers.
b. Provide complete documentation on both the product specified and the proposed substitute, including the following information as appropriate:

1) List of similar installations for completed projects, with project names and addresses as well as names and addresses of architects and owners.
2) Product data, including drawings and descriptions of products and fabrication and installation procedures.
3) Point-by-point comparison of specified and proposed substitute product data, fabrication drawings, and installation procedures.
4) Copies of current, independent third-party test data of salient product or system characteristics.
5) Samples where applicable or when requested by Architect.
6) Detailed comparison of significant qualities of proposed substitute with those of the Work specified. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
7) Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
8) Research reports, where applicable, evidencing compliance with building code in effect for Project, from ICC-ES or from applicable codes.
9) Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate contractors, which will become necessary to accommodate proposed substitute.

c. Provide certification by manufacturer that proposed substitute is equal to or superior to that required by the Procurement and Contracting Documents, and that its in-place performance will be equal to or superior to product or equipment specified in the application indicated.
d. Bidder, in submitting the Procurement Substitution Request, waives the right to additional payment or an extension of Contract Time because of the failure of substitute to perform as represented in the Procurement Substitution Request.

B. Architect's Action:

1. Architect may request additional information or documentation necessary for evaluation of the Procurement Substitution Request. Architect will notify all Bidders of acceptance of proposed substitute by means of an Addendum to the Procurement and Contracting Documents.

C. Architect's approval of substitute during bidding does not relieve Contractor of the responsibility to submit required Shop Drawings and to comply with all other requirements of the Contract Documents.

END OF DOCUMENT 002600

DOCUMENT 003132 - GEOTECHNICAL DATA

1.1 GEOTECHNICAL DATA

A. This Document, with its referenced attachments, is part of the Procurement and Contracting Requirements for the Project. They provide Owner's information for Bidders' convenience and are intended to supplement rather than serve in lieu of Bidders' own investigations. They are made available for Bidders' convenience and information. This Document and its attachments are not part of the Contract Documents.

B. Because subsurface conditions indicated by the soil borings are a sampling in relation to the entire construction area, and for other reasons, Owner, Architect, Architect's consultants, and the firm reporting the subsurface conditions do not warranty the conditions below the depths of the borings or that the strata logged from the borings are necessarily typical of the entire site. Any party using the information described in the soil borings and geotechnical report accepts full responsibility for its use.

C. Soil-Boring Data for Project, obtained by Geo-Hydro Engineers, Inc., dated April 6, 2026, is available for viewing as appended to this Project Manual.

D. A Geotechnical Investigation Report for Project, prepared by Geo-Hydro Engineers, Inc., dated April 6, 2026, is available for viewing as appended to this Project Manual.

1. The opinions expressed in this report are those of a geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by a geotechnical engineer. Owner is not responsible for interpretations or conclusions drawn from the data.
2. Any party using information described in the geotechnical report will make additional test borings and conduct other exploratory operations that may be required to determine the character of subsurface materials that may be encountered.

END OF DOCUMENT 003132

Report of Subsurface Exploration and Geotechnical Engineering Evaluation

Building Addition and Renovations
Jackson County Correctional Institute
265 I W Davis Road
Jefferson, Georgia

Geo-Hydro Project Number 261245.20

April 6, 2026

SUBMITTED TO:
Barry Vickery
Jackson County Government
67 Athens Street
Jefferson, Georgia 30549

SUBMITTED BY:
Geo-Hydro Engineers, Inc.
190 Ben Burton Road, Suite C
Bogart, Georgia 30622
T: 706.354.1800

190 BEN BURTON ROAD, SUITE C
BOGART, GEORGIA 30622

Barry Vickery
Jackson County Government
67 Athens Street
Jefferson, Georgia 30549

REPORT OF SUBSURFACE EXPLORATION AND GEOTECHNICAL ENGINEERING EVALUATION

BUILDING ADDITION AND RENOVATIONS
JACKSON COUNTY CORRECTIONAL INSTITUTE
265 I W DAVIS ROAD
JEFFERSON, GEORGIA
GEO-HYDRO PROJECT NUMBER 261245.20

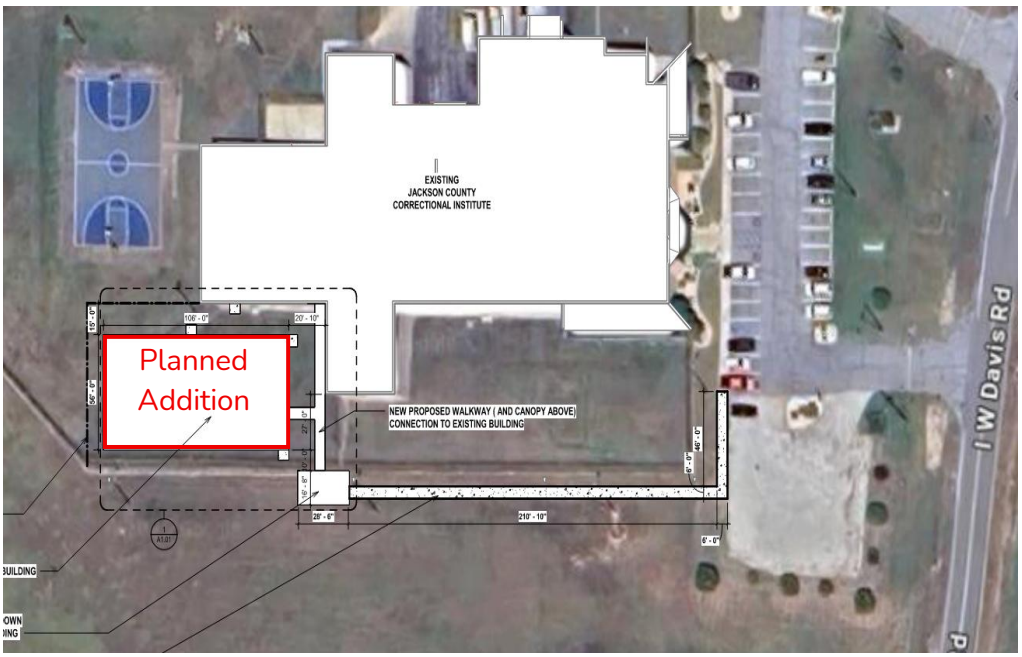
Geo-Hydro Engineers, Inc. has completed the authorized subsurface exploration for the above referenced project. The scope of services for this project was outlined in our proposal number 261245.P0 dated February 11, 2026.

PROJECT INFORMATION

The project consists of an expansion of the existing Jackson County Correctional Institute at 265 I W Davis Road in Jefferson, Georgia. Figure 1 in the Appendix shows the approximate site location.

The addition will have plan dimensions of 70 feet by 40 feet and will be connected to the southwest side of the existing building via a covered walkway. A small shakedown room (15 feet by 10 feet) with sidewalk extending to the eastern parking area is also planned. Based on the *Structural Geotechnical Information Request* prepared by Willett Engineering Company dated February 3, 2026, we understand that the building addition will be a single-story structure with load-bearing masonry walls and a slab on grade floor. The maximum column loads will be about 100 kips with wall loads no greater than 3 kips per lineal foot.

The addition footprint is currently grassed within the yard of the correctional facility. The annotated aerial photo below was provided to us and shows the planned addition footprint and current site conditions. We expect site grading to involve no more than about 5 feet of mass excavation and structural fill placement.



EXPLORATORY PROCEDURES

Machine-Drilled Borings

The subsurface exploration consisted of seven machine-drilled soil test borings performed at the approximate locations shown on Figure 2 included in the Appendix. The test borings were located in the field by Geo-Hydro using a handheld GPS unit (Garmin GPS Map 64S) with preloaded coordinates and by measuring distances from site reference points. In general, the boring locations should be considered approximate.

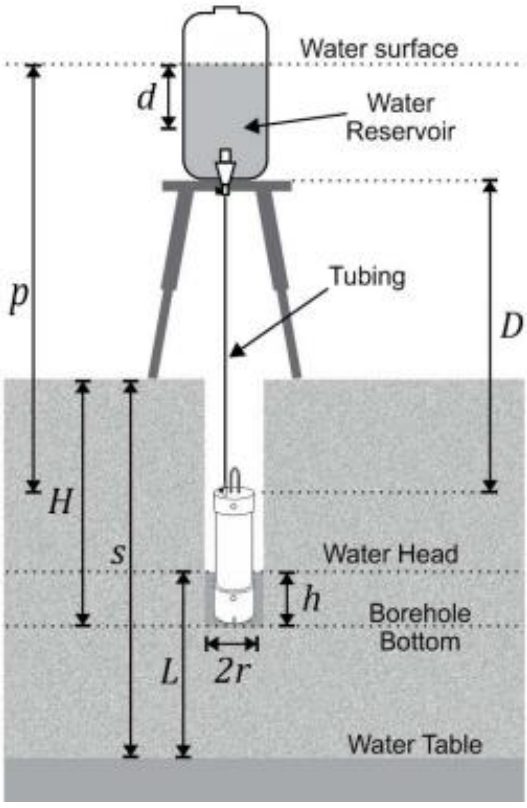
Standard penetration testing, as outlined in ASTM D1586, was performed at select depth intervals in the machine-drilled soil test borings. Soil samples obtained from the drilling operation were examined and classified in general accordance with ASTM D2488 (Visual-Manual Procedure for Description of Soils). Soil classifications include the use of the Unified Soil Classification System described in ASTM D2487 (Classification of Soils for Engineering Purposes). The soil classifications also include our evaluation of the geologic origin of the soils. Evaluations of geologic origin are based on our experience and interpretation and may be subject to some degree of error.

Descriptions of the soils encountered, groundwater conditions, standard penetration resistances, and other pertinent information are provided in the test boring records included in the Appendix.

Infiltration Tests

The field exploration included two infiltration tests performed at the approximate locations shown on Figure 2 in the Appendix. Test holes I-1 and I-2 were advanced to a depth of 10 feet using a drill rig and producing approximately 6-inch diameter boreholes.

The tests were performed using an Aardvark constant head permeameter to measure the saturated hydraulic conductivity (K_{sat}) of the soil. The Aardvark Permeameter estimates soil hydraulic conductivity using the amount of supplied water measured at equal time intervals, which is the equivalent to the amount of water that was infiltrated by the soil. The tests were performed until the soil-water infiltration rate reached a steady value that did not change over time. Soil hydraulic conductivity (K_{sat}) was then calculated using this steady flow rate (Q). The test procedure and model components are shown in the figure to the right.



Saturated hydraulic conductivity was calculated using the Reynolds and Elrick Method. The saturated hydraulic conductivity of a soil under steady flow from a borehole was calculated using the following equation:

$$K_S = \frac{Q_S C_0}{2\pi(h^2) + \left(C_0\pi(r^2)\right) + \left(2\pi(h/\alpha)\right)}$$

Where Q_S is the steady flow rate in volume of water (cm^3) per time (min), h is the height of water ponded in the borehole (cm), r is the radius of the hole (cm), α is the soil macroscopic capillary length (cm^{-1}), and C_0 is a

unitless geometric factor. The values of α and C_0 are dependent on the texture and structure of the soil, and are fixed values predetermined by Reynolds and Elrick (1992)[1].

REGIONAL GEOLOGY

The project site is located in the Southern Piedmont Geologic Province of Georgia. Soils in this area have been formed by the in-place weathering of the underlying crystalline rock, which accounts for their classification as "residual" soils. Residual soils near the ground surface that have experienced advanced weathering frequently consist of red brown clayey silt (ML) or silty clay (CL). The thickness of this surficial clayey zone may range up to roughly 6 feet. For various reasons, such as erosion or local variation of mineralization, the upper clayey zone is not always present.

With increased depth, the soil becomes less weathered, coarser grained, and the structural character of the underlying parent rock becomes more evident. These residual soils are typically classified as sandy micaceous silt (ML) or silty micaceous sand (SM). With a further increase in depth, the soils eventually become quite hard and take on an increasing resemblance to the underlying parent rock. When these materials have a standard penetration resistance of l00 blows per foot or greater, they are referred to as partially weathered rock. The transition from soil to partially weathered rock is usually a gradual one, and may occur at a wide range of depths. Lenses or layers of partially weathered rock are not unusual in the soil profile.

Partially weathered rock represents the zone of transition between the soil and the indurated metamorphic rocks from which the soils are derived. The subsurface profile is, in fact, a history of the weathering process that the crystalline rock has undergone. The degree of weathering is most advanced at the ground surface, where fine-grained soil may be present. Conversely, the weathering process is in its early stages immediately above the surface of relatively sound rock, where partially weathered rock may be found.

The thickness of the zone of partially weathered rock and the depth to the rock surface have both been found to vary considerably over relatively short distances. The depth to the rock surface may frequently range from the ground surface to 80 feet or more. The thickness of partially weathered rock, which overlies the rock surface, may vary from only a few inches to as much as 40 feet or more.

TEST BORING SUMMARY

Starting at the ground surface, all borings encountered a layer of topsoil about 3 inches thick. Detailed surface material measurements were not performed during this exploration. For planning purposes, we suggest assuming a topsoil thickness of 6 inches within the project area.

Beneath the topsoil, all borings encountered residual soils typical of the Piedmont region. The residual soils were classified as sandy silt, clayey sand, and silty sand with varying mica content. Standard penetration test resistances recorded in the residual soils ranged from 7 to 21 blows per foot.

At the time of drilling, groundwater was not encountered in the test borings. The borings were backfilled with soil cuttings after the initial groundwater level check. It should be noted that groundwater levels will fluctuate several feet depending on yearly and seasonal rainfall variations and other factors and may rise in the future.

For more detailed descriptions of subsurface conditions, please refer to the test boring records included in the Appendix.

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[1] Reynolds and Elrick (1992). *Advances in measurement of soil physical properties: Bringing theory into practice* (Vol. 30, pp. 1-24). Soil Science Society of America.

TEST BORING SUMMARY

BORING	BOTTOM OF FILL (FEET)	GROUNDWATER* (FEET)	TOP OF PWR (FEET)	AUGER REFUSAL (FEET)	BORING TERMINATION (FEET)
B-1	NE	NE	NE	NE	25
B-2	NE	NE	NE	NE	25
B-3	NE	NE	NE	NE	25
B-4	NE	NE	NE	NE	25
B-5	NE	NE	NE	NE	15
B-6	NE	NE	NE	NE	15
B-7	NE	NE	NE	NE	15

All depths and elevations in this table should be considered approximate
NE: Not Encountered
PWR: Partially Weathered Rock
*Groundwater level measured at time of drilling

INFILTRATION TEST RESULTS AND SUMMARY

The following table presents the results of the infiltration tests.

INFILTRATION TEST	GROUNDWATER DEPTH (FEET)	TEST DEPTH (FEET)	INTERPRETED INFILTRATION RATE (INCHES/HOUR)
I-1	NE	10	0.46
I-2	NE	10½	1.24

All depths in this table should be considered approximate
NE: Not Encountered

Test I-1 and I-2 were performed in residual soils classified as clayey sand and silty sand. It is important to note that infiltration properties can vary horizontally and vertically, and the results of the infiltration tests may not be representative of the entire area where infiltration is intended. Appropriate judgement should be used when selecting values for design.

EVALUATIONS AND RECOMMENDATIONS

The following evaluations and recommendations are based on the information available on the proposed construction, the data obtained from the test borings, and our experience with soils and subsurface conditions similar to those encountered at this site. Because the test borings represent a statistically small sampling of subsurface conditions, it is possible that conditions may be encountered during construction that are substantially different from those indicated by the test borings. In these instances, adjustments to the design and construction may be necessary.

Geotechnical Considerations

The following geotechnical characteristics of the site should be considered for planning and design:

- Fill materials were not encountered in the test borings. However, areas containing fill materials may be encountered during construction. Any fill materials encountered during construction should be thoroughly evaluated, and any loose or unstable fill should be excavated and replaced if it cannot be adequately densified in place.

- Based on the results of the test boings and our understanding of the project, favorable excavation conditions are anticipated within the excavation limits. Neither partially weathered nor materials causing auger refusal were encountered in any test borings.

- Based on the results of the soil test borings, and contingent upon proper site preparation and thorough evaluation of the foundation excavations, it is our opinion that the proposed additions can be supported using conventional shallow foundations and concrete slab-on-grade floors. Based on a maximum column load no greater than 100 kips and wall loads no greater than 3 kips per lineal foot, we recommend using an allowable bearing pressure of 2,500 psf for foundation design purposes.

- It is our opinion that the soil test borings were not extended to a depth sufficient to characterize the upper 100 feet of the soil subsurface for the purposes of determining the seismic *Site Class* in accordance with the 2024 International Building Code (Chapter 20, ASCE -22). We recommend using the *Default* seismic *Site Class* as suggested in the code. The mapped and design spectral response accelerations are as follows: S_S=0.270, S_1=0.095, S_{DS}=0.220, S_{D1}= 0.130. The *Seismic Design Category* (*SDC)* for the site is **C**.

The following sections provide recommendations regarding these issues and other geotechnical aspects of the project.

Existing Fill Materials

Fill materials were not encountered in any test borings. However, areas containing fill materials may be encountered during construction. There are a few important facts that should be considered regarding existing fill materials and the limitations of subsurface exploration.

- The quality of existing fill materials can be highly variable, and test borings are often not able to detect all of the zones or layers of poor-quality fill materials.

- Layers of poor-quality fill materials that are less than about 2½ to 5 feet thick may often remain undetected by soil test borings due to the discrete-interval sampling method used in this exploration.

- The interface between existing fill materials and the original ground surface may include a layer of organic material that was not properly stripped off during the original grading. Depending on its relationship to the foundation and floor slab bearing surfaces, an organic layer might adversely affect support of footings

and floor slabs. If such organic layers are encountered during construction, it may be necessary to "chase out" the organic layer by excavating the layer along with the overlying soils.

- Subsurface exploration is simply not capable of disclosing all conditions that may require remediation.

General Site Preparation

Fencing, topsoil, and other deleterious materials should be removed from the proposed construction area. All existing utilities should be excavated and removed unless they are to be incorporated into the new construction. Additionally, site clearing, grubbing, and stripping should be performed only during dry weather conditions. Operation of heavy equipment on the site during wet conditions could result in excessive subgrade degradation. All excavations resulting from general demolition or rerouting of underground utilities should be backfilled in accordance with the *Structural Fill* section of this report.

We recommend, wherever possible, that areas to receive structural fill be proofrolled prior to placement of structural fill. Areas of proposed excavation should be proofrolled after rough finished subgrade is achieved. Proofrolling should be performed with multiple passes in at least two directions using a fully loaded tandem axle dump truck weighing at least 18 tons. Proofrolling must be avoided within 10 feet of rights-of-way, existing structures, or hardscapes to remain. If low consistency soils are encountered that cannot be adequately densified in place, such soils should be removed and replaced with well compacted fill material placed in accordance with the *Structural Fill* section of this report. Proofrolling should be observed by Geo-Hydro to determine if remedial measures are necessary.

For planning purposes, we suggest considering that approximately 15 percent of the aggregate new building and pavement footprints will require undercutting and replacement extending to an average depth of 2 feet. *The suggested subgrade preparation approach is intended only as a tool to estimate a cost associated with managing unstable subgrade conditions. Ground stabilization may be accomplished by in-place densification, treatment with geosynthetics (grid or fabric) and crushed stone, or a combination of methods. The need for, extent of, location, and optimal method of stabilization should be determined by Geo-Hydro at the time of construction based on actual site conditions.*

During site preparation, burn pits or trash pits may be encountered. All too frequently such buried material occurs in isolated areas which are not detected by the soil test borings. Any buried debris or trash found during the construction operation should be thoroughly excavated and removed from the site.

Excavation Characteristics

Based on the results of the test boings and our understanding of the project, favorable excavation conditions are anticipated within the excavation limits. Neither partially weathered nor materials causing auger refusal were encountered in the test borings. If encountered, excavation of partially weathered rock typically requires large equipment capable of ripping. Due to the leverage required to pre-loosen the material, excavation of partially weathered rock is often impractical in trench excavations, on sloping terrain, or in wet conditions. In some cases, the use of impact hammers is necessary to remove partially weathered rock.

It is important to note that the depth to rock or partially weathered rock may vary drastically over relatively short distances. It would not be unusual to encounter partially weathered rock, rock lenses, rock pinnacles, or boulders between or around the test borings. The depth to partially weathered rock or auger refusal should be considered during planning and development of grading and utility plans.

For construction bidding and field verification purposes it is common to provide a verifiable definition of rock in the project specifications. The following are typical definitions of mass rock and trench rock:

- Mass Rock: Material which cannot be excavated with a single-tooth ripper drawn by a crawler tractor having a minimum draw bar pull rated at 56,000 pounds (Caterpillar D-8K or equivalent), and occupying an original volume of at least one cubic yard.

- Trench Rock: Material occupying an original volume of at least one-half cubic yard which cannot be excavated with a hydraulic excavator having a minimum flywheel power rating of 123 kW (165 hp); such as a Caterpillar 322C L, John Deere 230C LC, or a Komatsu PC220LC-7; equipped with a short tip radius bucket not wider than 42 inches.

The foregoing definitions are based on large equipment typically utilized for mass grading. Retail excavations for building foundations and underground utilities are often performed with smaller equipment such as rubber-tired backhoe/loaders or even mini-excavators. Small equipment may encounter difficult excavation during building construction and utility installation, and contractors will often request additional payment for mobilizing larger equipment than that which was anticipated during preparation of their construction bid. The amount of additional compensation, if any, and the minimum equipment size necessary to qualify for any additional compensation should be defined before the start of construction.

Reuse of Excavated Materials

Based on the results of the test borings and our observations, residual soils appear to be suitable for reuse as structural fill after routine moisture content adjustment. It is possible that some fill materials may be encountered during grading and construction that are not suitable for reuse. Geo-Hydro should observe the excavation of materials to evaluate their suitability for reuse. Routine adjustment of moisture content will be necessary to allow proper placement and compaction of excavated soils.

It is important to establish as part of the construction contract whether soils having elevated moisture content will be considered suitable for reuse. We often find this issue to be a point of contention and a source of delays and change orders. From a technical standpoint, soils with moisture contents wet of optimum as determined by the standard Proctor test (ASTM D698) can be reused provided that the moisture is properly adjusted to within the workable range. From a practical standpoint, wet soils can be very difficult to dry in small or congested sites and such difficulties should be considered during planning and budgeting. A clear understanding by the general contractor and grading subcontractor regarding the reuse of excavated soils will be important to avoid delays and unexpected cost overruns.

If generated during construction, excavated partially weathered rock materials will be suitable for reuse as structural fill only if they break down into a reasonably well-graded material that can be satisfactorily compacted. The presence of cobble size or boulder size material, which does not break down under the action of compaction equipment, will limit the suitability of partially weathered rock materials. Engineering judgment will be required in the field to evaluate the acceptability of partially weathered rock materials for reuse as structural fill.

Structural Fill

Materials selected for use as structural fill should be free of organic debris, waste construction debris, and other deleterious materials. The material should not contain rocks having a diameter over 4 inches. It is our opinion that the following soils represented by their USCS group symbols will typically be suitable for use as structural fill and are usually found in abundance in the Piedmont: (SM), (ML), and (CL). The following soil types are typically suitable but are not abundant in the Piedmont: (SW), (SP), (SC), (SP-SM), and (SP-SC). The following soil types are considered unsuitable: (MH), (CH), (OL), (OH), and (Pt).

Laboratory Proctor compaction tests and classification tests should be performed on representative samples obtained from the proposed borrow material to provide data necessary to determine acceptability and for quality control. The moisture content of suitable borrow soils should generally be no more than 3 percentage

points below or above optimum at the time of compaction. Tighter moisture limits may be necessary with certain soils.

Suitable fill material should be placed in thin lifts. Lift thickness depends on the type of compaction equipment, but a maximum loose-lift thickness of 8 inches is generally recommended. The soil should be compacted by a self-propelled sheepsfoot roller. Within small excavations such as in utility trenches, around manholes, above foundations, or behind retaining walls, we recommend the use of “wacker packers” or “Rammax” compactors to achieve the specified compaction. Loose lift thicknesses of 4 to 6 inches are recommended in small area fills.

We recommend that structural fill be compacted to at least 95 percent of the standard Proctor maximum dry density (ASTM D698). The upper 12 inches of floor slab subgrade soils should be compacted to at least 98 percent of the standard Proctor maximum dry density. The upper 12 inches of pavement subgrades should be compacted in accordance with Georgia DOT requirements to at least 100 percent of the standard Proctor maximum dry density (ASTM D698). Additionally, the maximum dry density of structural fill should be no less than 90 pcf. Geo-Hydro should perform density tests during fill placement.

Groundwater

At the time of drilling, groundwater was not encountered in the test borings. It is important to note that the groundwater level will fluctuate over time depending on local rainfall amounts and other factors and may be encountered at higher elevations during site grading. Based on the results of the borings, groundwater is not expected to be a hindrance to site development and construction. Regardless of groundwater conditions, the contractor should be prepared to manage surface runoff during wet weather conditions and subsurface drainage will be necessary behind all below-grade walls including foundation walls.

Earth Slopes

Temporary construction slopes should be designed in strict compliance with OSHA regulations. The exploratory borings indicate that most soils at the site are Type B as defined in 29 CFR 1926 Subpart P. This dictates that temporary construction slopes in residual soils above the groundwater level (Type B) be no steeper than 1H:1V for excavation depths of 20 feet or less. Any temporary excavation slopes in fill materials (Type C), or in any soil type extending below the groundwater level, should be no steeper than 1.5H:1V.

Temporary construction slopes should be closely observed on a daily basis by the contractor’s “competent person” for signs of mass movement: tension cracks near the crest, bulging at the toe of the slope, etc. The responsibility for excavation safety and stability of construction slopes should lie solely with the contractor.

We recommend that extreme caution be observed in trench excavations. Several cases of loss of life due to trench collapses in Georgia point out the lack of attention given to excavation safety on some projects. We recommend that applicable local and federal regulations regarding temporary slopes, and shoring and bracing of trench excavations be closely followed.

Formal analysis of slope stability was beyond the scope of work for this project. Based on our experience, permanent cut or fill slopes should be no steeper than 2H:1V to maintain long term stability and to provide ease of maintenance. The crest or toe of cut or fill slopes should be no closer than 10 feet to any foundation. The crest or toe should be no closer than 5 feet to the edge of any pavements. Erosion protection of slopes during construction and during establishment of vegetation should be considered an essential part of construction.

Earth Pressure (Cast-in-Place Structures)

Three earth pressure conditions are generally considered for retaining wall design: "at rest", "active", and "passive" stress conditions. Retaining walls which are rigidly restrained at the top and will be essentially unable to rotate under the action of earth pressure (such as basement or foundation walls) should be designed for "at rest" conditions. Retaining walls which can move outward at the top as much as 0.5 percent of the wall height (such as free-standing walls) should be designed for "active" conditions. For the evaluation of the resistance of soil to lateral loads the "passive" earth pressure must be calculated. It should be noted that full development of passive pressure requires deflections toward the soil mass on the order of 1.0 percent to 4.0 percent of total wall height.

Earth pressure may be evaluated using the following equation:

$$p_h = K\,(D_w Z + q_s) + W_w(Z\text{-}d)$$

where: p_h = horizontal earth pressure at any depth below the ground surface (Z).
W_w = unit weight of water
Z = depth to any point below the ground surface
d = depth to groundwater surface
D_w = wet unit weight of the soil backfill (depending on borrow sources). The wet unit weight of most residual soils may be expected to range from approximately 115 to 125 pcf. Below the groundwater level, D_w must be the buoyant weight.
q_s = uniform surcharge load (add equivalent uniform surcharge to account for construction equipment loads)
K = earth pressure coefficient as follows:

Earth Pressure Condition	Coefficient
At Rest (K_o)	0.53
Active (K_a)	0.36
Passive (K_p)	2.8

The groundwater term, $W_w(Z\text{-}d)$, should be used if no drainage system is incorporated behind retaining walls. If a drainage system is included which will not allow the development of any water pressure behind the wall, then the groundwater term may be omitted. The development of excessive water pressure is a common cause of retaining wall failures. Drainage systems should be carefully designed to ensure that long term permanent drainage is accomplished.

The above design recommendations are based on the following assumptions:

- Horizontal backfill
- 95 percent standard Proctor compactive effort on backfill (ASTM D698)
- No safety factor is included

For convenience, equivalent fluid densities are frequently used for the calculation of lateral earth pressures. For "at rest" stress conditions, an equivalent fluid density of 66 pcf may be used. For the "active" state of stress an equivalent fluid density of 45 pcf may be used. These equivalent fluid densities are based on the assumptions that drainage behind the retaining wall will allow *no* development of hydrostatic pressure; that native sandy silts or silty sands will be used as backfill; that the backfill soils will be compacted to 95 percent of standard Proctor maximum dry density; that backfill will be horizontal; and that no surcharge loads will be applied.

For analysis of sliding resistance of the base of a cast-in-place concrete retaining wall, the coefficient of friction may be taken as 0.4 for the soils at the project site. This is an ultimate value, and an adequate factor of safety

should be used in design. Customarily, retaining wall design includes a factor of safety which affects the global design. Using that design approach, it is not necessary to reduce the coefficient of friction as a design input. Such a reduction, coupled with the global factor of safety applied to the wall design, would place an unreasonable reduction in the calculation of the frictional resistance.

The force that resists base sliding is calculated by multiplying the normal force on the base by the coefficient of friction. Full development of the frictional force could require deflection of the base of roughly 0.1 to 0.3 inches.

Foundation Design

After general site preparation and site grading have been completed in accordance with the recommendations of this report, it is our opinion that the planned additions can be supported using conventional shallow foundations. We recommend that footings be designed using an allowable bearing pressure of 2,500 psf based on a maximum column load of 100 kips and wall loads no greater than 3 kips per lineal foot.

In addition, we recommend a minimum width of 24 inches for column footings and 18 inches for continuous wall footings to prevent general bearing capacity failure. Footings should bear at a minimum depth of 18 inches below the prevailing exterior ground surface elevation to avoid potential problems due to frost heave.

The recommended allowable bearing pressure is based on an estimated maximum total foundation settlement no greater than approximately 1 inch, with anticipated differential settlement between adjacent columns not exceeding about ½ inch. If the architect or structural engineer determines that the estimated total or differential settlement cannot be accommodated by the proposed structure, please contact us.

Because some foundation excavations may occur adjacent to the existing building, care should be taken to avoid undermining existing foundations and floor slabs. Generally, new footings located adjacent to existing footings should be constructed to bear at the same elevation as the existing footings. The responsibility for preserving foundation support for the existing building should lie solely with the contractor.

Foundation bearing surface evaluations should be performed in all footing excavations prior to placement of reinforcing steel. Geo-Hydro should perform these evaluations to confirm that the design allowable soil bearing pressure is available. Foundation bearing surface evaluations should be performed using a combination of visual observation, hand augering, and portable dynamic cone penetrometer testing (ASTM STP-399). Any soft, unstable materials should be removed from the foundation excavation.

Foundation bearing surface evaluations will be critical to aid in the identification and remediation of these situations. The bearing surface should be evaluated using a combination of random hand probing with a small-diameter steel rod, visual observations, and hand auger and penetrometer testing (ASTM STP-399).

Remedial measures should be based on actual field conditions. However, in most cases we expect the use of the stone replacement technique to be the primary remedial measure. Stone replacement involves the removal of soft or loose soils, followed by replacement with well-compacted graded aggregate base (GAB) meeting Georgia DOT specifications for gradation. Stone replacement is generally performed to depths ranging from a few inches to as much as 2 times the footing width, depending on the actual conditions. For budgetary purposes, we suggest considering that as much as 15 percent of the foundation excavations will require over excavation and stone replacement extending to a depth of 3 feet below bearing elevation. The actual quantity of stone replacement will be different and may exceed the provided estimate.

Seismic Design

It is our opinion that the soil test borings were not extended to a depth sufficient to characterize the upper 100 feet of the soil subsurface for the purposes of determining the seismic *Site Class* in accordance with the 2024 International Building Code (Chapter 20, ASCE 7-22). We recommend using the *Default* seismic *Site Class* as suggested in the code. The mapped and design spectral response accelerations are as follows: S_S=0.270, S_1=0.095, S_{DS}=0.220, S_{D1}= 0.130. The *Seismic Design Category* (SDC) for the site is **C**.

Based on the information obtained from the soil test borings, it is our opinion that the potential for liquefaction of the residual soils at the site due to earthquake activity is relatively low.

Floor Slab Subgrade Preparation

The soil subgrade in the area of concrete slab-on-grade support is often disturbed during foundation excavation, plumbing installation, and superstructure construction. We recommend that the floor slab subgrade be evaluated by Geo-Hydro immediately prior to beginning floor slab construction. If low consistency soils are encountered that cannot be adequately densified in place, such soils should be removed and replaced with well-compacted fill material placed in accordance with the *Structural Fill* section of this report or with well-compacted graded aggregate base (GAB).

Assuming that the top 12 inches of floor slab subgrade soils are compacted to at least 98 percent of the standard Proctor maximum dry density, we recommend that a modulus of subgrade reaction of 120 pci be used for design. This value is suitable only for light floor loads (no greater than 150 psf) and transient loads, and should not be used for design of thickened slab sections or floors supporting permanent or semi-permanent loads such as those from mechanical equipment and storage racks. For design of floor areas supporting permanent or semi-permanent loads from floor storage, storage racks, equipment, etc., we recommend using a modulus of subgrade reaction of 65 pci.

Moisture Control for Concrete Slabs

To prevent the capillary rise of groundwater from adversely affecting the concrete slab-on-grade floor, we recommend that slab-on-grade floors be underlain by a minimum 4-inch thickness of open-graded stone. Use of #57 crushed stone meeting Georgia DOT specifications for gradation is suggested. The stone must be covered by a vapor retarder. We suggest polyethylene sheeting at least 10 mils thick as a minimum vapor retarder.

In areas where floor slabs may be subjected to vehicular traffic including lift platforms, forklifts, trucks, or other relatively heavy wheeled equipment, we recommend that slab-on-grade floors be underlain by a minimum 5-inch thickness of graded aggregate base (GAB) compacted to at least 100 percent of the modified Proctor maximum dry density (ASTM D1557). The GAB must be covered by a vapor retarder as suggested above.

Flexible Pavement Design

Based on our experience with similar projects, assuming standard pavement design parameters, and contingent upon proper pavement subgrade preparation, we recommend the following pavement sections:

Entrance/Exit Driveways and Truck Traffic Areas

Material	Thickness (inches)
Asphaltic Concrete 9.5mm Superpave Type II	2
Asphaltic Concrete 19mm Superpave	2
Graded Aggregate Base (GAB) (Base Course)	8
Subgrade compacted to at least 100% standard Proctor maximum dry density (ASTM D698)	12

Automobile Parking and Automobile Traffic Only

Material	Thickness (inches)
Asphaltic Concrete 9.5mm Superpave Type II	2
Graded Aggregate Base (GAB) (Base Course)	6
Subgrade compacted to at least 100% standard Proctor maximum dry density (ASTM D698)	12

A concrete thickness of 7 inches is recommended for the approach and collection zone in front of any dumpsters, in loading/unloading zones, and in designated truck/bus turn-around areas. Please refer to the *Concrete Pavement* section of this report for concrete pavement recommendations.

Similar to floor slab subgrades, pavement subgrades generally deteriorate due to constructions activities between the time of general site preparation and pavement construction. The top 12 inches of pavement subgrade soils must be compacted to at least 100 percent of the standard Proctor maximum dry density (ASTM D698). It is likely that scarification and moisture will be required to achieve the recommended subgrade compaction level. Allowances for pavement subgrade preparation should be considered for budgeting and scheduling.

GAB must be compacted to at least 100 percent of the modified Proctor maximum dry density (ASTM D1557).

All pavement construction should be performed in general accordance with Georgia DOT specifications. Proper subgrade compaction, adherence to Georgia DOT specifications, and compliance with project plans and specifications, will be critical to the performance of the constructed pavement.

Concrete Pavement

A rigid Portland cement concrete pavement may be considered. Although usually more costly, a Portland cement concrete pavement is typically more durable and requires less maintenance throughout the life cycle of the facility. Concrete thicknesses of 5 inches in automobile parking areas and 6 inches in driveways and truck traffic areas are recommended. A concrete thickness of 7 inches is recommended for the approach and collection zone in front of any dumpsters, in loading/unloading zones, and in designated truck/bus turn-around areas. A 600-psi flexural strength concrete mix (approximately 4,000 psi compressive strength) with 4 to 6 percent air entrainment should be used. The concrete pavement should be underlain by no less than 5 inches of compacted graded aggregate base (GAB). GAB should be compacted to at least 100 percent of the modified Proctor maximum dry density (ASTM D1557). The top 12 inches of soil subgrade should be compacted to at least 100 percent of the standard Proctor maximum dry density (ASTM D698).

The concrete pavement may be designed as “plain concrete pavement” with no reinforcing steel, or reinforcing steel may be used at joints. Construction joints and other design details should be in accordance with guidelines provided by the Portland Cement Association and the American Concrete Institute.

In general, all pavement construction should be in accordance with Georgia DOT specifications. Proper subgrade compaction, adherence to Georgia DOT specifications, and compliance with project plans and specifications will be critical to the performance of the constructed pavement.

Pavement Design Limitations

The pavement sections discussed above are based on our experience with similar type developments. After traffic information has been developed, we recommend that you allow us to review the traffic data and revise our recommendations as necessary.

Pavement Materials Testing

To aid in verifying that the pavement system is installed in general accordance with the design considerations, the following materials testing services are recommended:

- Density testing of subgrade materials.
- Proofrolling of pavement subgrade materials immediately prior to placement of graded aggregate base (GAB). This proofrolling should be performed the same day GAB is installed.
- Density testing of GAB and verification of GAB thickness. In-place density should be verified using the sand cone method (ASTM D1556) or nuclear density gauge method (ASTM D6938).
- Coring of the pavement to verify thickness and density (asphalt pavement only).
- Preparation and testing of beams and cylinders for flexural and compressive strength testing (Portland cement concrete only). The total number of test specimens required will depend on the number of concrete placement events necessary to construct the pavement.

We appreciate the opportunity to serve as your geotechnical consultant for this project and are prepared to provide any additional services you may require. If you have any questions concerning this report or any of our services, please call us.

Sincerely,

GEO-HYDRO ENGINEERS, INC.

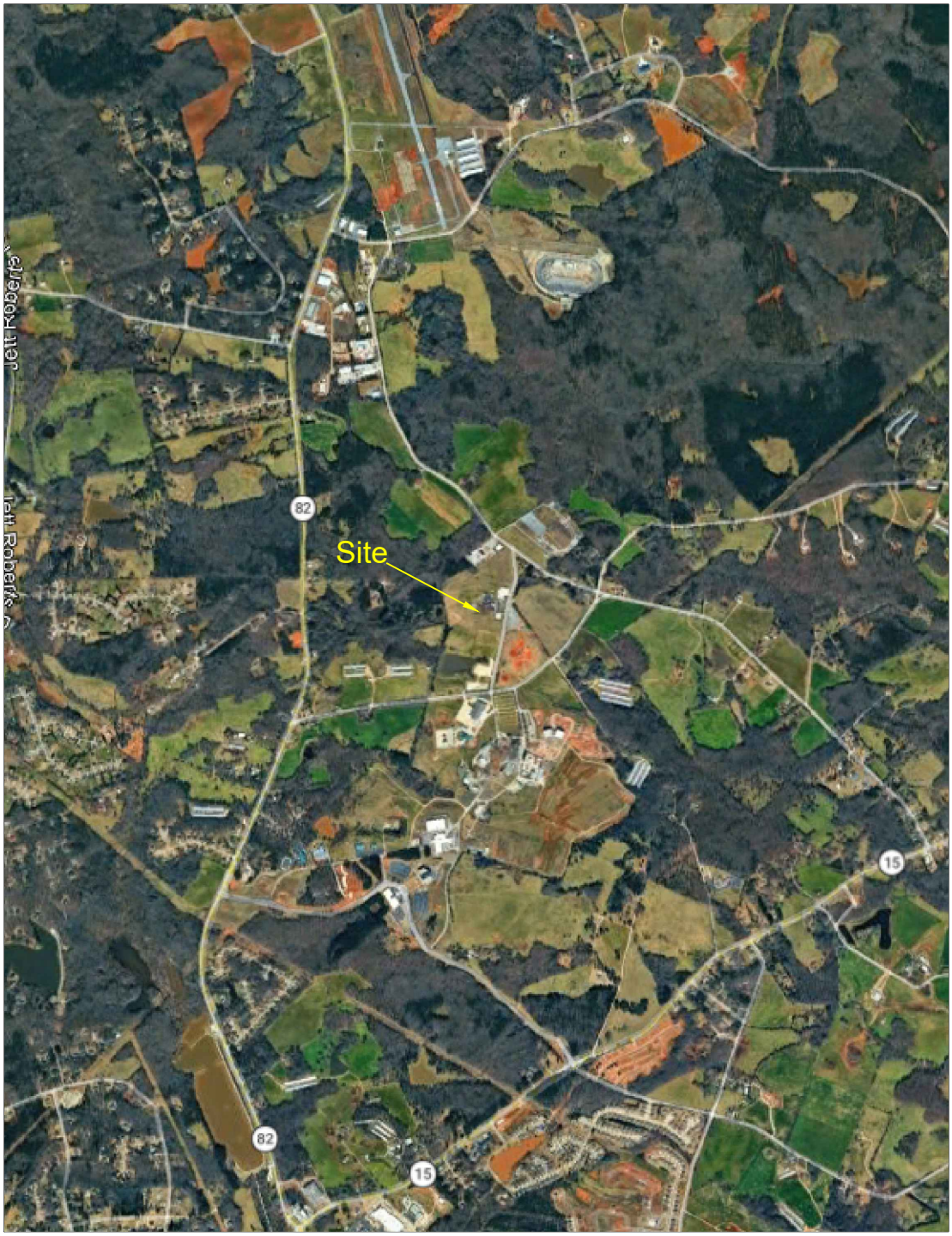


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APPENDIX

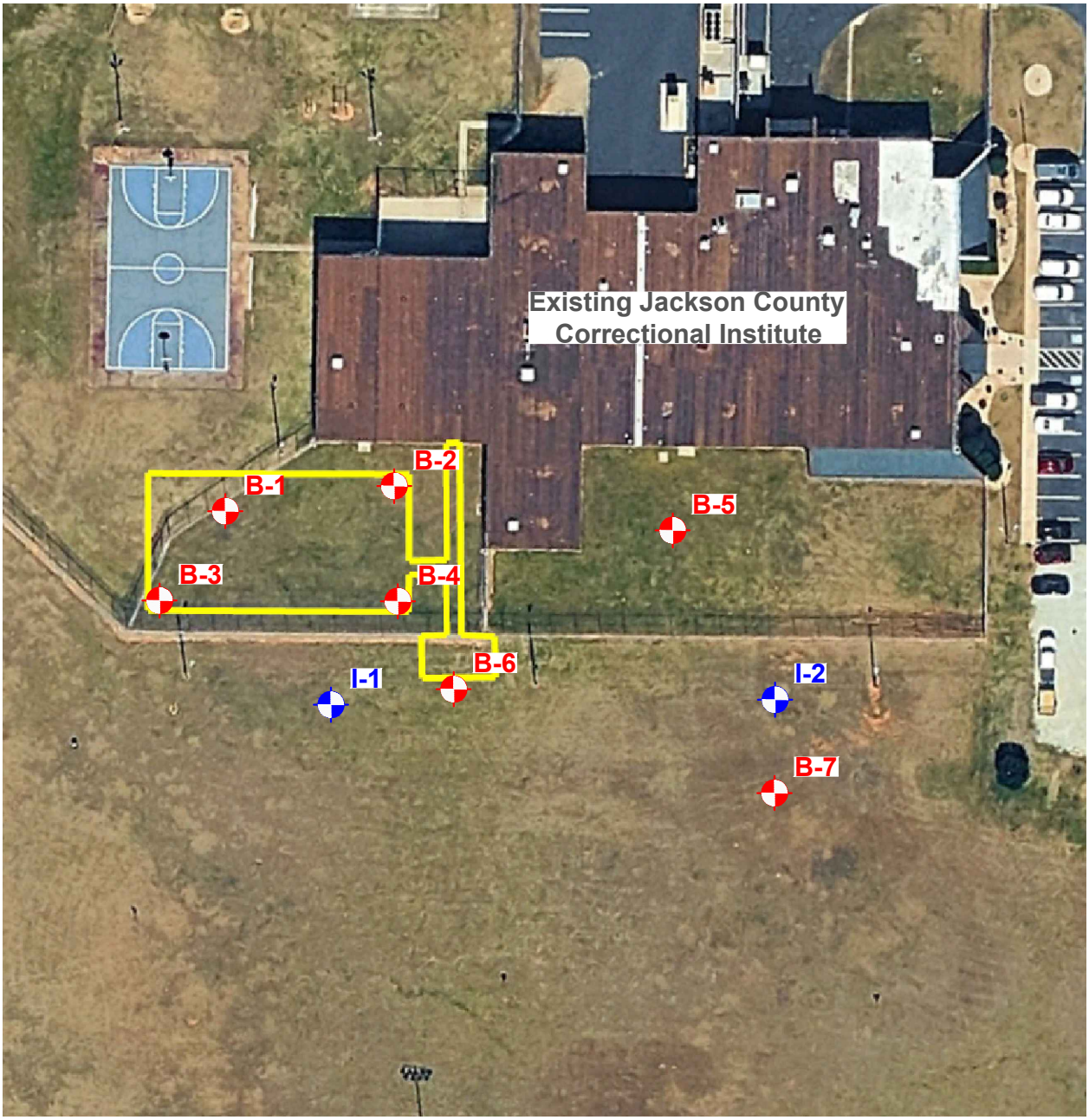


0 0.25 0.5 1 1.5

Approximate Scale, Miles

Figure 1: Site Location Plan

Building Addition and Renovations
Jackson County Correctional Institute
Jefferson, Georgia
Geo-Hydro Project Number 261245.20



LEGEND: Soil Test Boring
Infiltration Test Location

0 35 70 140 210

Approximate Scale: 1"=70

Figure 2: Boring Location Plan

Building Addition and Renovations
Jackson County Correctional Institute
Jefferson, Georgia
Geo-Hydro Project Number 261245.20

Symbols and Nomenclature

Symbols

	Thin-walled tube (TWT) sample recovered
	Thin-walled tube (TWT) sample not recovered
	Standard penetration resistance (ASTM D1586)
50/2”	Number of blows (50) to drive the split-spoon a number of inches (2)
65%	Percentage of rock core recovered
RQD	Rock quality designation - % of recovered core sample which is 4 or more inches long
GW	Groundwater
	Water level at least 24 hours after drilling
	Water level one hour or less after drilling
ALLUV	Alluvium
TOP	Topsoil
PM	Pavement Materials
CONC	Concrete
FILL	Fill Material
RES	Residual Soil
PWR	Partially Weathered Rock
SPT	Standard Penetration Testing

Penetration Resistance Results

	Number of Blows, N	Approximate Relative Density
Sands	0-4	very loose
	5-10	loose
	11-20	firm
	21-30	very firm
	31-50	dense
	Over 50	very dense

	Number of Blows, N	Approximate Consistency
Silts and	0-1	very soft
Clays	2-4	soft
	5-8	firm
	9-15	stiff
	16-30	very stiff
	31-50	hard
	Over 50	very hard

Drilling Procedures

Soil sampling and standard penetration testing performed in accordance with ASTM D 1586. The standard penetration resistance is the number of blows of a 140-pound hammer falling 30 inches to drive a 2-inch O.D., 1.4-inch I.D. split-spoon sampler one foot. Rock coring is performed in accordance with ASTM D 2113. Thin-walled tube sampling is performed in accordance with ASTM D 1587.

GEO HYDRO ENGINEERS

B-1

Test Boring Record

GEO HYDRO ENGINEERS

Project: **Building Addition and Renovations - Jackson County Correction Institute**		Project No: **261245.20**
Location: **Jefferson, Georgia**		Date: **3/17/26**
Method: **HSA- ASTM D1586**	GWT at Drilling: **Not Encountered**	G.S. Elev:
Driller: **FD (Auto-Hammer)**	GWT at 24 hrs: **N/A: Boring Backfilled**	Logged By: **BGS**

Elev. (Ft)	Depth (Ft)	GWT	Symbol	Description	N	Standard Penetration Test (Blows/Foot)
				Topsoil (Approximately 3 inches)		
				Loose to firm red-brown clayey fine sand (SC) (RESIDUUM)	7	
	5				11	
				Loose to firm pink, orange, and brown micaceous silty fine sand (SM)	7	
	10				11	
	15				7	
	20				7	
	25			Boring Terminated at 25 feet	12	
	30					

0 10 20 30 40 50 60 70 80 90 100

Remarks:

TEST BORING RECORD LOGS.GPJ GEO HYDRO.GDT 3/25/26

B-2

Test Boring Record

GEO HYDRO ENGINEERS

Project: **Building Addition and Renovations - Jackson County Correction Institute**		Project No: **261245.20**
Location: **Jefferson, Georgia**		Date: **3/17/26**
Method: **HSA- ASTM D1586**	GWT at Drilling: **Not Encountered**	G.S. Elev:
Driller: **FD (Auto-Hammer)**	GWT at 24 hrs: **N/A: Boring Backfilled**	Logged By: **BGS**

Elev. (Ft)	Depth (Ft)	GWT	Symbol	Description	N
				Topsoil (Approximately 3 inches)	
				Loose red-brown clayey fine sand (SC) (RESIDUUM)	9
				Loose to firm pink, orange, and brown micaceous silty fine sand (SM)	
	5				8
					10
	10				7
	15				10
	20				14
	25			Boring Terminated at 25 feet	10
	30				

Standard Penetration Test (Blows/Foot)

0 10 20 30 40 50 60 70 80 90 100

Remarks:

TEST BORING RECORD LOGS.GPJ GEO HYDRO.GDT 3/25/26

B-3

Test Boring Record

GEO HYDRO ENGINEERS

Project: **Building Addition and Renovations - Jackson County Correction Institute**		Project No: **261245.20**
Location: **Jefferson, Georgia**		Date: **3/17/26**
Method: **HSA- ASTM D1586**	GWT at Drilling: **Not Encountered**	G.S. Elev:
Driller: **FD (Auto-Hammer)**	GWT at 24 hrs: **N/A: Boring Backfilled**	Logged By: **BGS**

Elev. (Ft)	Depth (Ft)	GWT	Symbol	Description	N
	0			Topsoil (Approximately 3 inches)	
				Firm red-brown clayey fine sand (SC) (RESIDUUM)	11
				Loose to firm light brown to gray silty fine to medium sand (SM)	
	5				11
					7
	10				7
	15				18
	20				14
	25			Boring Terminated at 25 feet	12
	30				

Standard Penetration Test (Blows/Foot)

0 10 20 30 40 50 60 70 80 90 100

Remarks:

TEST BORING RECORD LOGS.GPJ GEO HYDRO.GDT 3/25/26

B-4

Test Boring Record

GEO HYDRO ENGINEERS

Project: **Building Addition and Renovations - Jackson County Correction Institute**		Project No: **261245.20**
Location: **Jefferson, Georgia**		Date: **3/17/26**
Method: **HSA- ASTM D1586**	GWT at Drilling: **Not Encountered**	G.S. Elev:
Driller: **FD (Auto-Hammer)**	GWT at 24 hrs: **N/A: Boring Backfilled**	Logged By: **BGS**

Elev. (Ft)	Depth (Ft)	GWT	Symbol	Description	N
				Topsoil (Approximately 3 inches)	
				Very firm red clayey fine sand (SC) (RESIDUUM)	21
				Loose to firm red-brown and purple and white silty fine sand (SM)	
	5				7
					9
	10				11
	15				12
	20				11
				Firm orange and black fine sandy silt (ML)	
	25			Boring Terminated at 25 feet	8
	30				

Standard Penetration Test (Blows/Foot)

0 10 20 30 40 50 60 70 80 90 100

Remarks:

TEST BORING RECORD LOGS.GPJ GEO HYDRO.GDT 3/25/26

B-5

Test Boring Record

GEO HYDRO ENGINEERS

Project: **Building Addition and Renovations - Jackson County Correction Institute**		Project No: **261245.20**
Location: **Jefferson, Georgia**		Date: **3/17/26**
Method: **HSA- ASTM D1586**	GWT at Drilling: **Not Encountered**	G.S. Elev:
Driller: **FD (Auto-Hammer)**	GWT at 24 hrs: **N/A: Boring Backfilled**	Logged By: **BGS**

Elev. (Ft)	Depth (Ft)	GWT	Symbol	Description	N	Standard Penetration Test (Blows/Foot)
				Topsoil (Approximately 3 inches)		
				Loose to firm red, orange, and pink silty fine sand (SM) (RESIDUUM)	8	
	5				9	
					9	
	10				10	
	15			Boring Terminated at 15 feet	14	
	20					
	25					
	30					

0 10 20 30 40 50 60 70 80 90 100

Remarks:

TEST BORING RECORD LOGS.GPJ GEO HYDRO.GDT 3/25/26

B-6

Test Boring Record

GEO HYDRO ENGINEERS

Project: **Building Addition and Renovations - Jackson County Correction Institute**		Project No: **261245.20**
Location: **Jefferson, Georgia**		Date: **3/17/26**
Method: **HSA- ASTM D1586**	GWT at Drilling: **Not Encountered**	G.S. Elev:
Driller: **FD (Auto-Hammer)**	GWT at 24 hrs: **N/A: Boring Backfilled**	Logged By: **BGS**

Elev. (Ft)	Depth (Ft)	GWT	Symbol	Description	N	Standard Penetration Test (Blows/Foot)
				Topsoil (Approximately 3 inches)		
				Loose to firm red and orange clayey fine sand (SC) (RESIDUUM)	8	
	5				11	
				Loose to firm tan-brown and pink micaceous silty fine sand (SM)	9	
	10				10	
	15			Boring Terminated at 15 feet	11	
	20					
	25					
	30					

0 10 20 30 40 50 60 70 80 90 100

Remarks:

TEST BORING RECORD LOGS.GPJ GEO HYDRO.GDT 3/25/26

B-7

Test Boring Record

GEO HYDRO ENGINEERS

Project: **Building Addition and Renovations - Jackson County Correction Institute**		Project No: **261245.20**
Location: **Jefferson, Georgia**		Date: **3/17/26**
Method: **HSA- ASTM D1586**	GWT at Drilling: **Not Encountered**	G.S. Elev:
Driller: **FD (Auto-Hammer)**	GWT at 24 hrs: **N/A: Boring Backfilled**	Logged By: **BGS**

Elev. (Ft)	Depth (Ft)	GWT	Symbol	Description	N	Standard Penetration Test (Blows/Foot)
				Topsoil (Approximately 3 inches)		
				Loose orange and tan clayey fine sand (SC) (RESIDUUM)	8	
				Firm orange and tan silty fine sand (SM)		
	5				11	
					11	
	10				12	
	15			Boring Terminated at 15 feet	11	
	20					
	25					
	30					

Standard Penetration Test (Blows/Foot): 0 10 20 30 40 50 60 70 80 90 100

Remarks:

TEST BORING RECORD LOGS.GPJ GEO HYDRO.GDT 3/25/26

GEO HYDRO ENGINEERS

ATHENS OFFICE
190 BEN BURTON ROAD, SUITE C
BOGART, GEORGIA 30622
geohydro.com

DOCUMENT 004113 - BID FORM - STIPULATED SUM (SINGLE-PRIME CONTRACT)

1.1 BID INFORMATION

A. Bidder: _____.

B. Project Name: Additions & Renovations to the Jackson Co. Correctional Institution.

C. Project Location: 265 I W Davis Rd., Jefferson GA 30549.

D. Owner: Jackson County Board of Commissioners.

E. Architect: Hussey Gay Bell, Christopher M. Caudle AIA.

F. Architect Project Number: 626 1202 07.

1.2 CERTIFICATIONS AND BASE BID

A. Base Bid, Single-Prime (All Trades) Contract: The undersigned Bidder, having carefully examined the Procurement and Contracting Requirements, Conditions of the Contract, Drawings, Specifications, and all subsequent Addenda, as prepared by Hussey Gay Bell and Architect's consultants, having visited the site, and being familiar with all conditions and requirements of the Work, hereby agrees to furnish all material, labor, equipment and services**, including all scheduled allowances indicated in "Attachment A",** necessary to complete the construction of the above-named Project, in accordance with the requirements of the Procurement and Contracting Documents, for the stipulated sum of:

1. Provide a base bid for the Building Additions & Renovation, for the New Fire Alarm System and for the Existing Building Roof Replacement:

Base Bid for the Building Additions & Renovation (including all allowances):

_____

_____ Dollars ($_____).

Base Bid for the New Fire Alarm System: _____

_____ Dollars ($_____).

Base Bid for the Existing Building Roof Replacement:_____

_____ Dollars ($_____).

2. The above amount may be modified by amounts indicated by the Bidder under the "Unit Prices" Article and the "Alternates" Article below.

3. A contingency of ten percent (10%) of the base bid is to be included.

A total of Base Bid for the Building Additions & Renovation (including all allowances) plus ten percent (10%) Contingency:

_____

_____ Dollars ($_____).

A total of Base Bid for the New Fire alarm system plus ten percent (10%) Contingency:

_____

_____ Dollars ($_____).

A total of Base Bid for the Existing Building Roof Replacement plus ten percent (10%) Contingency:

_____

_____ Dollars ($_____).

4. Total Base Bid including contingencies, the Building Additions & Renovation, the New Fire Alarm System and the Existing Building Roof Replacement:

Total Base Bid (including all allowances):_____

_____ Dollars ($_____).

1.3 UNIT PRICES

A. The undersigned Bidder proposes the amounts in “Attachment A” be added to or deducted from the Contract Sum on performance and measurement of the individual items of the Work, as described in Section 012200 "Unit Prices" and if applicable for adjustment of the quantity given in the Unit-Price Allowance for the actual measurement of individual items of the Work.

B. If the Unit Price does not affect the Work of this Contract, the Bidder to indicate "NOT APPLICABLE."

C. See Allowances and Unit Prices “Attachment A”. Shall be included with this bid form.

1.4 BID SECURITY

A. The undersigned Bidder agrees to execute a contract for this Work in the above amount and to furnish surety as specified within **10** days after a written Notice of Award, if offered within **60** days after receipt of bids, and on failure to do so agrees to forfeit to Owner the attached Bid Security, as liquidated damages for such failure as follows:

1. In the following amount, as stipulated in Document 001116 “Invitation to Bid":

   a. Bid Bond: _____

   _____Dollars ($_____).

   b. Performance and Payment Bond: _____

   _____Dollars ($_____).

B. Form of Bid Security: Bidder has attached the following:

1. ☐ AIA Document A310-2010, "Bid Bond."

2. ☐ AIA Document A312-2010, “Performance and Payment Bond”

C. In the event Owner does not offer Notice of Award within the time limits stated above, Owner will return to the undersigned the bonds.

1.5 SUBCONTRACTORS AND SUPPLIERS

A. The following companies to execute subcontracts for the portions of the Work indicated:

1. Concrete Work: _____.

2. Masonry Work: _____.

3. Roofing Work: _____.

4. Plumbing Work: _____.

5. HVAC Work: _____.

6. Electrical Work: _____.

7. Fire Sprinkler Work: _____.

8. Roofing Work: _____.

9. Steel Joists Erector: _____.

10. Grading Work: _____.

11. Window & Door Work: _____.

1.6 TIME OF COMPLETION

A. Time of Completion:

1. The undersigned Bidder proposes and agrees hereby to commence the Work of the Contract Documents on a date specified in a written Notice to Proceed to be issued by Architect, and to substantially complete the Work within **365 calendar days (12 months).**

1.7 ACKNOWLEDGMENT OF ADDENDA

A. The undersigned Bidder acknowledges receipt of and use of the following Addenda in the preparation of this Bid:

1. Addendum No. 1, dated _____.

2. Addendum No. 2, dated _____.

3. Addendum No. 3, dated _____.

4. Addendum No. 4, dated _____.

1.8 BID SUPPLEMENTS

A. The following supplements are a part of this Bid Form and are attached hereto:

1. Owner's attached document "**ITB 260009 (also provided as sections 01116 Invitation to Bid and 002113 Instructions to Bidders).**

1.9 CONTRACTOR'S LICENSE

A. The undersigned further states that it is a duly licensed contractor, for the type of work proposed, in Jackson County, Georgia, and that all fees, permits, etc., pursuant to submitting this proposal have been paid in full.

1.10 SUBMISSION OF BID

A. Respectfully submitted this ____ day of _____ (Month and Year).

B. Submitted by: _____ (Name of bidding firm or corporation).

C. Authorized Signature: _____ (Handwritten signature).

D. Signed by: _____ (Type or print name).

E. Title: _____ (Owner/Partner/President/Vice President).

F. Witnessed by: _____ (Handwritten signature).

G. Attest: _____ (Handwritten signature).

H. By: _____ (Type or print name).

I. Attester Title: _____ (Corporate Secretary or Assistant Secretary).

J. Street Address: _____.

K. City, State, Zip: _____.

L. Phone: _____.

M. License No.: _____.

(Affix Corporate Seal Here)

END OF DOCUMENT 004113

SECTION 004113-00 - ATTACHMENT A

A. **ALLOWANCES:** To provide **as a part of the Base Bid** an allowance for sum total of all work related to the below outlined. Unused allowances shall be credited back to the Owner at the end of the job as a deductive change order. Required allowances in excess of amount listed below shall be provided at the rate provided by the Contractor below.

Unsuitable materials shall be defined as:

1. Substances not capable of being compacted to the density specified,
2. Rock material larger than ½ cubic foot in volume,
3. Debris and organic material. Such materials shall be determined by the Owner's Geotechnical Testing Agency;
4. Materials which are not suitable for use on this project;
5. Unsuitability for sale of materials to third parties is not included in this definition.

Soil material which is too wet to permit the specified compaction but is still suitable to be used in structural capacity (once dried) based on the recommendations of the soils testing agency, shall be spread and permitted to dry in an area to be designated by the Architect. Contractor shall assist drying by discing, harrowing or pulverizing until the soil moisture content is reduced to the specified value. Only excavation of soil which is wet due to a concealed condition, including, but not limited to, underground springs, high water table and leaking pipes, shall be addressed as a potential additive change order. Suitable materials which are wet due to precipitation as determined by the Owner's Testing Agency shall be dried as specified and reused at no additional cost.

Allowances in Base Bid:

1. Fill and compact with suitable soils acquired on-site to replace unsuitable soils removal..... 500 cubic yards @ $ /cy
2. Fill and compact with suitable soils acquired off-site to replace unsuitable soils removed..... 500 cubic yards @ $ /cy
3. Excavate materials determined to be unsuitable by the Owner's Testing Agency and redistribute on the site ..... 500 cubic yards @ $ /cy
5. Excavate materials determined to be unsuitable by the Owner's Testing Agency and redistribute off the site legally 500 cubic yards @ $ /cy
6. Trench rock excavation, distribution and approved burial ..... 250 cubic yards @ $ /cy
7. Trench rock excavation and removal from site..... 250 cubic yards @ $ /cy

8. Fill and compact with suitable soils acquired on-site to replace trench rock removal ..... 250 cubic yards @ $ /cy

9. Fill and compact with suitable soils acquired off-site to replace trench rock removed ..... 250 cubic yards @ $ /cy

10. Mass rock removal, excavation, distribution and approved burial ..... 500 cubic yards @ $ /cy

11. Mass rock removal, excavation and removal from site..... 500 cubic yards @ $ /cy

12. Fill and compact with suitable soils acquired on-site to replace Mass rock removal ..... 500 cubic yards @ $ /cy

13. Fill and compact with suitable soils acquired off-site to replace mass rock removed ..... 500 cubic yards @ $ /cy

14.Furnish and install 43560 s.f. (1.0 acres) of APS 600 series silt stop as manufactured by Applied Polymer Systems, Norcross, Georgia or approved equal at a rate of 1.5 gallons per acre in a hydroseeder mix of appropriate seed, fertilizer, lime and mulch for the same acre. Follow all manufacturer's instruction and recommendations. Do not mechanically disturb treated areas after application……1.0 acres @ $ /acre

15.Contractor shall furnish, install and maintain APS 700 series silt stop as manufactured by Applied Polymer Systems, Norcross, Georgia or approved equal 200 lbs @ $ /lbContractor shall furnish, install and maintain

16.Erosion and Sediment Control Silt Fence (Sd1) 500 l.f. @ $ /lf

17.ContContractor shall furnish, install and maintain Erosion and Sediment Control Inlet Sediment Trap (Sd2)..... 18 @ $ /ea

18.Contractor shall furnish, install and maintain Erosion and Sediment Control Matting Blanket (Mb)..... 20 sq.yards @ $ /sy

G **UNIT PRICES (not in Base Bid):** To adjust the Contract amount based on the requirements of Section 012200: UNIT PRICES, if necessary, by the following amounts

The undersigned bidder agrees to provide additional work, if added, or to delete specified work, if requested, at the unit prices listed unless such prices have been equitably adjusted by the Architect as previously stated. The unit prices include charges for fee, layout, supervision (field, and home office), general expense, taxes, insurance, labor burden overhead and profit.

1. Dewatering trench consisting of 42”W x 12”D Cross section lined with “mirafi” filter filled with “mirafi”filter fabric filled with No. 57 gravel and at diameter perforated Schedule 40 PVC piping backfilled and compacted as per Earth Specification..... $_____/lf
2. Furnish and install a woven geotextile fabric suitable for heavy duty traffic over earth subgrade in conjunction with #57 stone stabilization…….....$_____/sy
3. Furnish and install stone stabilization base materials including:
   a. Graded Aggregate Base……..$_____/ton
   b. Gravel (#57 Stone)……..$_____/ton
   c. Crusher Stone (#810)……...$_____/ton
   d. Granular Bedding……$_____/ton
4. Furnish and install storm/sanitary sewer cleanout outside of pavement……$_____/vf
5. Furnish and install storm/sanitary sewer cleanout within paved area……$_____/vf
6. Furnish and install pipe materials including:

a. 4"Ø Class 50 D.I.P. w/Class ‘C’ bedding

   1. 4' deep to 8' deep.....$_____/lf

   2. 8' deep to 12' deep.....$_____/lf

b. 6"Ø Class 50 D.I.P. w/Class ‘C’ bedding

   1. 4' deep to 8' deep.....$_____/lf

   2. 8' deep to 12' deep.....$_____/lf

c. 8"Ø Class 50 D.I.P. w/Class ‘C’ bedding

   1. 4' deep to 8' deep.....$_____/lf

   2. 8' deep to 12' deep.....$_____/lf

d. 12"Ø Class 50 D.I.P. w/Class 'C' bedding

1. 4' deep to 8' deep.....$_____/lf

2. 8' deep to 12' deep.....$_____/lf

e. 6"Ø Schedule 40 PVC

1. 4' deep to 8' deep.....$_____/lf

2. 8' deep to 12' deep.....$_____/lf

f. 8"Ø Schedule 40 PVC

1. 4' deep to 8' deep.....$_____/lf

2. 8' deep to 12' deep.....$_____/lf

g. 12"Ø Schedule 40 PVC

1. 4' deep to 8' deep.....$_____/lf

2. 8' deep to 12' deep.....$_____/lf

h. 8" DIP Class 50 Pipe.....$_____/lf

1. 4' deep to 8' deep.....$_____/lf

2.8' deep to 12' deep.....$_____/lf

k. 18"Ø RCP

4' deep to 8' deep.....$_____/lf

8' deep to 12' deep.....$_____/lf

* Cost shall include all appurtenances, including fittings, bands, wyes, etc. and all appurtenant details.

7. Furnish and install:

a. Precast 48" diameter concrete storm drainage structures…….$_____/vf

b. Heavy duty cast iron grate and frame.....
.$_____/set

c. Cast iron ring and cover as per Jackson County Department of Public Utilities Standards.....
.$_____/set

8. Furnish and install Georgia D.O.T. Type C Erosion Control Silt Fence .....$_____/lf

Above listed unit prices are amounts to be used for work that will be **added to or deleted from** the Contract by Change Order in the event such additional work may be required. The Owner reserves the right to accept or reject these unit prices or require the work to be Performed on a time-and-materials basis with complete daily breakdown and logs submitted.

END OF SECTION 004113

DOCUMENT 004313 - BID SECURITY FORMS

1.1 BID FORM SUPPLEMENT

A. A completed bid bond form is required to be attached to the Bid Form.

1.2 BID BOND FORM

A. AIA Document A310-2010 "Bid Bond" is the recommended form for a bid bond. A bid bond acceptable to Owner, or other bid security as described in the Instructions to Bidders, is required to be attached to the Bid Form as a supplement.

B. Document A310-2012 "Performance and Payment Bond" is the recommended form for a performance and payment bond. A performance and payment bond acceptable to Owner, or other bid security as described in the Instructions to Bidders, is required to be attached to the Bid Form as a supplement.

C. Copies of AIA standard forms may be obtained from The American Institute of Architects; https://www.aiacontracts.org/; email: docspurchases@aia.org; (800) 942-7732.

END OF DOCUMENT 004313

SECTION 011000 - SUMMARY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Project information.
2. Work covered by Contract Documents.
3. Phased construction.
4. Contract with Owner' Designated Vendor.
5. Coordination with occupants.
6. Work restrictions.

1.2 PROJECT INFORMATION

A. Project Identification: Additions & Renovations to the Jackson Co. Correctional Institution.

1. Project Location: 265 I W Davis Rd., Jefferson, GA 30549.

B. Owner: Jackson County Board of Commissioners.

C. Architect: Hussey Gay Bell

1. Architect's Representative: Jenny Park; jpark@husseygaybell.com.

1.3 WORK COVERED BY CONTRACT DOCUMENTS

A. Type of Contract: Single-Prime Contract

1. Project will be constructed under a single prime contract.

1.4 PHASED CONSTRUCTION

A. Construct the Work in phases, with each phase substantially complete as indicated below.

1. Phase 1: All Work except new door #012 and corridor in existing building.

a. Commencement of Construction:

1) Notice to Proceed: Work of this phase shall commence within 30 days after the Notice to Proceed.

2. Phase 2: Perform the Work for new door #012 and corridor in existing building at last.

1.5 CONTRACT WITH OWNER-DESIGNATED VENDOR

A. The Contractor shall contract with an owner-designated, sole-source low voltage vendor.

B. Owner **will assign low voltage vendor to the Contractor during Pre-bid Meeting**.

1.6 COORDINATION WITH OCCUPANTS

A. Full Owner Occupancy: Owner will occupy Project site and existing building(s) during entire construction period. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's day-to-day operations. Maintain existing exits unless otherwise indicated.

1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and approval of authorities having jurisdiction.
2. Notify Owner not less than **72** hours in advance of activities that will affect Owner's operations.

B. Partial Owner Occupancy: Owner will occupy the premises during entire construction period, with the exception of areas under construction. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's operations. Maintain existing exits unless otherwise indicated.

1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and authorities having jurisdiction.
2. Provide not less than **72** hours' notice to Owner of activities that will affect Owner's operations.

1.7 WORK RESTRICTIONS

A. Comply with restrictions on construction operations.

1. Comply with limitations on use of public streets, work on public streets, rights of way, and other requirements of authorities having jurisdiction.

B. On-Site Work Hours: Limit work to between 7:30 a.m. to 4:30 p.m., Monday through Friday, unless otherwise indicated. Work hours may be modified to meet Project requirements if approved by Owner and authorities having jurisdiction.

1. Weekend Hours: No work permitted for weekend work.
2. Early Morning Hours: No work permitted on noisy work.
3. Work in Existing Building: Notify the Owner not less than three days in advance.
4. Hours for Utility Shutdowns: Notify the Owner not less than three days in advance.
5. Hours for Disruptive Operations: Notify the Owner not less than three days in advance.

C. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging for temporary utility services according to requirements indicated:

1. Notify Owner not less than three days in advance of proposed utility interruptions.

D. Noise, Vibration, Dust, and Odors: Coordinate operations that may result in high levels of noise and vibration, dust, odors, or other disruption to Owner occupancy with Owner.

1. Notify Owner not less than three days in advance of proposed disruptive operations.

E. Employee Screening: Comply with Owner's requirements for background screening of Contractor personnel working on Project site.

1. Maintain list of approved screened personnel with Owner's representative.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011000

SECTION 012100 - ALLOWANCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements governing allowances.

B. Types of allowances include the following:

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

C. Related Requirements:

1. Section 012200 "Unit Prices" for procedures for using unit prices, including adjustment of quantity allowances when applicable.
2. Section 012600 "Contract Modification Procedures" for procedures for submitting and handling Change Orders.
3. Section 014000 "Quality Requirements" for procedures governing the use of allowances for field testing by an independent testing agency.

1.3 DEFINITIONS

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

1.4 SELECTION AND PURCHASE

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

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

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

1.5 ACTION SUBMITTALS

A. Submit proposals for purchase of products or systems included in allowances in the form specified for Change Orders.

1.6 INFORMATIONAL SUBMITTALS

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

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

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

1.7 LUMP-SUM ALLOWANCES

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

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

1.8 UNIT-COST ALLOWANCES

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

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

1.9 QUANTITY ALLOWANCES

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

B. Unless otherwise indicated, Contractor's costs for receiving and handling at Project site, labor, installation, overhead and profit, and similar costs related to products and materials ordered by

Owner or selected by Architect under allowance shall be included as part of the Contract Sum and not part of the allowance.

1.10 CONTINGENCY ALLOWANCES

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

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

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

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

1.11 ADJUSTMENT OF ALLOWANCES

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

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

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

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

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

END OF SECTION 012100

SECTION 012200 - UNIT PRICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

B. Related Requirements:

1. Section 012100 "Allowances" for procedures for using unit prices to adjust quantity allowances.
2. Section 012600 "Contract Modification Procedures" for procedures for submitting and handling Change Orders.
3. Section 014000 "Quality Requirements" for field testing by an independent testing agency.

1.3 DEFINITIONS

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

1.4 PROCEDURES

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

B. Measurement and Payment: See individual Specification Sections for work that requires establishment of unit prices. Methods of measurement and payment for unit prices are specified in those Sections.

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

D. List of Unit Prices: A schedule of unit prices is in Section 004113-00 “Attachment A”. Specification Sections referenced in Section 004113-00 “Attachment A” contain requirements for materials described under each unit price.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012200

SECTION 012500 - SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for substitutions.

B. Related Requirements:

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

1.3 DEFINITIONS

A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents.

1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required to meet other Project requirements but may offer advantage to Contractor or Owner.

1.4 ACTION SUBMITTALS

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

1. Documentation: Show compliance with requirements for substitutions and the following, as applicable:

a. Statement indicating why specified product or fabrication or installation method cannot be provided, if applicable.
b. Coordination of information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.

c. Detailed comparison of significant qualities of proposed substitutions with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes, such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
e. Samples, where applicable or requested.
f. Certificates and qualification data, where applicable or requested.
g. List of similar installations for completed projects, with project names and addresses as well as names and addresses of architects and owners.
h. Material test reports from a qualified testing agency, indicating and interpreting test results for compliance with requirements indicated.
i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES and/or applicable code organization.
j. Detailed comparison of Contractor's construction schedule using proposed substitutions with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
k. Cost information, including a proposal of change, if any, in the Contract Sum.
l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents, except as indicated in substitution request, is compatible with related materials and is appropriate for applications indicated.
m. 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.

2. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within 7 days of receipt of a request for substitution. Architect will notify Contractor through the Construction Manager of acceptance or rejection of proposed substitution within 14 days of receipt of request, or 14 days of receipt of additional information or documentation, whichever is later.

a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

1.5 QUALITY ASSURANCE

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

1.6 PROCEDURES

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

1.7 SUBSTITUTIONS

A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 14 days prior to time required for preparation and review of related submittals.

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

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

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

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

a. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
b. Requested substitution does not require extensive revisions to the Contract Documents.
c. Requested substitution is consistent with the Contract Documents and will produce indicated results.
d. Substitution request is fully documented and properly submitted.
e. Requested substitution will not adversely affect Contractor's construction schedule.

f. Requested substitution has received necessary approvals of authorities having jurisdiction.
g. Requested substitution is compatible with other portions of the Work.
h. Requested substitution has been coordinated with other portions of the Work.
i. Requested substitution provides specified warranty.
j. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.
k. Substitution for convenience shall be considered for products or services only if the specification section for that product or service allows it.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012500

SECTION 012600 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

B. Related Requirements:

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

1.3 MINOR CHANGES IN THE WORK

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

1.4 PROPOSAL REQUESTS

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

1. Work Change Proposal Requests issued by Architect are not instructions either to stop work in progress or to execute the proposed change.
2. Within time specified in Proposal Request or 20 days, when not otherwise specified, after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.

a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
c. Include costs of labor and supervision directly attributable to the change.
d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and

finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.

e. Quotation Form: Use forms acceptable to Architect.

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

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

1.5 ADMINISTRATIVE CHANGE ORDERS

A. Allowance Adjustment: See Section 012100 "Allowances" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect actual costs of allowances.

B. Unit-Price Adjustment: See Section 012200 "Unit Prices" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect measured scope of unit-price work.

1.6 CHANGE ORDER PROCEDURES

A. On Owner's approval of a Work Change Proposal Request, Architect will issue a Change Order for signatures of Owner and Contractor on form acceptable to the Architect.

1.7 CONSTRUCTION CHANGE DIRECTIVE

A. Construction Change Directive: Architect may issue a Construction Change Directive. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.

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

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

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

1.8 WORK CHANGE DIRECTIVE

A. Work Change Directive: Architect Construction Manager may issue a Work Change Directive. Work Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.

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

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

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012600

SECTION 012900 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

B. Related Requirements:

1. Document 004373 "Proposed Schedule of Values Form" for requirements for furnishing proposed schedule of values with bid.
2. Section 012100 "Allowances" for procedural requirements governing the handling and processing of allowances.
3. Section 012200 "Unit Prices" for administrative requirements governing the use of unit prices.
4. Section 012600 "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
5. Section 013200 "Construction Progress Documentation" for administrative requirements governing the preparation and submittal of the Contractor's construction schedule.

1.3 DEFINITIONS

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

1.4 SCHEDULE OF VALUES

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

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

a. Project name and location.
b. Owner's name.
c. Owner's Project number.
d. Name of Architect.
e. Architect's Project number.

f. Contractor's name and address.
g. Date of submittal.

2. Arrange schedule of values consistent with format of AIA Document G703 .

3. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Provide multiple line items for principal subcontract amounts in excess of (5) Five percent of the Contract Sum.
4. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.

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

5. Allowances: Provide a separate line item in the schedule of values for each allowance. Show line-item value of unit-cost allowances, as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.
6. Temporary Facilities: Show cost of temporary facilities and other major cost items that are not direct cost of actual work-in-place as separate line items.

1.5 APPLICATIONS FOR PAYMENT

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

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

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

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

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

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

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

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

F. Transmittal: Submit (1) one signed and notarized digital copy of each Application for Payment to Architect by a method ensuring receipt. One copy shall include waivers of lien and similar attachments if required. Email is an acceptable form of Transmission

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

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

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

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

1. List of subcontractors.
2. Schedule of values.
3. Contractor's construction schedule (preliminary if not final).
4. Products list (preliminary if not final).
5. Sustainable design action plans, including preliminary project materials cost data.

6. Schedule of unit prices.
7. Submittal schedule (preliminary if not final).
8. List of Contractor's staff assignments.
9. List of Contractor's principal consultants.
10. Copies of building permits.
11. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
12. Initial progress report.
13. Report of preconstruction conference.
14. Certificates of insurance and insurance policies.
15. Performance and payment bonds.
16. Data needed to acquire Owner's insurance.

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

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

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

2. This application shall reflect Certificate(s) of Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

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

1. Evidence of completion of Project closeout requirements.
2. Certification of completion of final punch list items.
3. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
4. Updated final statement, accounting for final changes to the Contract Sum.
5. AIA Document G706.
6. AIA Document G706A.
7. AIA Document G707.
8. Evidence that claims have been settled.
9. 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.
10. Final liquidated damages settlement statement.
11. Proof that taxes, fees, and similar obligations are paid.
12. Waivers and releases.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012900

SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

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

B. Each contractor shall participate in coordination requirements. Certain areas of responsibility are assigned to a specific contractor.

C. Related Requirements:
1. Section 013200 "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
2. Section 017300 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
3. Section 017700 "Closeout Procedures" for coordinating closeout of the Contract.

1.3 DEFINITIONS

A. BIM: Building Information Modeling.

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

1.4 INFORMATIONAL SUBMITTALS

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

1. Name, address, telephone number, and email address of entity performing subcontract or supplying products.
2. Number and title of related Specification Section(s) covered by subcontract.
3. Drawing number and detail references, as appropriate, covered by subcontract.

B. Key Personnel Names: Within 20 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses, cellular telephone numbers, and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.

1.5 GENERAL COORDINATION PROCEDURES

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

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

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

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

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

1. Preparation of Contractor's construction schedule.
2. Preparation of the schedule of values.
3. Installation and removal of temporary facilities and controls.
4. Delivery and processing of submittals.
5. Progress meetings.
6. Preinstallation conferences.
7. Project closeout activities.
8. Startup and adjustment of systems.

1.6 REQUEST FOR INFORMATION (RFI)

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

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

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

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

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

C. RFI Forms: as acceptable to Architect.

1. Attachments shall be electronic files in PDF format.

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

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

    a. Requests for approval of submittals.
    b. Requests for approval of substitutions.
    c. Requests for approval of Contractor's means and methods.

d. Requests for coordination information already indicated in the Contract Documents.
e. Requests for adjustments in the Contract Time or the Contract Sum.
f. Requests for interpretation of Architect's actions on submittals.
g. Incomplete RFIs or inaccurately prepared RFIs.

2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt by Architect of additional information.
3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Section 012600 "Contract Modification Procedures."

a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 7 days of receipt of the RFI response.

E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log bi-monthly. Include the following:

1. Project name.
2. Name Contractor.
3. Name Architect.
4. RFI number, including RFIs that were returned without action or withdrawn.
5. RFI description.
6. Date the RFI was submitted.
7. Date Architect's response was received.

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.

1.7 DIGITAL PROJECT MANAGEMENT PROCEDURES

A. Architect's Data Files Not Available: Architect will not provide Architect's BIM Model for Contractor's use during construction.

B. Use of Architect's Digital Data Files: Digital data files of Architect's CAD drawings may be provided by Architect for Contractor's use during construction, upon request.

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

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

4. Agreement form will be provided to the contractor upon request of files.

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

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

1.8 PROJECT MEETINGS

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

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

a. Responsibilities and personnel assignments.
b. Tentative construction schedule.
c. Phasing.
d. Critical work sequencing and long lead items.
e. Designation of key personnel and their duties.
f. Lines of communications.
g. Procedures for processing field decisions and Change Orders.
h. Procedures for RFIs.
i. Procedures for testing and inspecting.
j. Procedures for processing Applications for Payment.
k. Distribution of the Contract Documents.
l. Submittal procedures.
m. Preparation of Asbuilt Documents.
n. Use of the premises and existing building.
o. Work restrictions.
p. Working hours.
q. Owner's occupancy requirements.
r. Responsibility for temporary facilities and controls.
s. Procedures for moisture and mold control.

t. Procedures for disruptions and shutdowns.
u. Construction waste management and recycling.
v. Parking availability.
w. Office, work, and storage areas.
x. Equipment deliveries and priorities.
y. First aid.
z. Security.
aa. Progress cleaning.

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

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

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

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

a. Contract Documents.
b. Options.
c. Related RFIs.
d. Related Change Orders.
e. Purchases.
f. Deliveries.
g. Submittals.
h. Review of mockups.
i. Possible conflicts.
j. Compatibility requirements.
k. Time schedules.
l. Weather limitations.
m. Manufacturer's written instructions.
n. Warranty requirements.
o. Compatibility of materials.
p. Acceptability of substrates.
q. Temporary facilities and controls.
r. Space and access limitations.
s. Regulations of authorities having jurisdiction.
t. Testing and inspecting requirements.
u. Installation procedures.
v. Coordination with other work.
w. Required performance results.
x. Protection of adjacent work.

y. Protection of construction and personnel.

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

C. Progress Meetings: Conduct progress meetings at bi-monthly intervals.

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

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

1) Review schedule for next period.

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

1) Interface requirements.
2) Sequence of operations.
3) Status of submittals.
4) Deliveries.
5) Off-site fabrication.
6) Access.
7) Site use.
8) Temporary facilities and controls.
9) Progress cleaning.
10) Quality and work standards.
11) Status of correction of deficient items.
12) Field observations.
13) Status of RFIs.
14) Status of Proposal Requests.
15) Pending changes.
16) Status of Change Orders.
17) Pending claims and disputes.

18) Documentation of information for payment requests.

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

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013100

013200 CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

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

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

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

1.2 DEFINITIONS

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

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

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

C. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.

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

1.3 INFORMATIONAL SUBMITTALS

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

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

B. Startup construction schedule.

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

1. Activity Report: List of activities sorted by activity number and then early start date, or actual start date if known.

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

E. Daily Construction Reports: Submit at monthly intervals.

F. Material Location Reports: Submit at monthly intervals.

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

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

1.4 COORDINATION

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

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

1.5 CONTRACTOR'S CONSTRUCTION SCHEDULE

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

B. Time Frame: Extend schedule from date established for [commencement of the Work] [the Notice of Award] [the Notice to Proceed] to date of [Substantial Completion] [Final Completion].

1. Contract completion date to not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.
2. Temporary Facilities: Indicate start and completion dates for the following as applicable:

a. Securing of approvals and permits required for performance of the Work.

b. Temporary facilities.
c. Construction of mock-ups, prototypes and samples.
d. Owner interfaces and furnishing of items.
e. Interfaces with Separate Contracts.
f. Regulatory agency approvals.
g. Punch list.

3. Procurement Activities: Include procurement process activities for the following long lead-time items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.

4. Submittal Review Time: Include review and resubmittal times indicated in Section 013300 "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's Construction Schedule with submittal schedule.
5. Startup and Testing Time: Include no fewer than (15) Fifteen days for startup and testing.
6. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's administrative procedures necessary for certification of Substantial Completion.
7. Punch List and Final Completion: Include not more than (30) Thirty days for completion of punch list items and Final Completion.

C. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and Final Completion[.][, and the following interim milestones:]

1. Temporary enclosure and space conditioning.
2. <Insert milestones not indicated elsewhere>.

D. Cost Correlation: Superimpose a cost correlation timeline, indicating planned and actual costs. On the line, show planned and actual dollar volume of the Work performed as of planned and actual dates used for preparation of payment requests.

1. See Section 012900 "Payment Procedures" for cost reporting and payment procedures.

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

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

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

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

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

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

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

1.6 GANTT-CHART SCHEDULE REQUIREMENTS

A. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal, Gantt-chart-type, Contractor's Construction Schedule within (30) Thirty days of date established for the Notice to Proceed.

1. Base schedule on the startup construction schedule and additional information received since the start of Project.

B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line.

1. For construction activities that require three months or longer to complete, indicate an estimated completion percentage in (10) Ten percent increments within time bar.

1.7 REPORTS

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

1. List of subcontractors at Project site.
2. List of separate contractors at Project site.
3. Approximate count of personnel at Project site.
4. Equipment at Project site.
5. Material deliveries.

6. High and low temperatures and general weather conditions, including presence of rain or snow.
7. Testing and inspection.
8. Accidents.
9. Meetings and significant decisions.
10. Unusual events.
11. Stoppages, delays, shortages, and losses.
12. Meter readings and similar recordings.
13. Emergency procedures.
14. Orders and requests of authorities having jurisdiction.
15. Change Orders received and implemented.
16. Construction Change Directives received and implemented.
17. Services connected and disconnected.
18. Equipment or system tests and startups.
19. Partial completions and occupancies.
20. Substantial Completions authorized.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013200

SECTION 013200 - PROJECT MEETINGS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section specifies administrative and procedural requirements for project meetings, including, but not limited to, the following:

1. Preconstruction Conference
2. Not Used
3. Preinstallation conferences.
4. Progress / Coordination Meetings
5. Jobsite Progress meetings.
6. Coordination meetings.

1.2 PRECONSTRUCTION CONFERENCE

A. Prior to work starting, a pre-construction conference shall be held. The contractor shall prepare the following items to be submitted to the Owner at the pre-construction conference:
1. CPM Schedule (4 copies)
2. Performance Bond with Power of Attorney. Include bond number and letter from the bonding company stating their A. M. Best rating and size (1 original, 2 copies). Performance Bond for major subcontractors with Power of Attorney Include bond number and letter from the bonding company stating their A. M. Best rating and size (1 original, 2 copies). These bonds may be submitted later, but must be submitted prior to the particular subcontractor beginning work on the site. The Owner will not pay the General Contractor for work performed by a non-approved subcontractor.
3. Labor and Material Payment Bond, including bond number (1 original and 2 copies). Certificates of Insurance (1 original and 2 copies).
4. W-9 form.
5. List of subcontractors with contact persons and 24-hour telephone numbers. Include same for General Contractor's Project Manager and Job Superintendent.
6. Provide digital copies of all required documents on a thumb drive.

B. Attendees: Authorized representatives of the Owner, Architect, and their consultants; the General Contractor and its superintendent; site grading sub-contractor, utility sub-contractor, all major sub-contractors and other concerned parties shall attend the conference. All participants at the conference shall be familiar with the Project and authorized to conclude matters relating to the Work.

C. Agenda: Discuss items of significance that could affect progress, including the following:

1. Tentative construction schedule.
2. Critical work sequencing.
3. Designation of responsible personnel.
4. Procedures for processing field decisions and Change Orders.
5. Procedures for processing Applications for Payment.
6. Distribution of Contract Documents.
7. Submittal of Shop Drawings, Product Data, and Samples.
8. Preparation of record documents.
9. Use of the premises.
10. Parking availability.

11. Office, work, and storage areas.
12. Equipment deliveries and priorities.
13. Safety procedures.
14. First aid.
15. Security.
16. Housekeeping.
17. Working hours.

1.3 PARTNERING WORKSHOP

A. Not used.

1.4 PREINSTALLATION CONFERENCES

A. Conduct a preinstallation conference at the Project Site before each construction activity that requires coordination with other construction. All shop drawings and / or submittals must be reviewed and approved by the Owner and Architect prior to conference. Pre-installation conference to be held prior to any installation, except as required for mock-up installations. At a minimum, the following Pre-Installation Conferences will be required (multiple conferences will be required on phased work):

1. Underground Detention System
2. Sheet Waterproofing
3. Footing / Foundation Placement
4. Roofing
5. Porcelain Tile/Ceramic Tile/Quarry Tile
5. Casework
6. Not used.
7. Not used.

B. Attendees: The Installer and representatives of manufacturers and fabricators involved in or affected by the installation, and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise the Architect of scheduled meeting dates.

1. Review the progress of other construction activities and preparations for the particular activity under consideration at each preinstallation conference.
2. Record significant discussions and agreements and disagreements of each conference, and the approved schedule. Promptly distribute the record of the meeting to everyone concerned, including the Owner and the Architect.
3. Do not proceed with the installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of Work and reconvene the conference at the earliest feasible date.

1.5 PROGRESS / COORDINATION MEETINGS

A. Bi-Monthly, during the entire construction time and close-out of the project, the Contractor and certain subcontractors shall attend Progress / Coordination Meetings held in the Owner's offices. Parties required to attend are:

1. Contractor's Job Superintendent
2. Contractor's Project Manager or Principal of the Contractor.

3. Any subcontractor requested to attend by the Owner or Architect, active on the jobsite, requesting payment on the current payment application, or scheduled to work within the next sixty (60) days.
4. Representative of the Owner.
5. Representative of the Architect.

1.6 JOBSITE PROGRESS MEETINGS

A. Conduct jobsite progress meetings at the Project Site at regular intervals. Notify the Owner and the Architect of scheduled meeting dates. Coordinate dates of meetings with preparation of the payment request. Schedule: weekly, or as determined by the Architect and Owner.

B. Attendees: In addition to representatives of the Owner and the Architect, each subcontractor, supplier, or other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the conference shall be familiar with the Project and authorized to conclude matters relating to the Work.

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

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

    a. Interface requirements.
    b. Time.
    c. Sequences.
    d. Status of submittals.
    e. Deliveries.
    f. Off-site fabrication problems.
    g. Access.
    h. Site utilization.
    i. Temporary facilities and services.
    j. Hours of work.
    k. Hazards and risks.
    l. Housekeeping.
    m. Quality and work standards.
    n. Change Orders.
    o. Documentation of information for payment requests.

D. Reporting: No later than 3 days after each meeting, distribute minutes of the meeting to each party present and to parties who should have been present. Include a brief summary, in narrative form, of progress since the previous meeting and report.

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

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 013200

SECTION 013300 - SUBMITTALS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for submittals required for performance of the Work, including the following:

1. Contractor's construction schedule.
2. Submittal schedule.
3. Shop Drawings.
4. Product Data.
5. Samples.
6. Quality assurance submittals.

B. Administrative Submittals: Refer to other Division 1 Sections and other Contract Documents for requirements for administrative submittals. Such submittals include, but are not limited to, the following:

1. Permits.
2. Applications for Payment.
3. Performance and payment bonds.
4. Insurance certificates.
5. List of subcontractors.

C. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 1 Section "Applications for Payment" specifies requirements for submittal of the Schedule of Values.
2. Division 1 Section "Coordination" specifies requirements governing preparation and submittal of required Coordination Drawings.
3. Division 1 Section "Project Meetings" specifies requirements for submittal and distribution of meeting and conference minutes.
4. Division 1 Section "Quality Control" specifies requirements for submittal of inspection and test reports.
5. Division 1 Section "Contract Closeout" specifies requirements for submittal of Project Record Documents and warranties at project closeout.

1.2 SUBMITTAL PROCEDURES

A. Coordination: Coordinate preparation and processing of submittals with performance of construction activities. Transmit each submittal sufficiently in advance of performance of related construction activities to avoid delay.
1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Coordinate transmittal of different types of submittals for related elements of the Work so processing will not be delayed by the need to review submittals concurrently for coordination.
a. The Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until all related submittals are received.

3. Processing: To avoid the need to delay installation as a result of the time required to process submittals, allow sufficient time for submittal review, including time for resubmittals.

a. Allow 2 weeks for initial review. Allow additional time if the Architect must delay processing to permit coordination with subsequent submittals.
b. If an intermediate submittal is necessary, process the same as the initial submittal.
c. Allow 2 weeks for reprocessing each submittal.
d. No extension of Contract Time will be authorized because of failure to transmit submittals to the Architect sufficiently in advance of the Work to permit processing.
e. Contractor shall fully review each submittal for compliance with the contract documents prior to submittal, and certify each compliance.
f. All submittals shall be directed to the architect's designated contract administrator, with copy to the architect and engineer.

B. Submittal Preparation: Place a permanent label or title block on each submittal for identification. Indicate the name of the entity that prepared each submittal on the label or title block.

1. Provide a space approximately 4 by 5 inches on the label or beside the title block on Shop Drawings to record the Contractor's review and approval markings and the action taken.
2. Include the following information on the label for processing and recording action taken.

a. Project name.
b. Date.
c. Name and address of the Architect.
d. Name and address of the Contractor.
e. Name and address of the subcontractor.
f. Name and address of the supplier.
g. Name of the manufacturer.
h. Drawing number and detail references, as appropriate.

C. Submittal Transmittal: Package each submittal appropriately for transmittal and handling. Transmit each submittal from the Contractor to the Architect using a transmittal form. The Architect will not accept submittals received from sources other than the Contractor.

1. On the transmittal, record relevant information and requests for data. On the form, or separate sheet, record deviations from Contract Document requirements, including variations and limitations. Include Contractor's signed certification that information complies with Contract Document requirements.

1.3 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Bar-Chart Schedule: Prepare a fully developed, horizontal bar-chart-type, contractor's construction schedule. Submit within 30 days after the date established for "Commencement of the Work."

1. Provide a separate time bar for each significant construction activity. Provide a continuous vertical line to identify the first working day of each week. Use the same breakdown of units of the Work as indicated in the "Schedule of Values."
2. Within each time bar, indicate estimated completion percentage in 10 percent increments. As Work progresses, place a contrasting mark in each bar to indicate Actual Completion.
3. Prepare the schedule on a sheet, or series of sheets, of stable transparency, or other reproducible media, of sufficient width to show data for the entire construction period.
4. Secure time commitments for performing critical elements of the Work from parties involved. Coordinate each element on the schedule with other construction activities; include minor elements involved in the sequence of the Work. Show each activity in proper sequence. Indicate graphically the sequences necessary for completion of related portions of

the Work.

5. Coordinate the Contractor's Construction Schedule with the Schedule of Values, list of subcontracts, Submittal Schedule, progress reports, payment requests, and other schedules.
6. Indicate completion in advance of the date established for Substantial Completion. Indicate Substantial Completion on the schedule to allow time for the Architect's procedures necessary for certification of Substantial Completion.

B. Area Separations: Provide a separate time bar to identify each major construction area for each major portion of the Work. Indicate where each element in an area must be sequenced or integrated with other activities. Use “Wing” or "Floor" designations as indicated on the Plans.

C. Distribution: Following response to the initial submittal, print and distribute copies to the Architect, Owner, subcontractors, and other parties required to comply with scheduled dates. Post copies in the Project meeting room and temporary field office.

1. When revisions are made, distribute to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in construction activities.

D. Schedule Updating: Revise the schedule after each meeting, event, or activity where revisions have been recognized or made. Issue the updated schedule concurrently with the report of each meeting.

1.4 SUBMITTAL SCHEDULE

A. After development and acceptance of the Contractor's Construction Schedule, prepare a complete schedule of submittals. Submit the schedule within 10 days of the date required for submittal of the Contractor's Construction Schedule.
1. Coordinate Submittal Schedule with the list of subcontracts, Schedule of Values, and the list of products as well as the Contractor's Construction Schedule.

2. Prepare the schedule in chronological order. Provide the following information:

a. Scheduled date for the first submittal.
b. Related Section number.
c. Submittal category (Shop Drawings, Product Data, or Samples).
d. Name of the subcontractor.
e. Description of the part of the Work covered.
f. Scheduled date for resubmittal.
g. Scheduled date for the Architect's final release or approval.

B. Distribution: Following response to the initial submittal, print and distribute copies to the Architect, Owner, subcontractors, and other parties required to comply with submittal dates indicated. Post copies in the Project meeting room and field office.

1. When revisions are made, distribute to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in construction activities.

C. Schedule Updating: Revise the schedule after each meeting or activity where revisions have been recognized or made. Issue the updated schedule concurrently with the report of each meeting.

1.5 SHOP DRAWINGS

A. Submit newly prepared information drawn accurately to scale. Highlight, encircle, or otherwise indicate deviations from the Contract Documents. Do not reproduce Contract Documents or copy standard information as the basis of Shop Drawings. Standard information prepared without specific reference to the Project is not a Shop Drawing.

B. Shop Drawings include fabrication and installation Drawings, setting diagrams, schedules, patterns, templates and similar Drawings. Include the following information:

1. Dimensions.
2. Identification of products and materials included by sheet and detail number.
3. Compliance with specified standards.
4. Notation of coordination requirements.
5. Notation of dimensions established by field measurement.
6. Sheet Size: Except for templates, patterns and similar full-size Drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches but no larger than 30 by 42 inches.
7. Initial Submittal: Submit electronic .PDF files for the Architect's review, and any printed documents necessary for review. The Architect will not print copies of submittals. Maintain one (1) printed copy of the returned submittal for the jobsite, one (1) printed copy for the record set, marked as a "Record Document" and returned with the close-out documents. If comments are made on printed documents, the contractor shall electronically scan and return record of those documents to the Architect.
8. Do not use Shop Drawings without an appropriate final stamp indicating action taken.

1.6 PRODUCT DATA

A. Collect Product Data into a single submittal for each element of construction or system. Product Data includes printed information, such as manufacturer's installation instructions, catalog cuts, standard color charts, roughing-in diagrams and templates, standard wiring diagrams, and performance curves.

1. Mark each copy to show applicable choices and options. Where printed Product Data includes information on several products that are not required, mark copies to indicate the applicable information. Include the following information:

a. Manufacturer's printed recommendations.
b. Compliance with trade association standards.
c. Compliance with recognized testing agency standards.
d. Notation of dimensions verified by field measurement.
e. Notation of coordination requirements.

2. Do not submit Product Data until compliance with requirements of the Contract Documents has been confirmed.

3. Submittals: Submit electronic .PDF files for the Architect's review, and any printed documents necessary for review, with appropriate copies for engineer's review.. The Architect will not print copies of submittals. Maintain one (1) printed copy of the returned submittal for the jobsite, one (1) printed copy for the record set, marked as a "Record Document" and returned with the close-out documents. If comments are made on printed documents, the contractor shall electronically scan and return record of those documents to the Architect.

a. Unless noncompliance with Contract Document provisions is observed, the submittal may serve as the final submittal.

4. Distribution: Furnish copies of final submittal to installers, subcontractors, suppliers, manufacturers, fabricators, and others required for performance of construction activities. Show distribution on transmittal forms.

    a. Do not proceed with installation until a copy of Product Data is in the Installer's possession.
    b. Do not permit use of unmarked copies of Product Data in connection with construction.

1.7 SAMPLES

A. Submit full-size, fully fabricated Samples cured and finished as specified and physically identical with the material or product proposed. Samples include partial sections of manufactured or fabricated components, cuts or containers of materials, color range sets, and swatches showing color, texture, and pattern.

    1. Mock Up Walls:

        a. Furnish (2) two 8’-0” wide x 8’-0” tall mockup walls:
            1. CMU with brick veneer
            2. Metal Stud with wall panels

        b. Both panels shall include (1) window, 24”x24”, and all associated damp proofing/waterproofing, flashings, etc. to demonstrate water tightness.

    2. Submit Samples for review of size, kind, color, pattern, and texture. Submit Samples for a final check of these characteristics with other elements and a comparison of these characteristics between the final submittal and the actual component as delivered and installed.

        a. Where variation in color, pattern, texture, or other characteristic is inherent in the material or product represented, submit at least 3 multiple units that show approximate limits of the variations.

    3. Preliminary Submittals: Submit a full set of choices where Samples are submitted for selection of color, pattern, texture, or similar characteristics from a range of standard choices.

        a. The Architect will review and return preliminary submittals with the Architect's notation, indicating selection and other action.

    4. Maintain sets of Samples, as returned, at the Project Site, for quality comparisons throughout the course of construction, and return one set for "Record Documents."

        a. Unless noncompliance with Contract Document provisions is observed, the submittal may serve as the final submittal.
        b. Sample sets may be used to obtain final acceptance of the construction associated with each set.

B. Distribution of Samples: Prepare and distribute additional sets to subcontractors, manufacturers, fabricators, suppliers, installers, and others as required for performance of the Work. Show distribution on transmittal forms.

1.8 QUALITY ASSURANCE SUBMITTALS

A. Submit quality-control submittals, including design data, certifications, manufacturer's instructions, manufacturer's field reports, and other quality-control submittals as required under other Sections of the Specifications.

B. Certifications: Where other Sections of the Specifications require certification that a product, material, or installation complies with specified requirements, submit a notarized certification from the manufacturer certifying compliance with specified requirements.

1. Signature: Certification shall be signed by an officer of the manufacturer or other individual authorized to sign documents on behalf of the company.

C. Inspection and Test Reports: Requirements for submittal of inspection and test reports from independent testing agencies are specified in Division 1 Section "Quality Control."

1.9 ARCHITECT'S ACTION

A. Except for submittals for the record or information, where action and return is required, the Architect will review each submittal, mark to indicate action taken, and return promptly.

1. Compliance with specified characteristics is the Contractor's responsibility.

B. Action Stamp: The Architect will stamp each submittal with a uniform, action stamp. The Architect will mark the stamp appropriately to indicate the action taken, as follows:

1. Final Unrestricted Release: When the Architect marks a submittal "Approved," the Work covered by the submittal may proceed provided it complies with requirements of the Contract Documents. Final payment depends on that compliance.

2. Final-But-Restricted Release: When the Architect marks a submittal "Approved as Noted," the Work covered by the submittal may proceed provided it complies with notations or corrections on the submittal and requirements of the Contract Documents. Final payment depends on that compliance.

3. Returned for Resubmittal: When the Architect marks a submittal "Not Approved, Revise and Resubmit," do not proceed with Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal according to the notations; resubmit without delay. Repeat if necessaryto obtain different action mark.

a. Do not use, or allow others to use, submittals marked "Not Approved, Revise and Resubmit" at the Project Site or elsewhere where Work is in progress.

4. Other Action: Where a submittal is for information or record purposes or special processing or other activity, the Architect will return the submittal marked "Action Not Required."

C. Costs incurred from reviews necessary due to non-compliance from initial or subsequent comments from the architect or his consultants will be the responsibility of the contractor if he neglects to incorporate or appropriately respond to initial comments.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 013300

SECTION 014000 – QUALITY CONTROL

PART 1 – GENERAL

1.1 SUMMARY

A. This section includes administrative and procedural requirements for quality-control services.

B. Quality-control services include inspections, tests, and related actions, including reports performed by Contractor, by independent agencies, and by governing authorities. They do not include contract enforcement activities performed by Architect.

C. Inspection and testing services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with Contract Document requirements.

D. Requirements of this Section relate to customized fabrication and installation procedures, not production of standard products.

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

E. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 1 Section "Cutting and Patching: specifies requirements for repair and restoration of construction disturbed by inspection and testing activities.

1.2 RESPONSIBILITIES

A. Contractor Responsibilities: Unless otherwise indicated as the responsibility of another identified entity, the Contractor shall coordinate and schedule inspections, tests, and other quality-control services specified in the Contract Documents and required by the authority having jurisdiction.

1. The Owner will employ and pay qualified independent testing agencies to perform required inspections, tests and quality control measures. See attached Owner provided Responsibility Matrix located at the end of this section.

B. Retesting: The Contractor is responsible for retesting where results of inspections, tests or other quality-control services prove unsatisfactory and whether the original test was Contractor's responsibility.

1. The cost of retesting construction, revised or replaced by the Contractor, is the Contractor's responsibility where required tests performed on original construction indicated noncompliance with Contract Document requirements.

C. Associated Services: Cooperate with agencies performing required inspections, tests, and similar services, and provide reasonable auxiliary services as requested. Notify the agency sufficiently in advance of operations to permit assignment of personnel. Auxiliary services required include, but are not limited to, the following:

1. Provide access to the Work.
2. Furnish incidental labor and facilities necessary to facilitate inspections and tests.
3. Take adequate quantities of representative samples of materials that require testing or assist the agency in taking samples.
4. Provide facilities for storage and curing of test samples.
5. Deliver samples to testing laboratories.
6. Provide the agency with a preliminary design mix proposed for use for materials mixes that require control by the testing agency.
7. Provide security and protection of samples and test equipment at the Project Site.

D. Duties of the Testing Agency: The independent agency engaged to perform inspections, sampling, and testing of materials and construction specified in individual Sections shall cooperate with the Architect and the Contractor in performance of the agency's duties. The testing agency shall provide qualified personnel to perform required inspections and tests.

1. The agency shall notify the Architect and the Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
2. The agency is not authorized to release, revoke, alter, or enlarge requirements of the Contract Documents or approve or accept any portion of the Work.
3. The agency shall not perform any duties of the Contractor.

E. Coordination: Coordinate the sequence of activities to accommodate required services with a minimum of delay. Coordinate activities to avoid the necessity of removing and replacing construction to accommodate inspections and tests.

1. The Contractor is responsible for scheduling times for inspections, tests taking samples, and similar activities.

1.3 DELEGATED DESIGN SERVICES

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

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

B. Delegated Design Services Statement: Submit a statement signed and sealed by the responsible design professional, for each product and system specifically assigned to

Contractor to be designed or certified by a design professional, indicating that the products and systems are in compliance with performance and design criteria indicated. Include list of codes, loads, and other factors used in performing these services.

1.4 SUBMITTALS

A. Unless the Contractor is responsible for this service, the independent testing agency shall submit a certified written report, in duplicate, of each inspection, test, or similar service to the Architect. If the Contractor is responsible for the service, submit a certified written report, in duplicate, of each inspection, test, or similar service through the Contractor.

1. Submit additional copies of each written report directly to the governing authority, when the authority so directs.
2. Report Data: written reports of each inspection, test, or similar service include, but not limited to, the following:

    a. Date of issue.
    b. Project title and number.
    c. Name, address, and telephone number of testing agency.
    d. Dates and locations of samples and tests or inspections.
    e. Names of individuals making the inspection or test.
    f. Designation of the work and test method.
    g. Identification of product and Specification Section.
    h. Complete inspection or test data.
    i. Test results and an interpretation of test results.
    j. Ambient conditions at the time of sample taking and testing.
    k. Comments or professional opinion on whether inspected or tested Work complies with Contract Document requirements.
    l. Name and signature of laboratory inspector.
    m. Recommendations on retesting.

1.5 QUALITY ASSURANCE

A. Qualifications for Service Agencies: Engage inspection and testing service agencies, including independent testing laboratories, that are prequalified as complying with the American Council of Independent Laboratories' "Recommended requirements for Independent Laboratory Qualification" and that specialize in the types of inspections and tests to be performed.

1. Each independent inspection and testing agency engaged on the Project shall be authorized by authorities having jurisdiction to operate in the state where the Project is located.

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

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION

3.1 REPAIR AND PROTECTION

A. General: Upon completion of inspection, testing, sample taking and similar services, repair damaged construction and restore substrates and finishes. Comply with Contract Document requirements for Division 1 Section “Cutting and Patching.”

B. Protect construction exposed by or for quality-control service activities, and protect repaired construction.

C. Repair and protection is Contractor’s responsibility, regardless of the assignment of responsibility for inspection, testing, or similar services.

END OF SECTION 014000

STATEMENT OF SPECIAL INSPECTIONS

PROJECT: Additions and Renovations to Jackson County Correctional Institution

LOCATION: 265 I W Davis Road, Jefferson, GA 30549

PERMIT APPLICANT: _____

APPLICANT'S ADDRESS: _____

ARCHITECT OF RECORD: Christopher M. Caudle

STRUCTURAL ENGINEER OF RECORD: Brandon Hoffman

MECHANICAL ENGINEER OF RECORD: Thomas Beal

ELECTRICAL ENGINEER OF RECORD: Wesley Wommack

REGISTERED DESIGN PROFESSIONAL IN RESPONSIBLE CHARGE: Christopher M. Caudle

This Statement of Special Inspections is submitted in accordance with Section 1704.3 of the 2024 International Building Code. It includes a *Schedule of Special Inspections Services* applicable to the above-referenced Project as well as the identity of the individuals, agencies, or firms intended to be retained for conducting these inspections. If applicable, it includes *Special Inspections for Seismic Resistance* and/or *Special Inspections for Wind Resistance*.

Are *Special Inspections for Seismic Resistance* included in the *Statement of Special Inspections*? ☐ Yes ☒ No

Are *Special Inspections for Wind Resistance* included in the *Statement of Special Inspections*? ☐ Yes ☒ No

The Special Inspector(s) shall keep records of all inspections and shall furnish interim inspection reports to the Building Official and to the Registered Design Professional in Responsible Charge at a frequency agreed upon by the Design Professional and the Building Official prior to the start of work. Discrepancies shall be brought to the immediate attention of the Contractor for correction. If the discrepancies are not corrected, the discrepancies shall be brought to the attention of the Building Official and the Registered Design Professional in Responsible Charge prior to completion of that phase of work. A *Final Report of Special Inspections* documenting required special inspections and corrections of any discrepancies noted in the inspections shall be submitted to the Building Official and the Registered Design Professional in Responsible Charge at the conclusion of the project.

Frequency of interim report submittals to the Registered Design Professional in Responsible Charge:

__Weekly X__Bi-Weekly __Monthly Other; specify:_____

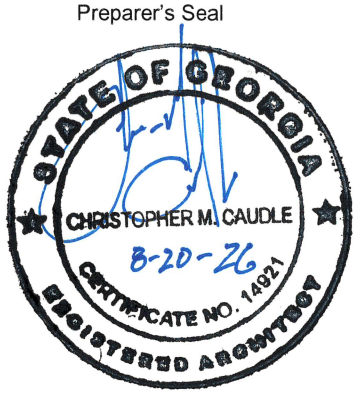
The Special Inspection program does not relieve the Contractor of the responsibility to comply with the Contract Documents. Jobsite safety and means and methods of construction are solely the responsibility of the Contractor.

Statement of Special Inspections Prepared by:

CHRISTOPHER M. CAUDLE, AIA
Type or print name

Signature 8-20-26 Date

Preparer's Seal



Building Official's Acceptance:

Signature Date

Permit Number:

Frequency of interim report submittals to the Building Official:

__Monthly __Bi- Monthly __Upon Completion Other; specify:_____

SCHEDULE OF SPECIAL INSPECTIONS SERVICES					
PROJECT	**Additions and Renovations to Jackson County Correctional Institution**				
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MATERIAL / ACTIVITY	**SERVICE**	**Y/N**	**EXTENT**	**AGENT***	**DATE COMPLETED**
1705.1.1 Special Cases (work unusual in nature, including but not limited to alternative materials and systems, unusual design applications, materials and systems with special manufacturer's requirements - add additional rows as needed.)	Submittal review, shop (3) and/or field inspection				
1. Inspection of anchors post-installed in solid grouted masonry: Per research reports including verification of anchor type, anchor dimensions, hole dimensions, hole cleaning procedures, anchor spacing, edge distances, masonry unit, grout, masonry compressive strength, anchor embedment and tightening torque	Field inspection	Y	Periodic or as required by the research report issued by an approved source		
2. Aggregate Pier Inspection: The special inspector's responsibilities include, but are not limited to, review of the aggregate pier designer's use of soil parameters as presented in the project soils report, and during construction, verification of aggregate properties, type and number of lifts of aggregate, hole size and depths and top elevations of the pier elements, and applied energy. Additionally, results of qualitative tests on production aggregate pier elements such as modulus load testing, uplift pull-out testing, bottom stabilization tests and dynamic cone penetration tests, shall be reviewed to verify compliance with design specifications.	Field inspection	N	Periodic or as required by the research report issued by an approved source		
1705.2.1 Structural Steel Construction					
1. Fabricator and erector documents (Verify reports and certificates as listed in AISC 360, Section N 3.2 for compliance with construction documents)	Submittal Review	Y	Each submittal		
2. Material verification of structural steel	Shop (3) and field inspection	Y	Periodic		
3. Structural steel welding:					
a. Inspection tasks Prior to Welding (Observe, or perform for each welded joint or member, the QA tasks listed in AISC 360, Table N5.4-1)	Shop (3) and field inspection	Y	Observe or Perform as noted (4)		
b. Inspection tasks During Welding (Observe, or perform for each welded joint or member, the QA tasks listed in AISC 360, Table N5.4-2)	Shop (3) and field inspection	Y	Observe or Perform as noted (4)		
c. Inspection tasks After Welding (Observe, or perform for each welded joint or member, the QA tasks listed in AISC 360, Table N5.4-3)	Shop (3) and field inspection	Y	Observe or Perform as noted (4)		
d. Nondestructive testing (NDT) of welded joints:					
1) Complete penetration groove welds 5/16" or greater in *risk category* III or IV	Shop (3) or field ultrasonic testing - 100%	Y	Periodic		
2) Complete penetration groove welds 5/16" or greater in *risk category* II	Shop (3) or field ultrasonic testing - 10% of welds minimum	N	Periodic		
3) Welded joints subject to fatigue when required by AISC 360, Appendix 3, Table A-3.1	Shop (3) or field radiographic or Ultrasonic testing	Y	Periodic		
4) Fabricator's NDT reports when fabricator performs NDT	Verify reports	Y	Each submittal (5)		
4. Structural steel bolting:	Shop (3) and field inspection				
a. Inspection tasks Prior to Bolting (Observe, or perform tasks for each bolted connection, in accordance with QA tasks listed in AISC 360, Table N5.6-1)		Y	Observe or Perform as noted (4)		
b. Inspection tasks During Bolting (Observe the QA tasks listed in AISC 360, Table N5.6-2)		Y	Observe (4)		
1) Pre-tensioned and slip-critical joints					
a) Turn-of-nut with matching markings		Y	Periodic		
b) Direct tension indicator		Y	Periodic		
c) Twist-off type tension control bolt		Y	Periodic		
d) Turn-of-nut without matching markings		Y	Continuous		
e) Calibrated wrench		Y	Continuous		
2) Snug-tight joints		Y	Periodic		

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c. Inspection tasks After Bolting (Perform tasks for each bolted connection in accordance with QA tasks listed in AISC 360, Table N5.6-3)		Y	Perform (4)		
5. Visual inspection of exposed cut surfaces of galvanized structural steel main members and exposed corners of the rectangular HSS for cracks subsequent to galvanizing	Shop (3) or field inspection	Y	Periodic		
6. Embedments (Verify diameter, grade, type, length, embedment. See 1705.3 for anchors)	Field inspection	Y	Periodic		
7. Verify member locations, braces, stiffeners, and application of joint details at each connection comply with construction documents	Field inspection	Y	Periodic		
1705.2.2 Structural Stainless Steel Construction					
1. Fabricator and erector documents (Verify reports and certificates as listed in AISC 370, Section N 3.2 for compliance with construction documents)	Submittal Review	N	Each submittal		
2. Material verification of structural stainless steel	Shop (3) and field inspection	N	Periodic		
3. Structural stainless steel welding:					
a. Inspection tasks Prior to Welding (Observe, or perform for each welded joint or member, the QA tasks listed in AISC 370, Table N5.4-1)	Shop (3) and field inspection	N	Observe or Perform as noted (4)		
b. Inspection tasks During Welding (Observe, or perform for each welded joint or member, the QA tasks listed in AISC 370, Table N5.4-2)	Shop (3) and field inspection	N	Observe (4)		
c. Inspection tasks After Welding (Observe, or perform for each welded joint or member, the QA tasks listed in AISC 370, Table N5.4-3)	Shop (3) and field inspection	N	Observe or Perform as noted (4)		
d. Nondestructive testing (NDT) of welded joints:					
1) Complete penetration groove welds 5/16" or greater in *risk category* III or IV	Shop (3) or field ultrasonic testing - 100%	N	Periodic		
2) Complete penetration groove welds 5/16" or greater in *risk category* II	Shop (3) or field ultrasonic testing - 10% of welds minimum	N	Periodic		
3) Welded joints subject to fatigue when required by AISC 370, Appendix 3, Table A-3.1	Shop (3) or field radiographic or Ultrasonic testing	N	Periodic		
4) Fabricator's NDT reports when fabricator performs NDT	Verify reports	N	Each submittal (5)		
4. Structural stainless steel bolting:	Shop (3) and field inspection				
a. Inspection tasks Prior to Bolting (Observe, or perform tasks for each bolted connection, in accordance with QA tasks listed in AISC 370, Table N5.6-1)		N	Observe or Perform as noted (4)		
b. Inspection tasks During Bolting (Observe the QA tasks listed in AISC 370, Table N5.6-2)		N	Observe (4)		
1) Pre-tensioned and slip-critical joints					
a) Turn-of-nut with matching markings		N	Periodic		
b) Direct tension indicator		N	Periodic		
c) Twist-off type tension control bolt		N	Periodic		
d) Turn-of-nut without matching markings		N	Continuous		
e) Calibrated wrench		N	Continuous		
2) Snug-tight joints		N	Periodic		
c. Inspection tasks After Bolting (Perform tasks for each bolted connection in accordance with QA tasks listed in AISC 370, Table N5.6-3)		N	Perform (4)		
5. Embedments (Verify diameter, grade, type, length, embedment. See 1705.3 for anchors)	Field inspection	N	Periodic		
6. Verify member locations, braces, stiffeners, and application of joint details at each connection comply with construction documents	Field inspection	N	Periodic		

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1705.2.3 Cold-Formed Steel Deck					
1. Manufacturer documents (Verify reports and certificates as listed in SDI QA/QC, Section B, Paragraphs B1 and B2 for compliance with construction documents)	Submittal Review	Y	Each submittal		
2. Material verification of steel deck, mechanical fasteners and welding materials	Shop (3) and field inspection	Y	Periodic		
3. Cold-formed steel deck placement:	Shop (3) and field inspection				
a. Inspection tasks Prior to Deck Placement (Perform the QA tasks listed in SDI QA/QC, Appendix 1 Table 1.1)		Y	Perform (4)		
b. Inspection tasks After Deck Placement (Perform the QA tasks listed in SDI QA/QC, Appendix 1 Table 1.2)		Y	Perform (4)		
4. Cold-formed steel deck welding:	Shop (3) and field inspection				
a. Inspection tasks Prior to Welding (Observe the QA tasks listed in SDI QA/QC, Appendix 1 Table 1.3)		Y	Observe (4)		
b. Inspection tasks During Welding (Observe the QA tasks listed in SDI QA/QC, Appendix 1 Table 1.4)		Y	Observe (4)		
c. Inspection tasks After Welding (Perform the QA tasks listed in SDI QA/QC, Appendix 1 Table 1.5)		Y	Perform (4)		
5. Cold-formed steel deck mechanical fastening:	Shop (3) and field inspection				
a. Inspection tasks Prior to Mechanical Fastening (Observe the QA tasks listed in SDI QA/QC, Appendix 1 Table 1.6)		Y	Observe (4)		
b. Inspection tasks During Mechanical Fastening (Observe the QA tasks listed in SDI QA/QC, Appendix 1 Table 1.7)		Y	Observe (4)		
c. Inspection tasks After Mechanical Fastening (Perform the QA tasks listed in SDI QA/QC, Appendix 1 Table 1.8)		Y	Perform (4)		
1705.2.4. Open-Web Steel Joists and Joist Girders					
1. Installation of open-web steel joists and joist girders.					
a. End connections - welding or bolted.	per SJI CJ or SJI 100	Y	Periodic		
b.. Bridging - horizontal or diagonal.					
1) Standard bridging.	per SJI CJ or SJI 100	Y	Periodic		
2) Bridging that differs from the specifications listed in SJI CJ or SJI 100.		Y	Periodic		
1705.2.5. Cold-Formed Steel Trusses Spanning 60 feet or Greater					
Verify temporary and permanent restraint/bracing are installed in accordance with the approved truss submittal package	Field inspection	N	Periodic		
1705.2.6. Metal Building Systems					
Inspections as listed above in 1705.2.1, 1705.2.3, 1705.2.4 and 1705.2.5.					
1. Installation of rafter/beam flange braces and column flange braces.	Field inspection	N	Periodic		
2. Installation of purlins and girts, including specified lapping.		N	Periodic		
3. Purlin and girt restraint/bridging/bracing.		N	Periodic		
4. Installation of X-bracing, tightened to remove any sag.		N	Periodic		
1705.3 Concrete Construction					
1. Inspect reinforcement, including prestressing tendons, and verify placement.	Shop (3) and field inspection	Y	Periodic		
2. Reinforcing bar welding:					
a. Verification of weldability of bars other than ASTM A706.	Shop (3) and field inspection	N	Periodic		
b. Inspect welding of reinforcement for special moment frames, boundary elements of special structural walls and coupling beams.	Shop (3) and field inspection	N	Continuous		
c. Inspect welded reinforcement splices.	Shop (3) and field inspection	N	Continuous		
d. Inspect welding of primary tension reinforcement in corbels.	Shop (3) and field inspection	N	Continuous		
e. Inspection of single-pass fillet welds 5/16 or less in size.	Shop (3) and field inspection	N	Periodic		

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f. Inspection of all other welds.	Shop (3) and field inspection	N	Continuous		
3. Inspection of anchors cast in concrete.	Shop (3) and field inspection	Y	Periodic		
4. Inspection of anchors post-installed in hardened concrete members per research reports, or, if no specific requirements are provided, requirements shall be provided by the registered design professional and approved by the building official, including verification of anchor type, anchor dimensions, hole dimensions, hole cleaning procedures, anchor spacing, edge distances, concrete minimum thickness, anchor embedment and tightening torque	Field inspection	Y	Periodic or as required by the research report issued by an approved source		
a. Adhesive anchors installed in horizontally or upwardly-inclined orientation that resist sustained tension loads.		Y	Continuous		
b. Mechanical and adhesive anchors not defined in 4a.		Y	Periodic		
5. Verify use of approved design mix	Shop (3) and field inspection	Y	Periodic		
6.a. Prior to placement, fabricate specimens for strength tests, fresh concrete sampling, perform slump or slump flow, and air content density tests, and determine temperature of concrete.	Shop (3) and field inspection	Y	Continuous		
6.b. Verify that concrete specimens for strength tests are maintained in the required initial curing and laboratory curing environment, and that the maximum and minimum temperatures during the initial curing period are reported.	Shop (3) and field inspection	Y	Continuous		
7. Inspection of concrete and shotcrete placement for proper application techniques	Shop (3) and field inspection	Y	Continuous		
8. Verify maintenance of specified curing temperature and techniques	Shop (3) and field inspection	Y	Periodic		
9. Inspection of prestressed concrete:	Shop (3) and field inspection				
a. Application of prestressing force		N	Continuous		
b. Grouting of bonded prestressing tendons		N	Continuous		
10. Inspect erection of precast concrete members	Field inspection	N	Periodic		
11. For precast concrete diaphragm connections or reinforcement at joints classified as moderate or high deformability elements (MDE or HDE) in structures assigned to Seismic Design Category C, D, E, or F, inspect such connections and reinforcement in the field for:	Field inspection				
a. Installation of the embedded parts.		N	Continuous		
b. Completion of the continuity of reinforcement across joints.		N	Continuous		
c. Completion of connections in the field.		N	Continuous		
12. Inspect installation tolerances of precast concrete diaphragm connections for compliance with ACI 550.5.	Field inspection	N	Periodic		
13. Verify in-situ concrete strength, prior to stressing of tendons in post tensioned concrete and prior to removal of shores and forms from beams and structural slabs	Review field testing and laboratory reports	Y	Periodic		
14. Inspection of formwork for shape, lines, location and dimensions	Field inspection	Y	Periodic		
15. Concrete strength testing and verification of compliance with construction documents	Field testing and review of laboratory reports	Y	Periodic		
1705.4 Masonry Construction					
MINIMUM VERIFICATION REQUIREMENTS					
(A) Level 1, 2 and 3 Quality Assurance:					
1. Prior to construction, verification of compliance of submittals	Submittal Review	Y	Prior to Construction		
(B) Level 2 & 3 Quality Assurance:					
1. Prior to construction verification of f'm and f'_{AAC} except where specifically exempted by the code	Testing by unit strength method or prism test method	Y	Prior to Construction		
2. During construction, verification of Slump Flow and Visual Stability Index (VSI) when self-consolidating grout is delivered to project site.	Testing by unit strength method or prism test method	Y	Periodic		

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(C) Level 3 Quality Assurance:					
1. During construction, verification of f'm and f'_{AAC} for every 5,000 SF	Testing by unit strength method or prism test method	N	Periodic		
2. During construction, verification of proportions of materials as delivered to the project site for premixed or preblended mortar, prestressing grout, and grout other than self-consolidating grout.	Field inspection	N	Periodic		
MINIMUM SPECIAL INSPECTION REQUIREMENTS					
(D) Levels 2 and 3 Quality Assurance:					
1. As masonry construction begins, verify that the following are in					
a. Proportions of the site-prepared mortar	Field inspection	Y	Periodic		
b. Grade and size of prestressing tendons and anchorages	Field Inspection	N	Periodic		
c. Grade, type, and size of reinforcement, anchor bolts, and prestressing tendons and anchorages	Field Inspection	Y	Periodic		
d. Prestressing technique	Field Inspection	N	Periodic		
e. Properties of thin-bed mortar for AAC masonry (b) Required for the first 5,000 square feet (c) Required after the first 5,000 square feet	Field Inspection	N	Level 2 - Continuous[(b)] Level 2 - Periodic[(c)]		
		N	Level 3 - Continuous		
f. Sample panel construction	Field Inspection	Y	Level 2 - Periodic		
		N	Level 3 - Continuous		
2. Prior to grouting, verify that the following are in compliance:					
a. Grout space	Field Inspection	Y	Level 2 - Periodic		
		N	Level 3 - Continuous		
b. Placement of prestressing tendons and anchorages	Field Inspection	N	Periodic		
c. Placement of reinforcement, connectors, and anchor bolts	Field inspection	Y	Level 2 - Periodic		
		N	Level 3 - Continuous		
d. Proportions of site-prepared grout and restressing grout for bonded tendons	Field Inspection	N	Periodic		
3. Verify compliance of the following during construction:					
a. Materials and procedures with the approved submittals	Field inspection	Y	Periodic		
b. Placement of masonry units and mortar joint construction	Field Inspection	Y	Periodic		
c. Size and location of structural members	Field inspection	Y	Periodic		
d. Type, size, location of anchors, including other details of anchorage of masonry to structural members, frames, or other construction	Field inspection	Y	Level 2 - Periodic		
		N	Level 3 - Continuous		
e. Welding of reinforcement	Field inspection	N	Continuous		
f. Preparation, construction, and protection of masonry during cold weather (temperature below 40°F) or hot weather (temperature above 90°F)	Field inspection	Y	Periodic		
g. Application and measurement of prestressing force	Field testing	N	Continuous		
h. Placement of grout and prestressing grout for bonded tendons is in compliance	Field inspection	N	Continuous		
i. Placement of AAC masonry units and construction of thin-bed mortar joints (b) Required for the first 5,000 square feet (c) Required after the first 5,000 square feet	Field inspection	N	Level 2 - Continuous[(b)] Level 2 - Periodic[(c)]		
		N	Level 3 - Continuous		
4. Observe preparation of grout specimens, mortar specimens, and/or prisms	Field inspection	Y	Level 2 - Periodic		
		N	Level 3 - Continuous		
1705.4.1 Glass Unit Masonry and Masonry Veneer in Risk Category IV.					
Inspect and test in accordance with TMS 602 Level 2	Field inspection	N	Periodic		
1705.5 Wood Construction					
1. For prefabricated wood structural elements, inspection of the fabrication process and assemblies in accordance with Section 1704.2.5.	In-plant review (3)	N	Periodic		

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2. For high-load diaphragms, verify grade and thickness of structural panel sheathing agree with approved building plans.	Field inspection	N	Periodic		
3. For high-load diaphragms, verify nominal size of framing members at adjoining panel edges, nail or staple diameter and length, number of fastener lines, and that spacing between fasteners in each line and at edge margins agree with approved building plans	Field inspection	N	Periodic		
4. Metal-plate-connected wood trusses:					
a. Verification that permanent individual truss member restraint/bracing has been installed in accordance with the approved truss submittal package when the truss height is greater than or equal to 60".	Field inspection	N	Periodic		
b. For trusses spanning 60 feet or greater: verify temporary and permanent restraint/bracing are installed in accordance with the approved truss submittal package	Field inspection	N	Periodic		
1705.5.3 Mass Timber Construction (Types IV-A, IV-B, and IV-C Construction)					
1. Inspection of anchorage and connection of mass timber construction to timber deep foundation systems.	Field inspection	N	Periodic		
2. Inspect erection of mass timber construction.	Field inspection	N	Periodic		
3. Inspection of connections where installation methods are required to meet design loads.					
a. Threaded Fasteners					
1) Verify use of proper installation equipment.	Field inspection	N	Periodic		
2) Verify use of pre-drilled holes where required.	Field inspection	N	Periodic		
3) Inspect screws, including diameter, length, head type, spacing, installation angle, and depth.	Field inspection	N	Periodic		
b. Adhesive anchors installed in horizontal or upwardly inclined orientation to resist sustained tension loads.	Field inspection	N	Continuous		
c. Adhesive anchors not defined in preceding cell.	Field inspection	N	Periodic		
d. Bolted connections.	Field inspection	N	Periodic		
e. Concealed connections	Field inspection	N	Periodic		
1705.6 Soils					
1. Verify materials below shallow foundations are adequate to achieve the design bearing capacity.	Field inspection	Y	Periodic		
2. Verify excavations are extended to proper depth and have reached proper material.	Field inspection	Y	Periodic		
3. Perform classification and testing of compacted fill materials.	Field inspection	Y	Periodic		
4. During fill placement, verify use of proper materials and procedures in accordance with the provisions of the approved geotechnical report. Verify densities and lift thicknesses during placement and compaction of compacted fill.	Field inspection	Y	Continuous		
5. Prior to placement of controlled fill, inspect subgrade and verify that site has been prepared properly.	Field inspection	Y	Periodic		
1705.7 Driven Deep Foundations					
1. Verify element materials, sizes and lengths comply with requirements	Field inspection	N	Continuous		
2. Determine capacities of test elements and conduct additional load tests, as required	Field inspection	N	Continuous		
3. Inspect driving operations and maintain complete and accurate records for each element	Field inspection	N	Continuous		
4. Verify placement locations and plumbness, confirm type and size of hammer, record number of blows per foot of penetration, determine required penetrations to achieve design capacity, record tip and butt elevations and document any damage to foundation element	Field inspection	N	Continuous		
5. For steel elements, perform additional inspections per Section 1705.2	See Section 1705.2	N	See Section 1705.2		

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6. For concrete elements and concrete-filled elements, perform tests and additional inspections per Section 1705.3	See Section 1705.3	N	See Section 1705.3		
7. For specialty elements, perform additional inspections as determined by the registered design professional in responsible charge	Field inspection	N	In accordance with construction documents		
1705.8 Cast-in-Place Deep Foundations					
1.Inspect drilling operations and maintain complete and accurate records for each element	Field inspection	N	Continuous		
2. Verify placement locations and plumbness, confirm element diameters, bell diameters (if applicable), lengths, embedment into bedrock (if applicable) and adequate end-bearing strata capacity. Record concrete or grout volumes	Field inspection	N	Continuous		
3. For concrete elements, perform tests and additional inspections in accordance with Section 1705.3	See Section 1705.3	N	See Section 1705.3		
1705.9 Helical Pile Foundations					
Verify installation equipment, pile dimensions, tip elevations, final depth, final installation torque and other pertinent installation data as required by construction documents.	Field inspection	N	Continuous		
1705.10 Not Used					
1705.11 Fabricated items					
1. List of fabricated items requiring special inspection during fabrication:	Shop inspection		As noted in each applicable shop activity		
2. List of fabricated items to be fabricated on the premises of a fabricator approved to perform such work without special inspection (including name of approved agency providing periodic auditing):					
1705.12.1 Structural Wood Special Inspections For Wind Resistance					
1. Inspection of field gluing operations of elements of the main windforce-resisting system	Field inspection	N	Continuous		
2. Inspection of nailing, bolting, anchoring and other fastening of components within the main windforce-resisting system, including wood shear walls, wood diaphragms, drag struts, braces and hold-downs.	Shop (3) and field inspection	N	Periodic		
1705.12.2 Cold-formed Steel Special Inspections For Wind Resistance					
1.Inspection during welding operations of elements of the main windforce-resisting system	Shop (3) and field inspection	N	Periodic		
2. Inspection of screw attachment, bolting, anchoring and other fastening of components within the main windforce-resisting system, including shear walls, braces, diaphragms, collectors (drag struts) and hold-downs.	Shop (3) and field inspection	N	Periodic		
1705.12.3 Wind-resisting Components					
1. Roof covering, roof deck and roof framing connections.	Shop (3) and field inspection	N	Periodic		
2. Exterior wall covering and wall connections to roof and floor diaphragms.	Shop (3) and field inspection	N	Periodic		
1705.13.1 Structural Steel Special Inspections for Seismic Resistance					
1. Seismic force-resisting systems in SDC B, C, D, E, or F.	Shop (3) and field inspection	N	In accordance with AISC 341		
2. Structural steel elements in SDC B, C, D, E, or F other than those in Item 1. including struts, collectors, chords and foundation elements.	Shop (3) and field inspection	N	In accordance with AISC 341		
1705.13.2 Structural Wood Special Inspections for Seismic Resistance					
1. Field gluing operations of elements of the seismic-force resisting system for SDC C, D, E or F.	Field inspection	N	Continuous		
2. Nailing, bolting, anchoring and other fastening of elements of the seismic-force-resisting system including wood shear walls, wood diaphragms, drag struts, braces shear panels and hold-downs for SDC C, D, E or F.	Shop (3) and field inspection	N	Periodic		

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1705.13.3 Cold-formed Steel Light-Frame Construction Special Inspections for Seismic Resistance					
1. During welding operations of elements of the seismic-force-resisting system for SDC C, D, E or F.	Shop (3) and field inspection	N	Periodic		
2. Screw attachment, bolting, anchoring and other fastening of components within the seismic-force-resisting system including shear walls, braces, diaphragms, collectors (drag struts) and hold-downs for SDC C, D, E or F.	Shop (3) and field inspection	N	Periodic		
1705.13.4 Designated Seismic Systems Verification Special Inspections for Seismic Resistance					
For SDC C, D, E or F, inspect and verify that that the label, anchorage and mounting conforms to the certificate of compliance in accordance with ASCE 7 Section 13.2.3.	Field inspection	N	Periodic		
1705.13.5 Architectural Components Special Inspections for Seismic Resistance					
1. For SDC D, E or F, inspection during the erection and fastening of exterior cladding and interior or exterior veneer more than 30 feet above grade or walking surface and weighing more than 5 psf.	Field inspection	N	Periodic		
2. For SDC D, E or F, inspection during the erection and fastening of interior nonbearing walls more than 30 feet above grade or walking surface and weighing more than 15 psf.	Field inspection	N	Periodic		
3. For SDC D, E or F, inspection during the erection and fastening of exterior nonbearing walls more than 30 feet above grade or walking surface.	Field inspection	N	Periodic		
4. For SDC D, E or F, inspection during anchorage of access floors	Field inspection	N	Periodic		
1705.13.6 Plumbing, Mechanical and Electrical Components Special Inspections for Seismic Resistance					
1. Inspection during the anchorage of electrical equipment for emergency or standby power systems in SDC C, D, E or F	Field inspection	Y	Periodic		
2. Inspection during the anchorage of other electrical equipment in SDC E or F	Field inspection	N	Periodic		
3. Inspection during installation and anchorage of piping systems designed to carry hazardous materials, and their associated mechanical units in SDC C, D, E or F	Field inspection	Y	Periodic		
4. Inspection during the installation and anchorage of HVAC ductwork designed to contain hazardous materials in SDC C, D, E or F	Field inspection	N	Periodic		
5. Inspection during the installation and anchorage of vibration isolation systems in SDC C, D, E or F where nominal clearance of 1/4 inch or less is required by the approved construction documents	Field inspection	N	Periodic		
6. Inspection during installation of mechanical and electrical equipment, including duct work, piping systems and their structural supports, where automatic fire sprinkler systems are installed in structures assigned to SDC C, D, E, or F to verify one of the following unless flexible sprinkler hose fittings are used:					
a. ASCE/SEI 7, Section 13.2.4 minimum required clearances have been provided.	Field inspection	N	Periodic		
b. A three inch or greater nominal clearance has been provided between fire protection sprinkler system drops and sprigs and: structural members not used collectively or independently to support the sprinklers; equipment attached to the building structure; and other systems' piping.	Field inspection	N	Periodic		
1705.13.7 Storage Racks Special Inspections for Seismic Resistance					
Inspection during the anchorage of storage racks 8 feet or greater in height in structures assigned to SDC D, E or F.	Field inspection				
1. Materials used, to verify compliance with one or more of the material test reports in accordance with the approved construction documents.	Field inspection	N	Periodic		
2. Fabricated storage rack elements.	Field inspection	N	Periodic		
3. Storage rack anchorage installation.	Field inspection	N	Periodic		

SCHEDULE OF SPECIAL INSPECTIONS SERVICES					
PROJECT	**Additions and Renovations to Jackson County Correctional Institution**				
		APPLICABLE TO THIS PROJECT			
MATERIAL / ACTIVITY	**SERVICE**	**Y/N**	**EXTENT**	**AGENT***	**DATE COMPLETED**
4. Completed storage rack system, to indicate compliance with the approved construction documents.	Field inspection	N	Periodic		
1705.13.8 Seismic Isolation Systems					
Inspection during the fabrication and installation of isolator units and energy dissipation devices used as part of the seismic isolation system in structures assigned to SDC B, C, D, E or F.	Shop and field inspection	N	Periodic		
1705.13.9 Cold-formed Steel Special Bolted Moment Frames					
Inspection of installation of cold-formed steel special bolted moment frames in the seismic force-resisting systems in structures assigned to SDC D, E or F.	Field inspection	N	Periodic		
1705.14.1 Structural Steel Testing for Seismic Resistance					
1. Nondestructive testing of structural steel in the seismic force-resisting systems in accordance with AISC 341 in structures assigned to SDC B, C, D, E, or F.	Field test	N	Periodic		
2. Nondestructive testing of structural steel elements in the seismic force-resisting systems not covered in Item 1 above, including struts, collectors, chords, and foundation elements in accordance with AISC 341 in structures assigned to SDC B, C, D, E, or F.	Field test	N	Periodic		
1705.14.2 Seismic Certification of Nonstructural Components					
1.Review certificate of compliance for non-structural components in structures assigned to SDC B, C, D, E, or F.	Certificate of compliance review	N	Each submittal		
1705.14.3 Seismic Certification of Designated Seismic Systems					
Review certificate of compliance for designated seismic system, subject to the requirements of ASCE 7, Section 13.2.4, as noted on the construction documents, in structures assigned to SDC C, D, E or F	Certificate of compliance review	N	Each submittal		
1705.14.4 Seismic Isolation Systems					
Test seismic isolation system in accordance with ASCE 7 Section 17.8 in structures assigned to SDC B, C, D, E or F.	Prototype testing	N	Per ASCE 7		
1705.15 Sprayed Fire-resistive Materials					
Special inspection shall be performed during construction with an additional visual inspection after the rough installation of electrical, sprinklers, mechanical and plumbing systems and suspension systems for ceilings, and before concealment where applicable.					
1. Verify surface condition preparation of structural members	Field inspection	N	Periodic		
2. Verify the substrate's minimum ambient temperature before and after application and note the ventilation of the area during and after application as required by the approved manufacturers' written instructions.	Field inspection	N	Periodic		
3. Verify minimum thickness of sprayed fire-resistant materials applied to structural members	Field inspection	N	Periodic		
4. Verify density of the sprayed fire-resistant material complies with approved fire-resistant design	Field inspection and testing	N	Per IBC Section 1705.15.5		
5. Verify the cohesive/adhesive bond strength of the cured sprayed fire-resistant material	Field inspection and testing	N	Per IBC Section 1705.15.6		
6. Condition of finished application	Field inspection	N	Periodic		

SCHEDULE OF SPECIAL INSPECTIONS SERVICES

PROJECT	Additions and Renovations to Jackson County Correctional Institution				
		APPLICABLE TO THIS PROJECT			
MATERIAL / ACTIVITY	SERVICE	Y/N	EXTENT	AGENT*	DATE COMPLETED
1705.16 Intumescent Fire-Resistive Materials					
Special inspection shall be performed during construction with an additional visual inspection after the rough installation of electrical, sprinklers, mechanical and plumbing systems and suspension systems for ceilings, and before concealment where applicable.					
Inspect and test intumescent fire-resistive materials applied to structural elements and decks per AWCI 12-B	Field inspection and testing	N	Periodic		
1705.17 Exterior Insulation and Finish Systems (EIFS)					
Inspection of water-resistive barrier over sheathing substrate	Field inspection	N	Periodic		
1705.18 Fire-Resistant Penetrations and Joints					
1. Inspect penetration firestop systems	Field testing	Y	Per ASTM E2174		
2. Inspect fire-resistant joint systems	Field testing	Y	Per ASTM E2393		
1705.19 Smoke Control Systems					
1. Leakage testing and recording of device locations prior to concealment	Field testing	N	Periodic		
2. Prior to occupancy and after sufficient completion, pressure difference testing, flow measurements, and detection and control verification	Field testing	N	Periodic		
1705.20 Sealing of Mass Timber Construction					
1. Inspect sealants and adhesives to resist passage of air in buildings of Type IV-A, IV-B, and IV-C..	Field testing				
a. At abutting edges and intersections of mass timber building elements required to be fire-resistance rated.	Field testing	N	Periodic		
b. At abutting intersections of mass timber building elements and building elements of other materials where both are required to be fire-resistance rated.	Field testing	N	Periodic		

* INSPECTION AGENTS FIRM	ADDRESS	TELEPHONE NO.
1.		
2.		
3.		
4.		

Notes: 1. The inspection and testing agent(s) shall be engaged by the Owner or the Owner's Agent, and not by the Contractor or Subcontractor whose work is to be inspected or tested. Any conflict of interest must be disclosed to the Building Official prior to commencing work. The qualifications of the Special Inspector(s) and/or testing agencies may be subject to the approval of the Building Official and/or the Design Professional.

2. The list of Special Inspectors may be submitted as a separate document, if noted so above.

3. Shop Inspections of fabricated items are not required where the fabricator is approved in accordance with IBC Section 1704.2.5.1 and listed in activity 1705.11.2.

4. Observe: Observe on a random basis, operations need not be delayed pending these inspections. Perform: These tasks shall be performed for each welded joint, bolted connection, or steel element.

5. NDT of welds completed in an approved fabricator's shop may be performed by that fabricator when approved by the AHJ. Refer to AISC 360, N6.

6. After-The-Fact Inspections: Any area(s) that have been covered without proper inspections shall be immediately brought to the attention of the Design Professional of Record (DPOR) and the Building Official. After-the-fact special inspections, if approved, shall be performed as directed by the DPOR to ensure adequate inspections are performed to meet the design intent.

Are *Special Inspections for Seismic Resistance* included in the *Statement of Special Inspections*? **Yes** **No**

Are *Special Inspections for Wind Resistance* included in the *Statement of Special Inspections*? **Yes** **No**

DATE:

Special Inspections for Seismic Resistance

See the Schedule of Special Inspections for inspection and testing requirements

Seismic Design Category: C___

Special Inspections for Seismic Resistance Required (Yes/No): No_____

Description of seismic force-resisting system subject to special inspection and testing for seismic resistance:
(Where required per IBC Sections 1705.13.1, 1705.13.2, and 1705.13.3) (Special inspections for seismic resistance of structural steel, where required, shall be in accordance with AISC 341)

N/A

Description of designated seismic systems subject to special inspection and testing for seismic resistance:
(Required for architectural, electrical and mechanical systems and their components that require design in accordance with Chapter 13 of ASCE 7, have a component importance factor, *Ip*, greater than one and are in Seismic Design Categories C, D, E or F.)

N/A

Description of additional seismic systems and components requiring special inspections:
(Required for systems noted in IBC Section 1705.13.5, 1705.13.6, 1705.13.7, 1705.13.8, and 1705.13.9.)

N/A

Description of additional seismic systems and components requiring testing:
(Where required per IBC Section 1705.14)

N/A

Statement of Responsibility:
Each contractor responsible for the construction or fabrication of a system or component described above must submit a Statement of Responsibility.

Special Inspections for Wind Resistance

See the Schedule of Special Inspections for inspection and testing requirements

Basic Wind Speed, V: 113 m.p.h.

Wind Exposure Category: C

Special Inspection for Wind Resistance Required (Yes/No): No
(Required in wind exposure Category B, where the basic wind speed, V, is 150 miles per hour or greater. Required in wind exposure Category C or D, where the basic wind speed, V, is 140 miles per hour or greater.)

Description of structural wood and cold-formed steel light frame construction main windforce-resisting system subject to special inspections for wind resistance:
(Required for systems noted in IBC Section 1705.12.1 and 1705.12.2).

N/A

Description of windforce-resisting components subject to special inspections for wind resistance:
(Required for systems and components noted in IBC Section 1705.12.3)

N/A

Statement of Responsibility:
Each contractor responsible for the construction or fabrication of a system or component described above must submit a Statement of Responsibility.

SECTION 014001 - CUTTING AND PATCHING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for cutting and patching.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 1 Section "Coordination" for procedures for coordinating cutting and patching with other construction activities.
2. Refer to other Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.

a. Requirements of this Section apply to mechanical and electrical installations. Refer to Division 15 Sections for other requirements and limitations applicable to cutting and patching mechanical and electrical installations.

1.2 QUALITY ASSURANCE

A. Requirements for Structural Work: Do not cut and patch structural elements in a manner that would change their load-carrying capacity or load-deflection ratio.

1. Obtain approval of the cutting and patching proposal before cutting and patching the following structural elements:

a. Foundation construction.
b. Bearing and retaining walls.
c. Structural concrete.
d. Structural steel.
e. Lintels.
f. Structural decking.
g. Exterior curtain-wall construction.
h. Equipment supports.
i. Piping, ductwork, vessels, and equipment.
j. Structural systems of special construction in Division 13 Sections.

B. Operational Limitations: Do not cut and patch operating elements or related components in a manner that would result in reducing their capacity to perform as intended. Do not cut and patch operating elements or related components in a manner that would result in increased maintenance or decreased operational life or safety.

1. Obtain approval of the cutting and patching proposal before cutting and patching the following operating elements or safety related systems:

a. Primary operational systems and equipment.
b. Air or smoke barriers.
c. Water, moisture, or vapor barriers.
d. Membranes and flashings.
e. Fire protection systems.

f. Noise and vibration control elements and systems.
g. Control systems.
h. Communication systems.
i. Electrical wiring systems.

C. Visual Requirements: Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in the Architect's opinion, reduce the building's aesthetic qualities. Do not cut and patch construction in a manner that would result in visual evidence of cutting and patching. Remove and replace construction cut and patched in a visually unsatisfactory manner.

1. Retain the original Installer or fabricator to cut and patch the exposed Work listed below. If it is impossible to engage the original Installer or fabricator, engage another recognized experienced and specialized firm.

a. Masonry.
b. Preformed metal panels.
c. Firestopping.
d. Acoustical ceilings.
e. Tile.
f. Fluid-applied flooring.
g. Carpeting.
h. Painting.

1.3 WARRANTY

A. Existing Warranties: Replace, patch, and repair material and surfaces cut or damaged by methods and with materials in such a manner as not to void any warranties required or existing.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Use materials identical to existing materials. For exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible. If identical materials are unavailable or cannot be used, use materials whose installed performance will equal or surpass that of existing materials.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine surfaces to be cut and patched and conditions under which cutting and patching is to be performed before cutting. If unsafe or unsatisfactory conditions are encountered, take corrective action before proceeding.

1. Before proceeding, meet at the Project Site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

3.2 PREPARATION

A. Temporary Support: Provide temporary support of work to be cut.

B. Protection: Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of the Project that might be exposed during cutting and patching operations.

C. Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

D. Avoid cutting existing pipe, conduit, or ductwork serving the building but scheduled to be removed or relocated until provisions have been made to bypass them.

3.3 PERFORMANCE

A. General: Employ skilled workmen to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time and complete without delay.

1. Cut existing construction to provide for installation of other components or performance of other construction activities and the subsequent fitting and patching required to restore surfaces to their original condition.

B. Cutting: Cut existing construction using methods least likely to damage elements retained or adjoining construction. Where possible, review proposed procedures with the original Installer; comply with the original Installer's recommendations.

1. In general, where cutting, use hand or small power tools designed for sawing or grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. To avoid marring existing finished surfaces, cut or drill from the exposed or finished side into concealed surfaces.
3. Cut through concrete and masonry using a cutting machine, such as a Carborundum saw or a diamond-core drill.
4. Comply with requirements of applicable Division 2 Sections where cutting and patching requires excavating and backfilling.
5. Where services are required to be removed, relocated, or abandoned, by-pass utility services, such as pipe or conduit, before cutting. Cut-off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal the remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after by-passing and cutting.

C. Patching: Patch with durable seams that are as invisible as possible. Comply with specified tolerances.

1. Where feasible, inspect and test patched areas to demonstrate integrity of the installation.
2. Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.

a. Where patching occurs in a smooth painted surface, extend final paint coat over entire

unbroken surface containing the patch after the area has received primer and second coat.

3.4 CLEANING

A. Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar items. Thoroughly clean piping, conduit, and similar features before applying paint or other finishing materials. Restore damaged pipe covering to its original condition.

END OF SECTION 014001

SECTION 014002 - FIELD ENGINEERING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. General: This Section specifies administrative and procedural requirements for field-engineering services including, but not limited to, the following:

1. Land survey work.
2. Civil-engineering services.
3. Geotechnical monitoring.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 1 Section "Coordination" for procedures for coordinating field engineering with other construction activities.
2. Division 1 Section "Submittals" for submitting Project record surveys.
3. Division 1 Section "Project Closeout" for submitting final property survey with Project Record Documents and recording of Owner-accepted deviations from indicated lines and levels.

1.3 SUBMITTALS

A. Certificates: Submit a certificate signed by the land surveyor or professional engineer certifying the location and elevation of improvements.

B. Final Property Survey: Submit two (2) copies of the final property survey, and electronic .dwg and .pdf copies.

1.4 QUALITY ASSURANCE

A. Surveyor Qualifications: Engage a land surveyor registered in the state where the Project is located, to perform required land-surveying services.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Identification: The Architect will identify existing control points and property line corner stakes.

B. Verify layout information shown on the Drawings, in relation to the property survey and existing benchmarks, before proceeding to lay out the Work. Locate and protect existing benchmarks and control points. Preserve permanent reference points during construction.

1. Do not change or relocate benchmarks or control points without prior written approval. Promptly report lost or destroyed reference points or requirements to relocate reference points because of necessary changes in grades or locations.
2. Promptly replace lost or destroyed Project control points. Base replacements on the original survey control points.

C. Establish and maintain a minimum of 2 permanent benchmarks on the site, referenced to data established by survey control points.

1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.

D. 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 the existence and location of underground utilities and other construction.

1. Prior to construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping.
2. Verify the elevations of the existing building pads, retaining walls, utility connections etc.

3.2 PERFORMANCE

A. Work from lines and levels established by the property survey. Establish benchmarks and markers to set lines and levels at each story of construction and elsewhere as needed to locate each element of the Project. Calculate and measure required dimensions within indicated or recognized tolerances. Do not scale Drawings to determine dimensions.

1. Advise entities engaged in construction activities of marked lines and levels provided for their use.
2. As construction proceeds, check every major element for line, level, and plumb.

B. Surveyor's Log: Maintain a surveyor's log of control and other survey work. Make this log available for reference.

1. Record deviations from required lines and levels, and advise the Architect when deviations that exceed indicated or recognized tolerances are detected. On Project Record Drawings, record deviations that are accepted and not corrected.
2. On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and sitework.

C. Site Improvements: Locate and lay out site improvements, including pavements, stakes for grading, fill and topsoil placement, utility slopes, and invert elevations.

D. Building Lines and Levels: Locate and lay out batter boards for structures, building foundations, column grids and locations, floor levels, and control lines and levels required for mechanical and electrical work.

E. Existing Utilities: Furnish information necessary to adjust, move, or relocate existing structures, utility poles, lines, services, or other appurtenances located in or affected by construction.

Coordinate with local authorities having jurisdiction.

F. Final Property Survey: Prepare a final property survey showing significant features (real property) for the Project. 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.

1. Recording: At Substantial Completion, have the final property survey recorded by or with local governing authorities as the official "property survey."
2. Give (2) printed copies and .dwg and .pdf electronic files to the architect and owner.

END OF SECTION 014002

SECTION 014339 - MOCKUPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Exterior mockups.

B. Related Requirements:

1. Section 014000 "Quality Requirements" for quality assurance requirements for aesthetic and workmanship mockups specified in other Sections.

1.2 DEFINITIONS

A. Integrated Exterior Mockups: Mockups of the exterior envelope constructed on-site as **freestanding temporary built elements**, consisting of multiple products, assemblies, and subassemblies.

1.3 QUALITY ASSURANCE

A. Build mockups to do the following:

1. Demonstrate aesthetic effects.
2. Demonstrate the qualities of products and workmanship.
3. Demonstrate acceptable coordination between components and systems.

B. Fabrication: Before fabricating or installing portions of the Work requiring mockups, build mockups for each form of construction and finish required. Use materials and installation methods as required for the Work.

1. Build mockups of size indicated.
2. Build mockups in location indicated or, if not indicated, as directed by Architect**.**
3. Employ supervisory personnel who will oversee mockup construction. Employ workers who will be employed to perform same tasks during the construction at Project.
4. Demonstrate the proposed range of aesthetic effects and workmanship.
5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
6. Demolish and remove mockups when directed unless otherwise indicated.

C. Approval: Obtain Architect's approval of mockups before starting fabrication or construction of corresponding Work.

1. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.

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

1.4 COORDINATION

A. Coordinate schedule for construction of mockups, so construction and review of mockups do not impact Project schedule.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design support structure for free-standing mockups.

B. Structural Performance:

1. Wind Loads: As indicated on Drawings.

2.2 EXTERIOR MOCKUPS

A. Construct integrated exterior mockups **as indicated on Drawings**. Construct mockups to demonstrate constructability, coordination of trades, and sequencing of Work; and to ensure materials, components, subassemblies, assemblies, and interfaces integrate into a system complying with indicated performance and aesthetic requirements.

B. Design and construct foundation and superstructure to support free-standing integrated exterior mockups.

C. Build integrated exterior mockups using installers and construction methods that will be used in completed construction.

D. Use specified products that have been approved by Architect. Coordinate installation of materials and products specified in individual Specification Sections that include Work included in exterior mockups.

E. The Work of exterior mockups includes, but is not limited to, the following:

1. Precast architectural concrete.
2. Masonry veneer.
3. Manufactured Stone.
4. Cold-formed metal framing and sheathing.
5. Air and weather barriers.
6. Thermal insulation.
7. Through-wall flashing.
8. Flashing and sheet metal trim.

9. Joint sealants.
10. Aluminum-framed entrances and storefront.
11. Glazed curtain walls.
12. Glazing.

PART 3 - EXECUTION

END OF SECTION 014339

SECTION 015000 - CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes requirements for construction facilities and temporary controls, including temporary utilities, support facilities, and security and protection.

B. Temporary utilities include, but are not limited to, the following:

1. Water service and distribution.
2. Temporary electric power and light.
3. Temporary heat.
4. Ventilation.
5. Telephone service.
6. Sanitary facilities, including drinking water.
7. Storm and sanitary sewer.

C. Support facilities include, but are not limited to, the following:

1. Field offices and storage sheds.
2. Temporary roads and paving.
3. Dewatering facilities and drains.
4. Temporary enclosures.
5. Hoists and temporary elevator use.
6. Temporary project identification signs and bulletin boards.
7. Waste disposal services.
8. Rodent and pest control.
9. Construction aids and miscellaneous services and facilities.

D. Security and protection facilities include, but are not limited to, the following:

1. Temporary fire protection.
2. Barricades, warning signs, and lights.
3. Enclosure fence for the site.
4. Environmental protection.

1.3 QUALITY ASSURANCE

A. Regulations: Comply with industry standards and applicable laws and regulations of authorities having jurisdiction including, but not limited to, the following:

1. Building code requirements.
2. Health and safety regulations.

3. Utility company regulations.
4. Police, fire department, and rescue squad rules.
5. Environmental protection regulations.

B. Standards: Comply with NFPA 241 "Standard for Safeguarding Construction, Alterations, and Demolition Operations," ANSI A10 Series standards for "Safety Requirements for Construction and Demolition," and NECA Electrical Design Library "Temporary Electrical Facilities."

1. Electrical Service: Comply with NEMA, NECA, and UL standards and regulations for temporary electric service. Install service in compliance with NFPA 70 "National Electric Code."

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

1.4 PROJECT CONDITIONS

A. Temporary Utilities: Prepare a schedule indicating dates for implementation and termination of each temporary utility. At the earliest feasible time, when acceptable to the Owner, change over from use of temporary service to use of permanent service.

B. Conditions of Use: Keep temporary services and facilities clean and neat in appearance. Operate in a safe and efficient manner. Relocate temporary services and facilities as the Work progresses. Do not overload facilities or permit them to interfere with progress. Take necessary fire-prevention measures. Do not allow hazardous, dangerous, or unsanitary conditions, or public nuisances to develop or persist on-site.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Provide new materials. If acceptable to the Architect, the Contractor may use undamaged, previously used materials in serviceable condition. Provide materials suitable for use intended.

B. Lumber and Plywood: Comply with requirements in Division 6 Section "Rough Carpentry."

C. Water: Provide potable water approved by local health authorities.

D. Open-Mesh Fencing: Provide 0.120-inch- thick, galvanized 2-inch chainlink fabric fencing 6 feet high with galvanized barbed-wire top strand and galvanized steel pipe posts, 1-1/2 inches I.D. for line posts and 2-1/2 inches I.D. for corner posts.

2.2 EQUIPMENT

A. General: Provide new equipment. If acceptable to the Architect, the Contractor may use undamaged, previously used equipment in serviceable condition. Provide equipment suitable for use intended.

B. Water Hoses: Provide 3/4-inch, heavy-duty, abrasion-resistant, flexible rubber hoses 100 feet long, with pressure rating greater than the maximum pressure of the water distribution system. Provide

adjustable shutoff nozzles at hose discharge.

C. Electrical Outlets: Provide properly configured, NEMA-polarized outlets to prevent insertion of 110- to 120-Volt plugs into higher voltage outlets. Provide receptacle outlets equipped with ground-fault circuit interrupters, reset button, and pilot light for connection of power tools and equipment.

D. Electrical Power Cords: Provide grounded extension cords. Use hard-service cords where exposed to abrasion and traffic. Provide waterproof connectors to connect separate lengths of electric cords if single lengths will not reach areas where construction activities are in progress. Do not exceed safe length-voltage ratio.

E. Lamps and Light Fixtures: Provide general service incandescent lamps of wattage required for adequate illumination. Provide guard cages or tempered-glass enclosures where exposed to breakage. Provide exterior fixtures where exposed to moisture.

F. Heating Units: Provide temporary heating units that have been tested and labeled by UL, FM, or another recognized trade association related to the type of fuel being consumed.

G. Temporary Offices: Provide prefabricated or mobile units or similar job-built construction with lockable entrances, operable windows, and serviceable finishes. Provide heated and air-conditioned units on foundations adequate for normal loading.

H. Temporary Toilet Units: Provide self-contained, single-occupant toilet units of the chemical, aerated recirculation, or combustion type. Provide units properly vented and fully enclosed with a glass-fiber-reinforced polyester shell or similar nonabsorbent material.

I. Fire Extinguishers: Provide hand-carried, portable, UL-rated, Class A fire extinguishers for temporary offices and similar spaces. In other locations, provide hand-carried, portable, UL-rated, Class ABC, dry-chemical extinguishers or a combination of extinguishers of NFPA-recommended classes for the exposures.

1. Comply with NFPA 10 and NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Use qualified personnel for installation of temporary facilities. Locate facilities where they will serve the Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required.

B. Provide each facility ready for use when needed to avoid delay. Maintain and modify as required. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

A. General: Engage the appropriate local utility company to install temporary service or connect to existing service. Where company provides only part of the service, provide the remainder with

matching, compatible materials and equipment. Comply with company recommendations.

1. Arrange with company and existing users for a time when service can be interrupted, if necessary, to make connections for temporary services.
2. Provide adequate capacity at each stage of construction. Prior to temporary utility availability, provide trucked-in services.
3. Obtain easements to bring temporary utilities to the site where the Owner's easements cannot be used for that purpose.
4. Use Charges: Cost or use charges for temporary facilities are not chargeable to the Owner or Architect. Neither the Owner nor Architect will accept cost or use charges as a basis of claims for Change Orders.

B. Water Service: Install water service and distribution piping of sizes and pressures adequate for construction until permanent water service is in use.

1. Sterilization: Sterilize temporary water piping prior to use.

C. Temporary Electric Power Service: Provide weatherproof, grounded electric power service and distribution system of sufficient size, capacity, and power characteristics during construction period. Include meters, transformers, overload-protected disconnects, automatic ground-fault interrupters, and main distribution switch gear.

1. Install electric power service underground, except where overhead service must be used.
2. Power Distribution System: Install wiring overhead and rise vertically where least exposed to damage. Where permitted, wiring circuits not exceeding 125 Volts, ac 20 Ampere rating, and lighting circuits may be nonmetallic sheathed cable where overhead and exposed for surveillance.

D. Temporary Lighting: When overhead floor or roof deck has been installed, provide temporary lighting with local switching.

1. Install and operate temporary lighting that will fulfill security and protection requirements without operating the entire system. Provide temporary lighting that will provide adequate illumination for construction operations and traffic conditions.

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

F. Heating Facilities: Except where the Owner authorizes use of the permanent system, provide vented, self-contained, LP-gas or fuel-oil heaters with individual space thermostatic control.

1. Use of gasoline-burning space heaters, open flame, or salamander heating units is prohibited.

G. Temporary Telephones: Provide temporary telephone service throughout the construction period for all personnel engaged in construction activities.

H. Sanitary facilities include temporary toilets, wash facilities, and drinking-water fixtures. Comply with regulations and health codes for the type, number, location, operation, and maintenance of fixtures and facilities. Install where facilities will best serve the Project's needs.

1. Provide toilet tissue, paper towels, paper cups, and similar disposable materials for each facility. Provide covered waste containers for used material.

I. Not used.

J. Toilets: Install self-contained toilet units. Shield toilets to ensure privacy. Use of pit-type privies will not be permitted.

1. Provide separate facilities for male and female personnel.

K. Wash Facilities: Install wash facilities supplied with potable water at convenient locations for personnel involved in handling materials that require wash-up for a healthy and sanitary condition. Dispose of drainage properly. Supply cleaning compounds appropriate for each condition.

L. Drinking-Water Facilities: Provide containerized, tap-dispenser, bottled-water drinking-water units, including paper supply.

M. Sewers and Drainage: If sewers are available, provide temporary connections to remove effluent that can be discharged lawfully. If sewers are not available or cannot be used, provide drainage ditches, dry wells, stabilization ponds, and similar facilities. If neither sewers nor drainage facilities can be lawfully used for discharge of effluent, provide containers to remove and dispose of effluent off-site in a lawful manner.

1. Filter out excessive amounts of soil, construction debris, chemicals, oils, and similar contaminants that might clog sewers or pollute waterways before discharge.
2. Connect temporary sewers to the municipal system, as directed by sewer department officials.
3. Maintain temporary sewers and drainage facilities in a clean, sanitary condition. Following heavy use, restore normal conditions promptly.

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

3.3 SUPPORT FACILITIES INSTALLATION

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

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

B. Field Offices: Provide insulated, conditioned, weathertight temporary offices of sufficient size to accommodate required office personnel at the Project Site. Keep the office clean and orderly for progress meetings with adequate furniture to accommodate meetings.

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

D. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities.

E. Collection and Disposal of Waste: Collect waste from construction areas and elsewhere daily. Comply with requirements of NFPA 241 for removal of combustible waste material and debris. Enforce requirements strictly. Do not hold materials more than 7 days during normal weather or 3 days when the temperature is expected to rise above 80 deg F. Handle hazardous, dangerous, or unsanitary waste materials separately from other waste by containerizing properly. Dispose of material lawfully.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

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

B. Temporary Fire Protection: Until fire-protection needs are supplied by permanent facilities, install and maintain temporary fire-protection facilities of the types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 10 "Standard for Portable Fire Extinguishers" and NFPA 241 "Standard for Safeguarding Construction, Alterations, and Demolition Operations."

1. Locate fire extinguishers where convenient and effective for their intended purpose.
2. Store combustible materials in containers in fire-safe locations.
3. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire-protection facilities, and other access routes for fighting fires. Prohibit smoking in hazardous fire-exposure areas.
4. Provide supervision of welding operations, combustion-type temporary heating units, and similar sources of fire ignition.

C. Permanent Fire Protection: At the earliest feasible date in each area of the Project, complete installation of the permanent fire-protection facility, including connected services, and place into operation and use. Instruct key personnel on use of facilities.

D. Barricades, Warning Signs, and Lights: Comply with standards and code requirements for erection of structurally adequate barricades. Paint with appropriate colors, graphics, and warning signs to inform personnel and the public of the hazard being protected against. Where appropriate and needed, provide lighting, including flashing red or amber lights.

E. Enclosure Fence: Before excavation begins, install an enclosure fence with lockable entrance gates. Locate where indicated, or enclose the entire site or the portion determined sufficient to accommodate construction operations. Install in a manner that will prevent people, dogs, and other animals from easily entering the site, except by the entrance gates.

1. Provide open-mesh, chainlink fencing with posts set in a compacted mixture of gravel and earth.

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

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

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

3.5 OPERATION, TERMINATION, AND REMOVAL

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

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

1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
2. Protection: Prevent water-filled piping from freezing. Maintain markers for underground lines. Protect from damage during excavation operations.

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

1. Materials and facilities that constitute temporary facilities are the Contractor's property.
2. Where the area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil in the area. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at the temporary entrances, as required by the governing authority.
3. At Substantial Completion, clean and renovate permanent facilities used during the construction period including, but not limited to, the following:

    a. Replace air filters and clean inside of ductwork and housings.
    b. Replace significantly worn parts and parts subject to unusual operating conditions.
    c. Replace lamps burned out or noticeably dimmed by hours of use.

END OF SECTION 015000

SECTION 016000 - MATERIALS AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative and procedural requirements governing the Contractor's selection of products for use in the Project.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 1 Section "Submittals" specifies requirements for submittal of the Contractor's Construction Schedule and the Submittal Schedule.
2. Division 1 Section "Substitutions" specifies administrative procedures for handling requests for substitutions made after award of the Contract.

1.3 DEFINITIONS

A. Definitions used in this Article are not intended to change the meaning of other terms used in the Contract Documents, such as "specialties," "systems," "structure," "finishes," "accessories," and similar terms. Such terms are self-explanatory and have well-recognized meanings in the construction industry.

1. "Products" are items purchased for incorporation in the Work, whether purchased for the Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.

a. "Named Products" are items identified by the manufacturer's product name, including make or model number or other designation, shown or listed in the manufacturer's published product literature, that is current as of the date of the Contract Documents.

2. "Materials" are products substantially shaped, cut, worked, mixed, finished, refined or otherwise fabricated, processed, or installed to form a part of the Work.
3. "Equipment" is a product with operational parts, whether motorized or manually operated, that requires service connections, such as wiring or piping.

1.4 QUALITY ASSURANCE

A. Source Limitations: To the fullest extent possible, provide products of the same kind from a single source.

1. When specified products are available only from sources that do not, or cannot, produce a quantity adequate to complete project requirements in a timely manner, consult with the Architect to determine the most important product qualities before proceeding. Qualities

may include attributes, such as visual appearance, strength, durability, or compatibility. When a determination has been made, select products from sources producing products that possess these qualities, to the fullest extent possible.

B. Compatibility of Options: When the Contractor is given the option of selecting between 2 or more products for use on the Project, the product selected shall be compatible with products previously selected, even if previously selected products were also options.

1. Each prime contractor is responsible for providing products and construction methods that are compatible with products and construction methods of other prime or separate contractors.
2. If a dispute arises between prime contractors over concurrently selectable, but incompatible products, the Architect will determine which products shall be retained and which are incompatible and must be replaced.

C. Foreign Product Limitations: Except under one or more of the following conditions, provide domestic products, not foreign products, for inclusion in the Work:

1. No available domestic product complies with the Contract Documents.
2. Domestic products that comply with the Contract Documents are available only at prices or terms substantially higher than foreign products that comply with the Contract Documents.

D. Nameplates: Except for required labels and operating data, do not attach or imprint manufacturer's or producer's nameplates or trademarks on exposed surfaces of products that will be exposed to view in occupied spaces or on the exterior.

1. Labels: Locate required product labels and stamps on concealed surfaces or, where required for observation after installation, on accessible surfaces that are not conspicuous.
2. Equipment Nameplates: Provide a permanent nameplate on each item of service-connected or power-operated equipment. Locate on an easily accessible surface that is inconspicuous in occupied spaces. The nameplate shall contain the following information and other essential operating data:

a. Name of product and manufacturer.
b. Model and serial number.
c. Capacity.
d. Speed.
e. Ratings.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products according to the manufacturer's recommendations, using means and methods that will prevent damage, deterioration, and loss, including theft.

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

ensure that products are undamaged and properly protected.

5. Store products at the site in a manner that will facilitate inspection and measurement of quantity or counting of units.
6. Store heavy materials away from the Project structure in a manner that will not endanger the supporting construction.
7. Store products subject to damage by the elements above ground, under cover in a weathertight enclosure, with ventilation adequate to prevent condensation. Maintain temperature and humidity within range required by manufacturer's instructions.

PART 2 - PRODUCTS

2.1 PRODUCT / MATERIALS SELECTION

A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, new at the time of installation.

1. Provide products complete with accessories, trim, finish, safety guards, and other devices and details needed for a complete installation and the intended use and effect.
2. Standard Products: Where available, provide standard products of types that have been produced and used successfully in similar situations on other projects.
3. The Architect, to the best of his knowledge, has specified materials, products and assemblies which are totally free of asbestos, polychlorinated biphenyl (PCB) or other similar materials believed endanger the health and safety of construction workers and future building occupants.
4. Neither the Contractor, nor his material suppliers, nor his subcontractors shall install or otherwise incorporate any materials containing asbestos, PCB or other hazardous materials within the boundaries of the project. No soil found on site, or transported to the site from remote locations, shall be used for fill, backfill or landscape topsoil, if such soils are contaminated with material containing asbestos, PCB, Radon, gasoline, fuel oil, diesel fuel or other similar fossil fuels.
5. Contractor shall require that each of his subcontractors and material suppliers warrants to the Owner and Architect that all materials, products and assemblies incorporate, or submitted for incorporation into this project, are totally free of asbestos, PCB, or other such hazardous materials.
6. If the Contractor or his subcontractors, or materials suppliers have knowledge that, or believe that an item, component, material or accessory within a product or assembly may contain asbestos, PCB, or other such hazardous material, it is the Contractor’s sole responsibility to secure a written certification from the manufacturer of any suspected material stating this material is totally free of asbestos, PCB or other hazardous materials. A copy of the written certification shall be submitted to the Owner and Architect.

B. Product Selection Procedures: The Contract Documents and governing regulations govern product selection. Procedures governing product selection include the following:

1. Proprietary Specification Requirements: Where Specifications name only a single product or manufacturer, provide the product indicated. No substitutions will be permitted.
2. Semiproprietary Specification Requirements: Where Specifications name 2 or more products or manufacturers, provide 1 of the products indicated. No substitutions will be permitted.

a. Where Specifications specify products or manufacturers by name, accompanied by the term "or equal" or "or approved equal," comply with the Contract Document provisions concerning "substitutions" to obtain approval for use of an unnamed product.

3. Nonproprietary Specifications: When Specifications list products or manufacturers that are available and may be incorporated in the Work, but do not restrict the Contractor to use of these products only, the Contractor may propose any available product that complies with Contract requirements. Comply with Contract Document provisions concerning "substitutions" to obtain approval for use of an unnamed product.
4. Descriptive Specification Requirements: Where Specifications describe a product or assembly, listing exact characteristics required, with or without use of a brand or trade name, provide a product or assembly that provides the characteristics and otherwise complies with Contract requirements.
5. Performance Specification Requirements: Where Specifications require compliance with performance requirements, provide products that comply with these requirements and are recommended by the manufacturer for the application indicated.

    a. Manufacturer's recommendations may be contained in published product literature or by the manufacturer's certification of performance.

6. Compliance with Standards, Codes, and Regulations: Where Specifications only require compliance with an imposed code, standard, or regulation, select a product that complies with the standards, codes, or regulations specified.

7. Visual Matching: Where Specifications require matching an established Sample, the Architect's decision will be final on whether a proposed product matches satisfactorily.

    a. Where no product available within the specified category matches satisfactorily and complies with other specified requirements, comply with provisions of the Contract Documents concerning "substitutions" for selection of a matching product in another product category.

8. Visual Selection: Where specified product requirements include the phrase "... as selected from manufacturer's standard colors, patterns, textures ..." or a similar phrase, select a product and manufacturer that complies with other specified requirements. The Architect will select the color, pattern, and texture from the product line selected.

PART 3 - EXECUTION

3.1 INSTALLATION OF PRODUCTS

A. Comply with manufacturer's instructions and recommendations for installation of products in the applications indicated. Anchor each product securely in place, accurately located and aligned with other Work.

1. Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

END OF SECTION 016000

SECTION 017700 - CONTRACT CLOSEOUT

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for contract closeout including, but not limited to, the following:

1. Inspection procedures.
2. Project record document submittal.
3. Operation and maintenance manual submittal.
4. Submittal of warranties.
5. Final cleaning.

B. Closeout requirements for specific construction activities are included in the appropriate Sections in Divisions 1 through 33.

1.2 SUBSTANTIAL COMPLETION

A. Preliminary Procedures: Before requesting inspection for certification of Substantial Completion, complete the following. List exceptions in the request. Compile and address a punch-list, and submit to architect for review.

1. In the Application for Payment that coincides with, or first follows, the date Substantial Completion is claimed, show 100 percent completion for the portion of the Work claimed as substantially complete.

a. Include supporting documentation for completion as indicated in these Contract Documents and a statement showing an accounting of changes to the Contract Sum. Also furnish a current Certificate of Insurance and a Consent of Surety with the final pay application.
b. If 100 percent completion cannot be shown, include a list of incomplete items, the value of incomplete construction, and reasons the Work is not complete.

2. Advise the Owner of pending insurance changeover requirements.
3. Submit specific warranties, workmanship bonds, maintenance agreements, final certifications, and similar documents.
4. Obtain and submit releases enabling the Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
5. Submit record drawings, maintenance manuals, and similar final record information.
6. Deliver keys, valve schedules, tools, spare parts, attic stock material, extra stock, and similar items no later than the Project Substantial Completion Date. Deliver keys directly to the Owner.
7. Complete startup testing of systems and instruction of the Owner's operation and maintenance personnel. Discontinue and remove temporary facilities from the site, along with mockups, construction tools, and similar elements.
8. Complete final cleanup requirements, including touchup painting.
9. Touch up and otherwise repair and restore marred, exposed finishes.

B. Inspection Procedures: On receipt of a request for inspection, the Architect will either proceed with inspection or advise the Contractor of unfilled requirements. The Architect will prepare the Certificate of Substantial Completion following inspection or advise the Contractor of construction that must be completed or corrected before the certificate will be issued.

1. The Architect will repeat inspection when requested with confirmation from the contractor that all items have been addressed, and assured that the Work is substantially complete.
2. Results of the completed inspection will form the basis of requirements for final acceptance.
3. Costs incurred by the architect for re-inspections due to failure to complete previous deficiencies will be charged to the general contractor.

1.3 FINAL ACCEPTANCE

A. Preliminary Procedures: Before requesting final inspection for certification of final acceptance and final payment, complete the following. List exceptions in the request.

1. Submit the final payment request with releases and supporting documentation not previously submitted and accepted. Include insurance certificates for products and completed operations where required.
2. Submit an updated final statement, accounting for final additional changes to the Contract Sum.
3. Submit a certified copy of the Architect's final inspection list of items to be completed or corrected, endorsed and dated by the Architect. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance and shall be endorsed and dated by the Architect.
4. Submit final meter readings for utilities, and similar data as of the date of Substantial Completion or when the Owner took possession of and assumed responsibility for corresponding elements of the Work.
5. Submit consent of surety to final payment.
6. Submit evidence of final, continuing insurance coverage complying with insurance requirements.

B. Reinspection Procedure: The Architect will reinspect the Work upon receipt of notice that the Work, including inspection list items from earlier inspections, has been completed, except for items whose completion is delayed under circumstances acceptable to the Architect.

1. Upon completion of reinspection, the Architect will prepare a certificate of final acceptance. If the Work is incomplete, the Architect will advise the Contractor of Work that is incomplete or of obligations that have not been fulfilled but are required for final acceptance.
2. If necessary, reinspection will be repeated.
3. Costs incurred by the architect for re-inspections due to failure to complete previous deficiencies will be charged to the general contractor.

1.4 RECORD DOCUMENT SUBMITTALS

A. General: Do not use record documents for construction purposes. Protect record documents from deterioration and loss in a secure, fire-resistant location. Provide access to record documents for the Architect's reference during normal working hours.

B. Record Drawings: Maintain a clean, undamaged set of blue or black line white-prints of Contract Drawings and Shop Drawings with all addenda included. Mark the set to show the actual installation where the installation varies substantially from the Work as originally shown. Mark which drawing is most capable of showing conditions fully and accurately. Where Shop Drawings are used, record a cross-reference at the corresponding location on the Contract Drawings. Give particular attention to concealed elements that would be difficult to measure and record at a later date.

1. Mark record sets with red erasable pencil. Use other colors to distinguish between variations in separate categories of the Work.
2. Mark new information that is important to the Owner but was not shown on Contract Drawings or Shop Drawings.
3. Note related change-order numbers where applicable.
4. Organize record drawing sheets into manageable sets. Bind sets with durable-paper cover sheets; print suitable titles, dates, and other identification on the cover of each set.

C. Record Specifications: Maintain one complete copy of the Project Manual, including all addenda posted. Include with the Project Manual one copy of other written construction documents, such as Change Orders and modifications issued in printed form during construction.

1. Mark these documents to show substantial variations in actual Work performed in comparison with the text of the Specifications and modifications.
2. Give particular attention to substitutions and selection of options and information on concealed construction that cannot otherwise be readily discerned later by direct observation.
3. Note related record drawing information and Product Data.
4. Upon completion of the Work, submit record Specifications to the Architect for the Owner's records.

D. Miscellaneous Record Submittals: Refer to other Specification Sections for requirements of miscellaneous record keeping and submittals in connection with actual performance of the Work. Immediately prior to the date or dates of Substantial Completion, complete miscellaneous records and place in good order. Identify miscellaneous records properly and bind or file, ready for continued use and reference. Submit to the Architect for the Owner's records.

E. Maintenance Manuals: Organize operation and maintenance data into suitable sets of manageable size. Bind properly indexed data in individual, heavy-duty, 2-inch (51-mm), 3-ring, vinyl-covered binders, with pocket folders for folded sheet information. Mark appropriate identification on front and spine of each binder. Include the following types of information:
1. Emergency instructions.
2. Spare parts list.
3. Copies of warranties.
4. Wiring diagrams.
5. Recommended "turn-around" cycles.
6. Inspection procedures.
7. Shop Drawings and Product Data.

PART 2 - PRODUCTS

A. Provide all required attic stock items, securely packaged and labeled, delivered to the offices of the owner.

PART 3 - EXECUTION

3.1 CLOSEOUT PROCEDURES

A. Operation and Maintenance Instructions: Arrange for each Installer of equipment that requires regular maintenance to meet with the Owner's personnel to provide instruction in proper operation and maintenance. Provide instruction by manufacturer's representatives if installers are not experienced in operation and maintenance procedures. Include a detailed review of the following items:

1. Maintenance manuals.
2. Record documents.
3. Spare parts and materials.
4. Tools.
5. Lubricants.
6. Identification systems.
7. Control sequences.
8. Hazards.
9. Cleaning.
10. Warranties and bonds.
11. Maintenance agreements and similar continuing commitments.

B. As part of instruction for operating equipment, demonstrate the following procedures:

1. Startup.
2. Shutdown.
3. Emergency operations.
4. Noise and vibration adjustments.
5. Safety procedures.
6. Economy and efficiency adjustments.
7. Effective energy utilization.

C. Provide a training schedule spreadsheet for distribution to Owner at least one week before instruction/training sessions.

D. Provide a video record of all trainings for future reference.

END OF SECTION 017700

SECTION 017823 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for operation and maintenance manuals, including the following:

1. Preparing and submitting operation and maintenance manuals for building operating systems and equipment.
2. Preparing and submitting instruction manuals covering the care, preservation, and maintenance of architectural products and finishes.
3. Instruction of the Owner's operating personnel in the operation and maintenance of building systems and equipment.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 1 Section "Submittals" specifies preparation of Shop Drawings and Product Data.
2. Division 1 Section "Contract Closeout" specifies general closeout requirements.
3. Division 1 Section "Contract Closeout" specifies general requirements for submitting project record documents.
4. Appropriate Sections of Divisions 2 through 16 specify special operation and maintenance data requirements for specific pieces of equipment or building operating systems.

1.2 SUBMITTALS

A. Submittal Schedule: Comply with the following schedule for submitting operation and maintenance manuals:

1. Submit 1 copy of data in final form at least 15 days before final inspection. The Architect will return this copy within 15 days after final inspection, with comments.
2. After final inspection, make corrections or modifications to comply with the Architect's comments. Submit the specified number of copies of each approved manual to the Architect within 15 days of receipt of the Architect's comments.

B. Form of Submittal: Prepare operation and maintenance manuals in the form of an instructional manual for use by the Owner's operating personnel. Organize into suitable sets of manageable size. Where possible, assemble instructions for similar equipment into a single binder.

1. Binders: For each manual, provide heavy-duty, commercial-quality, 3-ring, vinyl-covered, loose-leaf binders, 2” size, sized to receive 8-1/2-by-11- inch (115-by-280-mm) paper. Provide a clear plastic sleeve on the spine to hold labels describing contents. Provide pockets in the covers to receive folded sheets.

a. Identify each binder on front and spine, with the printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter covered. Indicate volume number for multiple volume sets of manuals.

2. Dividers: Provide heavy paper dividers with celluloid-covered tabs for each separate Section. Mark each tab to indicate contents. Provide a typed description of the product and

major parts of equipment included in the Section on each divider.

3. Protective Plastic Jackets: Provide protective, transparent, plastic jackets designed to enclose diagnostic software for computerized electronic equipment.
4. Text Material: Where maintenance manuals require written material, use the manufacturer's standard printed material. If manufacturer's standard printed material is not available, provide specially prepared data, neatly typewritten, on 8-1/2-by-11-inch (115-by-280-mm), 20-lb/sq. ft. (75-g/sq. m) white bond paper.
5. Drawings: Where maintenance manuals require drawings or diagrams, provide reinforced, punched binder tabs on drawings and bind in with text.

    a. Where oversize drawings are necessary, fold drawings to the same size as text pages and use as a foldout.
    b. If drawings are too large to be used practically as a foldout, place the drawing, neatly folded, in front or rear pocket of binder. Insert a typewritten page indicating drawing title, description of contents, and drawing location at the appropriate location in the manual.

1.3 MANUAL CONTENT

A. In each manual include information specified in the individual Specification Section and the following information for each major component of building equipment and its controls:

1. General system or equipment description.
2. Design factors and assumptions.
3. Copies of applicable Shop Drawings and Product Data.
4. System or equipment identification, including:

    a. Name of manufacturer.
    b. Model number.
    c. Serial number of each component.
5. Operating instructions.
6. Emergency instructions.
7. Wiring diagrams.
8. Inspection and test procedures.
9. Maintenance procedures and schedules.
10. Precautions against improper use and maintenance.
11. Copies of warranties.
12. Repair instructions including spare parts listing.
13. Sources of required maintenance materials and related services.
14. Manual index.

B. Organize each manual into separate Sections for each piece of related equipment. As a minimum, each manual shall contain a title page; a table of contents; copies of Product Data, supplemented by Drawings and written text; and copies of each warranty, bond, and service contract issued.

1. Title Page: Provide a title page in a transparent, plastic envelope as the first sheet of each manual. Provide the following information:

    a. Subject matter covered by the manual.
    b. Name and address of the Project.
    c. Date of submittal.
    d. Name, address, and telephone number of the Contractor.

e. Name and address of the Architect.
f. Cross-reference to related systems in other operation and maintenance manuals.

2. Table of Contents: After title page, include a typewritten table of contents for each volume, arranged systematically according to the Project Manual format. Include a list of each product included, identified by product name or other appropriate identifying symbol and indexed to the content of the volume.

   a. Where a system requires more than one volume to accommodate data, provide a comprehensive table of contents for all volumes in each volume of the set.

3. General Information: Provide a general information Section immediately following table of contents, listing each product included in the manual, identified by product name. Under each product, list the name, address, and telephone number of the subcontractor or Installer and the maintenance contractor. Clearly delineate the extent of responsibility of each of these entities. Include a local source for replacement parts and equipment.
4. Product Data: Where the manuals include manufacturer's standard printed data, include only sheets that are pertinent to the part or product installed. Mark each sheet to identify each part or product included in the installation. Where the Project includes more than one item in a tabular format, identify each item, using appropriate references from the Contract Documents. Identify data that is applicable to the installation, and delete references to information that is not applicable.
5. Written Text: Prepare written text to provide necessary information where manufacturer's standard printed data is not available, and the information is necessary for proper operation and maintenance of equipment or systems. Prepare written text where it is necessary to provide additional information or to supplement data included in the manual. Organize text in a consistent format under separate headings for different procedures. Where necessary, provide a logical sequence of instruction for each operation or maintenance procedure.

6. Drawings: Provide specially prepared drawings where necessary to supplement manufacturer's printed data to illustrate the relationship of component parts of equipment or systems or to provide control or flow diagrams. Coordinate these drawings with information contained in project record drawings to assure correct illustration of the completed installation.

   a. Do not use original project record documents as part of operation and maintenance manuals.

7. Warranties, Bonds, and Service Contracts: Provide a copy of each warranty, bond, or service contract in the appropriate manual for the information of the Owner's operating personnel. Provide written data outlining procedures to follow in the event of product failure. List circumstances and conditions that would affect validity of warranty or bond.

1.4 MATERIAL AND FINISHES MAINTENANCE MANUAL

A. Submit 2 copies of each manual, in final form, on material and finishes to the Architect for distribution. Provide one section for architectural products, including applied materials and finishes. Provide a second section for products designed for moisture protection and products exposed to the weather.

   1. Refer to individual Specification Sections for additional requirements on care and maintenance of materials and finishes.

B. Architectural Products: Provide manufacturer's data and instructions on care and maintenance of architectural products, including applied materials and finishes.

1. Manufacturer's Data: Provide complete information on architectural products, including the following, as applicable:

a. Manufacturer's catalog number.
b. Size.
c. Material composition.
d. Color.
e. Texture.
f. Reordering information for specially manufactured products.

2. Care and Maintenance Instructions: Provide information on care and maintenance, including manufacturer's recommendations for types of cleaning agents to be used and methods of cleaning. Provide information on cleaning agents and methods that could prove detrimental to the product. Include manufacturer's recommended schedule for cleaning and maintenance.

C. Moisture Protection and Products Exposed to the Weather: Provide complete manufacturer's data with instructions on inspection, maintenance, and repair of products exposed to the weather or designed for moisture-protection purposes.

1. Manufacturer's Data: Provide manufacturer's data giving detailed information, including the following, as applicable:

a. Applicable standards.
b. Chemical composition.
c. Installation details.
d. Inspection procedures.
e. Maintenance information.
f. Repair procedures.

D. Not used.

1.5 EQUIPMENT AND SYSTEMS MAINTENANCE MANUAL

A. Submit 3 copies of each manual, in final form, on equipment and systems to the Architect for distribution. Provide separate manuals for each unit of equipment, each operating system, and each electric and electronic system.

1. Refer to individual Specification Sections for additional requirements on operation and maintenance of the various pieces of equipment and operating systems.

B. Equipment and Systems: Provide the following information for each piece of equipment, each building operating system, and each electric or electronic system.

1. Description: Provide a complete description of each unit and related component parts, including the following:

a. Equipment or system function.
b. Operating characteristics.
c. Limiting conditions.
d. Performance curves.
e. Engineering data and tests.
f. Complete nomenclature and number of replacement parts.

2. Manufacturer's Information: For each manufacturer of a component part or piece of equipment, provide the following:

   a. Printed operation and maintenance instructions.
   b. Assembly drawings and diagrams required for maintenance.
   c. List of items recommended to be stocked as spare parts.

3. Maintenance Procedures: Provide information detailing essential maintenance procedures, including the following:

   a. Routine operations.
   b. Troubleshooting guide.
   c. Disassembly, repair, and reassembly.
   d. Alignment, adjusting, and checking.

4. Operating Procedures: Provide information on equipment and system operating procedures, including the following:

   a. Startup procedures.
   b. Equipment or system break-in.
   c. Routine and normal operating instructions.
   d. Regulation and control procedures.
   e. Instructions on stopping.
   f. Shutdown and emergency instructions.
   g. Summer and winter operating instructions.
   h. Required sequences for electric or electronic systems.
   i. Special operating instructions.

5. Servicing Schedule: Provide a schedule of routine servicing and lubrication requirements, including a list of required lubricants for equipment with moving parts.
6. Controls: Provide a description of the sequence of operation and as-installed control diagrams by the control manufacturer for systems requiring controls.
7. Coordination Drawings: Provide each Contractor's Coordination Drawings.

   a. Provide as-installed, color-coded, piping diagrams, where required for identification.

8. Valve Tags: Provide charts of valve-tag numbers, with the location and function of each valve.
9. Circuit Directories: For electric and electronic systems, provide complete circuit directories of panelboards, including the following:

   a. Electric service.
   b. Controls.
   c. Communication.

C. Not used.

1.6 INSTRUCTIONS FOR THE OWNER'S PERSONNEL

A. Prior to final inspection, instruct the Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Provide instruction at mutually agreed upon times.

1. Use operation and maintenance manuals for each piece of equipment or system as the basis of instruction. Review contents in detail to explain all aspects of operation and maintenance.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 017823

SECTION 017840 - WARRANTIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for warranties required by the Contract Documents, including manufacturers standard warranties on products and special warranties.

1. Refer to the General Conditions for terms of the Contractor's period for correction of the Work.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 1 Section "Submittals" specifies procedures for submitting warranties.
2. Division 1 Section "Contract Closeout" specifies contract closeout procedures.
3. Divisions 2 through 16 Sections for specific requirements for warranties on products and installations specified to be warranted.
4. Certifications and other commitments and agreements for continuing services to Owner are specified elsewhere in the Contract Documents.

C. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the Work that incorporates the products. Manufacturer's disclaimers and limitations on product warranties do not relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the Contractor.

1.2 DEFINITIONS

A. Standard product warranties are preprinted written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to the Owner.

B. Special warranties are written warranties required by or incorporated in the Contract Documents, either to extend time limits provided by standard warranties or to provide greater rights for the Owner.

1.3 WARRANTY REQUIREMENTS

A. Related Damages and Losses: When correcting failed or damaged warranted construction, remove and replace construction that has been damaged as a result of such failure or must be removed and replaced to provide access for correction of warranted construction.

B. Reinstatement of Warranty: When Work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.

C. Replacement Cost: Upon determination that Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of the Contract Documents. The Contractor is responsible for the cost of replacing or rebuilding defective Work regardless of whether the Owner has benefited from use of the Work through a portion of its anticipated useful service life.

D. Owner's Recourse: Expressed warranties made to the Owner are in addition to implied warranties and shall not limit the duties, obligations, rights, and remedies otherwise available under the law. Expressed warranty periods shall not be interpreted as limitations on the time in which the Owner can enforce such other duties, obligations, rights, or remedies.

1. Rejection of Warranties: The Owner reserves the right to reject warranties and to limit selection to products with warranties not in conflict with requirements of the Contract Documents.

E. Where the Contract Documents require a special warranty, or similar commitment on the Work or part of the Work, the Owner reserves the right to refuse to accept the Work, until the Contractor presents evidence that entities required to countersign such commitments are willing to do so.

1.4 SUBMITTALS

A. Submit written warranties to the Architect prior to the date certified for Substantial Completion. If the Architect's Certificate of Substantial Completion designates a commencement date for warranties other than the date of Substantial Completion for the Work, or a designated portion of the Work, submit written warranties upon request of the Architect.

B. When the Contract Documents require the Contractor, or the Contractor and a subcontractor, supplier or manufacturer to execute a special warranty, prepare a written document that contains appropriate terms and identification, ready for execution by the required parties. Submit a draft to the Owner, through the Architect, for approval prior to final execution.

1. Refer to Divisions 1 through 33 Sections for specific content requirements and particular requirements for submitting special warranties.

C. Form of Submittal: At Final Completion compile 2 copies of each required warranty properly executed by the Contractor, or by the Contractor, subcontractor, supplier, or manufacturer. Organize the warranty documents into an orderly sequence by CSI designation.

D. Bind warranties and bonds in heavy-duty, commercial-quality, durable 3-ring, vinyl-covered loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch (115-by-280-mm) paper.

1. Provide heavy paper dividers with celluloid covered tabs for each separate warranty. Mark the tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product, and the name, address, and telephone number of the Installer.
2. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project title or name, and name of the Contractor.
3. When warranted construction requires operation and maintenance manuals, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.

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

END OF SECTION 017840

SECTION 022820 - TERMITE CONTROL

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes soil treatment for termite control.

1.2 SUBMITTALS

A. General: Submit the following according to Conditions of Contract and Division 1 Specification Sections.

B. Product data and application instructions.

C. Certification that products used comply with U.S. Environmental Protection Agency (EPA) regulations for termiticides.

1.3 QUALITY ASSURANCE

A. In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for preparing substrate and application.

B. Engage a professional pest control operator who is licensed according to regulations of governing authorities to apply soil treatment solution.

C. Use only termiticides that bear a federal registration number of the EPA and are approved by the Georgia EPD.

1.4 JOB CONDITIONS

A. Restrictions: Do not apply soil treatment solution until excavating, filling, and grading operations are completed, except as otherwise required in construction operations.

B. To ensure penetration, do not apply soil treatment to frozen or excessively wet soils or during inclement weather. Comply with handling and application instructions of the soil toxicant manufacturer.

1.5 WARRANTY

A. Warranty: Furnish written warranty, executed by Applicator and Contractor, certifying that applied soil termiticide treatment will prevent infestation of subterranean termites. If subterranean termite activity is discovered during warranty period, Contractor will re-treat soil and repair or replace damage caused by termite infestation.

B. Warranty Period: 5 years from date of the Architect’s Final Certificate.

C. The warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under requirements of the Contract Documents.

PART 2 - PRODUCTS

2.1 SOIL TREATMENT SOLUTION

A. General: Use an emulsible, concentrated termiticide that dilutes with water, specially formulated to prevent termite infestation. Fuel oil will not be permitted as a diluent. Provide a solution consisting of one of following chemical elements.

B. Products: Subject to compliance with requirements, provide one of the following:

1. Chloropyrifos:

a. Dursban TC, Dow Chemical Co.

2. Permathrin:

a. Dragnet FT, FMC Corp.
b. Torpedo, ICI Americas, Inc.

3. Cypermethrine:

a. Prevail FT, FMC Corp.
b. Demon, ICI Americas, Inc.

4. Fenvalerate:

a. Gold Coast Tribute, Du Pont.

5. Isofenphose:

a. Pryfon, Mobay Corp.

C. Dilute with water to concentration level recommended by manufacturer.

D. Other solutions may be used as recommended by Applicator if approved for intended application by local authorities having jurisdiction. Use only soil treatment solutions that are not harmful to plants.

PART 3 - EXECUTION

3.1 APPLICATION

A. Surface Preparation: Remove foreign matter that could decrease treatment effectiveness on areas to be treated. Loosen, rake, and level soil to be treated, except previously

compacted areas under slabs and foundations. Toxicants may be applied before placing compacted fill under slabs if recommended by toxicant manufacturer.

B. Application Rates: Apply soil treatment solution as follows:

1. Under slab-on-grade structures, treat soil before concrete slabs are placed, using

the following application rates:

a. Apply 4 gallons of chemical solution per 10 linear feet to soil in critical areas under slab, including entire inside perimeter of foundation walls, along both sides of interior partition walls, around plumbing pipes and electric conduit penetrating slab, and around interior column footers.

b. Apply 1 gallon of chemical solution per 10 sq. ft. as an overall treatment under slab and attached slab areas where fill is soil or unwashed gravel. Apply 1-1/2 gallon of chemical solution per 10 sq. ft. to areas where fill is washed gravel or other coarse absorbent material.

c. Apply 4 gallons of chemical solution per 10 linear feet of trench for each 12 inches of depth from grade to footing, along outside edge of building. Dig a trench 6 to 8 inches wide along outside of foundation to a depth of not less than 12 inches. Punch holes to top of footing at not more than 12 inches o.c. and apply chemical solution. Mix chemical solution with the soil as it is being replaced in the trench.

2. At expansion joints, control joints, and areas where slabs will be penetrated, apply at rate of 4 gallons per 10 linear feet of penetration.

C. Post signs in areas of application to warn workers that soil termiticide treatment has been applied. Remove signs after areas are covered by other construction.

D. Reapply soil treatment solution to areas disturbed by subsequent excavation, landscape grading, or other construction activities following application.

E. Disposal of toxicant material shall be as approved in the Federal Insecticide, Fungicide and Rodenticide Act.

END OF SECTION 022820

SECTION 02 41 13-SITE DEMOLITION

1. SCOPE:

Under this heading shall be included all operations necessary for demolition of the existing structures, foundations, site work and utilities as shown.

2. PROCEDURES:

The procedures proposed for the accomplishment of salvage and demolition work shall be submitted for review. The procedures shall provide for safe conduct of the work, careful removal and disposition of materials specified to be salvaged, protection of property which is to remain undisturbed, coordination with other work in progress, and timely disconnection of utility services. The submittal shall include a detailed description of the methods and equipment to be used for each operation, and the sequence of operation. The Contractor shall strictly adhere to the haul route for disposal as shown on the location plan.

3. STRUCTURES:

All existing structures shall be completely removed where denoted on the plans. All foundations and slabs shall be broken up and removed from the site. Sidewalks, curbs, gutters, streets and street light bases shall be completely removed. It is not anticipated that piling will be encountered under any of the structures to be removed; however, where piling are encountered they shall be removed to a point three feet below existing ground.

4. RAILROAD TRACKS:

All railroad tracks where shown to be removed will be coordinated with the Engineer as to it disposition. The rail, hardware and appurtenances will remain the property of the Owner. All rail, hardware and crossties that can be reused will be stockpiled at a separate location from the nonusable items. Stockpile areas are designated on the plans.

5. DUST CONTROL:

The amount of dust resulting from demolition shall be controlled to prevent the spread of dust to occupied portions of the site and to avoid creation of a nuisance in the surrounding area. Use of water will not be permitted when it will result in, or create, hazardous or objectionable conditions such as ice, flooding and pollution.

6. DISCONNECTION OF UTILITY SERVICES:

Utilities shall be disconnected at the points indicated. Where such disconnection will interrupt the utility services to an area not included in the Contract, arrangements for such interruption shall be reviewed with the Engineer at least 72 hours in advance of the interruption. Where water and sewer lines are disconnected or removed the remaining utility shall be plugged and left in such a manner that reconnection can be made.

7. BURNING:

The use of burning at the project site for the disposal of refuse and debris will not be permitted.

8. PROTECTION OF EXISTING WORK:

Existing work to remain shall be protected from damage. Work damaged by the Contractor shall be repaired or restored to its original condition or acceptable equivalent.

9. EXISTING UTILITIES:

a) Utility Services.

Disconnections of utility services shall be coordinated so as not to affect service to other areas outside of the project limits. The owners of all utilities must be contacted prior to proceeding with work.

b) Utilities.

Remove or abandon all existing utilities as indicated. When utility lines are encountered that are not indicated on the drawings, they shall be removed or abandoned to the extent that they would project into or interfere with the new construction.

10. DISPOSITION OF MATERIAL:

a) Title to Materials.

Title to all materials and equipment to be demolished, except railroad trackage, track hardware, crossties to be salvaged and historical items, is vested in the Contractor upon receipt of notice to proceed. The Owner will not be responsible for the condition, loss or damage to such property after notice to proceed.

b) Material for Salvage.

Material that is salvageable will be removed from the project site by the Contractor.

c) Unsalvageable Materials.

Concrete, masonry, and other noncombustible materials, other than concrete permitted to remain in place, shall be disposed of by the Contractor off the property. Other materials such as nonuseable crossties, lumber, etc. shall be removed from the site and property of the Owner by the Contractor.

11. HISTORICAL ITEMS:

There are no known historical items on the project site; however, if historical items are discovered, remove historical items in a manner to prevent damage.

Turn over historical items, if found, to the Owner for disposition such as:

Corner Stones
Contents of Corner Stones
Document Boxes wherever located on the site.
Belgian Block

12. CLEANUP:

Remove debris and rubbish from the site as soon as practicable. Do not allow debris or rubbish to accumulate in buildings or on site. Remove and transport debris in a manner as to prevent spillage on streets or adjacent areas.

13. HAUL ROAD:

The haul roads as designated on the plans will be strictly adhered to for disposal and stockpile of material.

14. MEASUREMENT AND PAYMENT:

Measurement and payment for work under this Section shall be in accordance with Section 01150.

SECTION 024119 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Demolition and removal of selected portions of building or structure.

B. Related Requirements:

1. Section 011000 "Summary of Work" for restrictions on use of the premises, Owner-occupancy requirements, and phasing requirements.
2. Section 014001 "Cutting and Patching" for cutting and patching procedures.

1.3 DEFINITIONS

A. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged or reinstalled.

B. Remove and Salvage: Detach items from existing construction, in a manner to prevent damage, and deliver to Owner ready for reuse.

C. Remove and Reinstall: Detach items from existing construction, in a manner to prevent damage, prepare for reuse, and reinstall where indicated.

D. Existing to Remain: Leave existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.

E. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.

1.4 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition waste becomes property of Contractor.

B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.

1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.5 PREINSTALLATION MEETINGS

A. Predemolition Conference: Conduct conference at Project site.

1. Inspect and discuss condition of construction to be selectively demolished.
2. Review structural load limitations of existing structure.
3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
5. Review areas where existing construction is to remain and requires protection.
6. Discuss setting up a second meeting at the site after ceiling tile and grid removal. The owner will walk the site and will determine what HVAC equipment is to be salvaged before HVAC demolition occurs in these areas.

1.6 INFORMATIONAL SUBMITTALS

A. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection, for dust control and, for noise control. Indicate proposed locations and construction of barriers.

B. Schedule of Selective Demolition Activities: Indicate the following:

1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's on-site operations are uninterrupted.
2. Interruption of utility services. Indicate how long utility services will be interrupted.
3. Coordination for shutoff, capping, and continuation of utility services.
4. Use of elevator and stairs.
5. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.

C. Predemolition Photographs or Video: Show existing conditions of adjoining construction, including finish surfaces, that might be misconstrued as damage caused by demolition operations

1.7 FIELD CONDITIONS

A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.

B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
   1. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.

E. Hazardous Materials: Present in buildings and structures to be selectively demolished. A report on the presence of hazardous materials is on file for review and use. Examine report to become aware of locations where hazardous materials are present.

   1. Hazardous material remediation is specified elsewhere in the Contract Documents.
   2. Do not disturb hazardous materials or items suspected of containing hazardous materials except under procedures specified elsewhere in the Contract Documents.
   3. Owner will provide material safety data sheets for suspected hazardous materials that are known to be present in buildings and structures to be selectively demolished because of building operations or processes performed there.

F. Storage or sale of removed items or materials on-site is not permitted.

G. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

   1. Maintain fire-protection facilities in service during selective demolition operations.

1.8 COORDINATION

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

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ASSE A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

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

B. Review Project Record Documents of existing construction or other existing condition and hazardous material information provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.

C. Perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective building demolition operations.

1. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

D. Verify that hazardous materials have been remediated before proceeding with building demolition operations.

E. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs or video.

1. Inventory and record the condition of items to be removed and salvaged. Provide photographs or video of conditions that might be misconstrued as damage caused by salvage operations.
2. Before selective demolition or removal of existing building elements that will be reproduced or duplicated in final Work, make permanent record of measurements, materials, and construction details required to make exact reproduction.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

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

B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utility services and mechanical/electrical systems serving areas to be selectively demolished.

1. Owner will arrange to shut off indicated services/systems when requested by Contractor.
2. Arrange to shut off utilities with utility companies.
3. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
4. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated on Drawings to be removed.

    a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
    b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material and leave in place.
    c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
    d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.

e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
f. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
g. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material and leave in place.

3.3 PROTECTION

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

1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
4. Cover and protect furniture, furnishings, and equipment that have not been removed.
5. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Section 015000 "Temporary Facilities and Controls."

B. Temporary Shoring: Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

1. Strengthen or add new supports when required during progress of selective demolition.

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

3.4 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden

space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.

5. Maintain fire watch during and for at least 2 hours after flame-cutting operations.
6. Maintain adequate ventilation when using cutting torches.
7. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
8. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
9. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
10. Dispose of demolished items and materials promptly.

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

C. Removed and Salvaged Items:

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

D. Removed and Reinstalled Items:

1. Clean and repair items to functional condition adequate for intended reuse.
2. Pack or crate items after cleaning and repairing. Identify contents of containers.
3. Protect items from damage during transport and storage.
4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

E. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. 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.

3.5 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

A. Concrete: Demolish in small sections. Using power-driven saw, cut concrete to a depth of at least 3/4 inch at junctures with construction to remain. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete. Neatly trim openings to dimensions indicated.

B. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals using power-driven saw, and then remove concrete between saw cuts.

C. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, and then remove masonry between saw cuts.

D. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, and then break up and remove.

E. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI's "Recommended Work Practices for the Removal of Resilient Floor Coverings." Do not use methods requiring solvent-based adhesive strippers.

3.6 DISPOSAL OF DEMOLISHED MATERIALS

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

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

B. Burning: Do not burn demolished materials.

3.7 CLEANING

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

3.8 SELECTIVE DEMOLITION SCHEDULE

A. Remove: As indicated on drawings.

END OF SECTION 024119

SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Concrete formwork.

B. Floors and slabs on grade.

C. Concrete foundation walls.

D. Concrete reinforcement.

E. Joint devices associated with concrete work.

F. Concrete curing.

1.2 RELATED REQUIREMENTS

A. Section 033511 - Concrete Floor Finishes: Densifiers, hardeners, applied coatings, and polishing.

B. Section 079200 - Joint Sealants: Products and installation for sealants and joint fillers for saw cut joints and isolation joints in slabs.

1.3 REFERENCE STANDARDS

A. ACI CODE-318 - Building Code Requirements for Structural Concrete and Commentary; 2019 (Reapproved 2022).

B. ACI PRC-211.1 - Selecting Proportions for Normal-Density and High Density-Concrete - Guide; 2022.

C. ACI PRC-302.1 - Guide to Concrete Floor and Slab Construction; 2015.

D. ACI PRC-304 - Guide for Measuring, Mixing, Transporting, and Placing Concrete; 2000 (Reapproved 2009).

E. ACI PRC-305 - Guide to Hot Weather Concreting; 2020.

F. ACI PRC-306 - Guide to Cold Weather Concreting; 2016.

G. ACI PRC-308 - Guide to External Curing of Concrete; 2016.

H. ACI PRC-347 - Guide to Formwork for Concrete; 2014 (Reapproved 2021).

I. ACI SPEC-117 - Specification for Tolerances for Concrete Construction and Materials; 2010 (Reapproved 2015).

J. ACI SPEC-301 - Specifications for Concrete Construction; 2020.

K. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2022.

L. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2024.

M. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2023.

N. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens; 2023.

O. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2024.

P. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 50 mm [2 in.] Cube Specimens); 2023.

Q. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete; 2020.

R. ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete; 2020.

S. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete; 2010a (Reapproved 2016).

T. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete; 2019.

U. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete; 2019, with Editorial Revision (2022).

V. ASTM C685/C685M - Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing; 2017.

W. ASTM C827/C827M - Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens of Cementitious Mixtures; 2023.

X. ASTM C881/C881M - Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete; 2020a.

Y. ASTM C1059/C1059M - Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete; 2021.

Z. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink); 2020.

AA. ASTM C150/C150M - Standard Specification for Portland Cement; 2022.

BB. ASTM C1602/C1602M - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete; 2022.

CC. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Asphalt Types); 2023.

DD. ASTM D2103 - Standard Specification for Polyethylene Film; 2023a.

EE. ASTM E1155/E1155M - Standard Test Method for Determining FF Floor Flatness and FL Floor Levelness Numbers; 2023.

FF. ASTM E1155M - Standard Test Method for Determining FF Floor Flatness and FL Floor Levelness Numbers (Metric); 2014.

GG. ASTM E1643 - Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs; 2018a.

HH. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs; 2017 (Reapproved 2023).

II. ICRI 310.2R - Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, Polymer Overlays, and Concrete Repair; 2013.

1.4 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Submit manufacturers' data on manufactured products showing compliance with specified requirements and installation instructions.

1. For curing compounds, provide data on method of removal in the event of incompatibility with floor covering adhesives.
2. For membrane-forming, moisture emission-reducing, curing and sealing compound, provide manufacturer's installation instructions,.

C. Mix Design: Submit proposed concrete mix design.

1. Indicate proposed mix design complies with requirements of ACI SPEC-301, Section 4 - Concrete Mixtures.
2. Indicate proposed mix design complies with requirements of ACI CODE-318, Chapter 5 - Concrete Quality, Mixing and Placing.
3. Indicate proposed mix design complies with fiber reinforcing manufacturer's written recommendations.
4. Indicate proposed mix design complies with admixture manufacturer's written recommendations.
5. Indicate proposed mix design complies with expansive component manufacturer's written recommendations.

D. Samples: Submit samples of underslab vapor retarder to be used.

E. Samples: Submit two, 12 inch long samples of waterstops and construction joint devices.

F. Testing

1. Concrete strength tests shall be specified, with cylinders being made by certified technicians. Slump testing shall also be required to ensure that properly mixed concrete is being placed. All costs associated with the initial concrete testing shall be the responsibility of the Owner. Any additional or secondary testing, that may be required due to improper installation and/or unsatisfactory test results, shall be the responsibility of the General Contractor.

G. Test Reports: Submit report for each test or series of tests specified.

H. Manufacturer's Installation Instructions: For concrete accessories, indicate installation procedures and interface required with adjacent construction.

I. Project Record Documents: Accurately record actual locations of embedded utilities and components that will be concealed from view upon completion of concrete work.

J. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.5 QUALITY ASSURANCE

A. Perform work of this section in accordance with ACI SPEC-301 and ACI CODE-318.

1. Maintain one copy of each document on site.

B. Follow recommendations of ACI PRC-305 when concreting during hot weather.

C. Follow recommendations of ACI PRC-306 when concreting during cold weather.

PART 2 PRODUCTS

2.1 FORMWORK

A. Formwork Design and Construction: Comply with guidelines of ACI PRC-347 to provide formwork that will produce concrete complying with tolerances of ACI SPEC-117.

B. Form Materials: Contractor's choice of standard products with sufficient strength to withstand hydrostatic head without distortion in excess of permitted tolerances.

1. Form Facing for Exposed Finish Concrete: Contractor's choice of materials that will provide smooth, stain-free final appearance.
2. Earth Cuts: Do not use earth cuts as forms for vertical surfaces. Natural rock formations that maintain a stable vertical edge may be used as side forms.
3. Form Coating: Release agent that will not adversely affect concrete or interfere with application of coatings.

4. Form Ties: Cone snap type that will leave no metal within 1-1/2 inches of concrete surface.

2.2 CONCRETE SLAB REINFORCING

A. Provide welded wire mesh in interior concrete slabs and exterior concrete where indicated on the drawings and as specified. Synthetic fiber concrete reinforcement may be used in lieu of welded wire mesh for all exterior site concrete

2.3 REINFORCEMENT MATERIALS

A. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi).

1. Type: Deformed billet-steel bars.
2. Finish: Unfinished, unless otherwise indicated.

B. Steel Welded Wire Reinforcement (WWR): Galvanized, plain type, ASTM A1064/A1064M.

1. Form: Flat Sheets.

C. Reinforcement Accessories:

1. Tie Wire: Annealed, minimum 16 gauge, 0.0508 inch.
2. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for adequate support of reinforcement during concrete placement.
3. Provide stainless steel, galvanized, plastic, or plastic coated steel components for placement within 1-1/2 inches of weathering surfaces.
4. Coupler Systems: Mechanical devices for splicing reinforcing bars; capable of developing full steel reinforcing design strength in tension and compression.

2.4 READY-MIXED CONCRETE

A. The minimum specified compressive strength shall be at least 3,000 p.s.i. at 28 days. Use #57 size coarse aggregate, unless otherwise specified.

B. Concrete which will be exposed to freezing and thawing while wet shall be air-entrained with a minimum of 4% air by volume.

C. Concrete produced above 70 degrees F shall contain an ASTM C494 type D admixture.

2.5 CONCRETE MATERIALS

A. Cement: ASTM C150/C150M, Type I - Normal Portland type.

1. Acquire cement for entire project from same source.

B. Fine and Coarse Aggregates: ASTM C33/C33M.

1. Acquire aggregates for entire project from same source.

C. Fly Ash: No fly ash shall be substituted for hydraulic (Portland) cement content.

D. Water: ASTM C1602/C1602M; clean, potable, and not detrimental to concrete.

2.6 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 C260/C260M.

1. Manufacturers:

a. Master Builders Solutions; MasterAir Series: www.master-builders-solutions.com/en-us/#sle.

C. High Range Water Reducing Admixture: ASTM C494/C494M Type F.

D. Water Reducing and Retarding Admixture: ASTM C494/C494M Type D.

E. Retarding Admixture: ASTM C494/C494M Type B.

F. Water Reducing Admixture: ASTM C494/C494M Type A.

2.7 ACCESSORY MATERIALS

A. Underslab Vapor Retarder:

1. Sheet Material: ASTM E1745, Class A; stated by manufacturer as suitable for installation in contact with soil or granular fill under concrete slabs. Single-ply polyethylene is prohibited.
2. Accessory Products: Vapor retarder manufacturer's recommended tape, adhesive, mastic, prefabricated boots, etc., for sealing seams and penetrations.

B. Non-Shrink Cementitious Grout: Premixed compound consisting of nonmetallic aggregate, cement, water reducing and plasticizing agents.

1. Grout: Comply with ASTM C1107/C1107M.
2. Height Change, Plastic State; when tested in accordance with ASTM C827/C827M:

a. Maximum: Plus 4 percent.
b. Minimum: Plus 1 percent.

3. Minimum Compressive Strength at 48 Hours, ASTM C109/C109M: 2,000 pounds per square inch.
4. Minimum Compressive Strength at 28 Days, ASTM C109/C109M: 7,000 pounds per square inch.

5. Products containing aluminum powder are not permitted.

2.8 BONDING AND JOINTING PRODUCTS

A. Latex Bonding Agent: Non-redispersable acrylic latex, complying with ASTM C1059/C1059M, Type II.

B. Epoxy Bonding System:

C. 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.

D. Slab Isolation Joint Filler: 1/2-inch thick, height equal to slab thickness, with removable top section forming 1/2-inch deep sealant pocket after removal.

1. Material: ASTM D1751, cellulose fiber.

E. Slab Contraction Joint Device: Preformed linear strip intended for pressing into wet concrete to provide straight route for shrinkage cracking.

F. Slab Construction Joint Devices: Combination keyed joint form and screed, galvanized steel, with rectangular or round knockout holes for conduit or rebar to pass through joint form 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.

2.9 CURING MATERIALS

A. Evaporation Reducer: Liquid thin-film-forming compound that reduces rapid moisture loss caused by high temperature, low humidity, and high winds; intended for application immediately after concrete placement.

B. Curing Compound, Naturally Dissipating: Clear, water-based, liquid membrane-forming compound; complying with ASTM C309.

C. Curing Agent, Water-Cure Equivalent Type: Clear, water-based, non-film-forming, liquid-water cure replacement agent.

1. Comply with ASTM C309 standards for water retention.
2. Compressive Strength of Treated Concrete: Equal to or greater than strength after 14-day water cure when tested in accordance with ASTM C39/C39M.
3. VOC Content: Zero.

D. Resin Curing Compound: Solvent-based liquid, white pigmented, membrane-forming.

1. For use on exterior slabs. When slab will be painted, sealed, topped, or receive other applied finish, completely remove curing compound after curing is complete and before finish coatings are applied.
2. Comply with ASTM C309, Type 2, Classes A and B.
3. VOC Content: Less than 350 g/L.
4. Solids Content: 20 percent, minimum.

E. Curing Compound, Non-Dissipating: Liquid, membrane-forming, clear, nonyellowing acrylic; complying with ASTM C309.

F. Curing and Sealing Compound, Low Gloss: Liquid, membrane-forming, clear, non-yellowing acrylic; complying with ASTM C1315 Type 1 Class A.

G. Moisture-Retaining Sheet: ASTM C171.

1. Curing paper, regular.
2. Polyethylene film, white opaque, minimum nominal thickness of 4 mil, 0.004 inch.
3. White-burlap-polyethylene sheet, weighing not less than 3.8 ounces per square yard.

H. Polyethylene Film: ASTM D2103, 4 mil, 0.004 inch thick, clear.

I. Water: Potable, not detrimental to concrete.

2.10 CONCRETE MIX DESIGN

A. Proportioning Normal Weight Concrete: Comply with ACI PRC-211.1 recommendations.

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 SPEC-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 PRC-211.1 and at rates recommended or required by manufacturer.

D. Normal Weight Concrete:

1. Compressive Strength, when tested in accordance with ASTM C39/C39M at 28 days: 3,000 pounds per square inch.
2. Water-Cement Ratio: Maximum 45 percent by weight.
3. Maximum Aggregate Size: 5/8 inch.

2.11 MIXING

A. On Project Site: Mix in drum type batch mixer, complying with ASTM C685/C685M. Mix each batch not less than 1-1/2 minutes and not more than 5 minutes.

B. Transit Mixers: Comply with ASTM C94/C94M.

C. Adding Water: If concrete arrives on-site with slump less than suitable for placement, do not add water that exceeds the maximum water-cement ratio or exceeds the maximum permissible slump.

D. Do not use expansive component in same concrete batch with MVRA or PIA.

E. Do not use shrinkage-reducing admixture (SRA) in same concrete batch with MVRA or PIA.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify lines, levels, and dimensions before proceeding with work of this section.

3.2 PREPARATION

A. Formwork: Comply with requirements of ACI SPEC-301. Design and fabricate forms to support all applied loads until concrete is cured and for easy removal without damage to concrete.

B. Verify that forms are clean and free of rust before applying release agent.

C. Coordinate placement of embedded items with erection of concrete formwork and placement of form accessories.

D. Prepare existing concrete surfaces to be repaired according to ICRI 310.2R, CSP 6.

E. Where new concrete is to be bonded to previously placed concrete, prepare existing surface by cleaning and applying bonding agent in according to bonding agent manufacturer's instructions.

1. Use epoxy bonding system for bonding to damp surfaces, for structural load-bearing applications, and where curing under humid conditions is required.
2. Use latex bonding agent only for non-load-bearing applications.

F. 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.

G. Interior Slabs on Grade: Install vapor retarder under interior slabs on grade. Comply with ASTM E1643. Lap joints minimum 6 inches. Seal joints, seams and penetrations watertight with manufacturer's recommended products and follow manufacturer's written instructions. Repair damaged vapor retarder before covering.

1. Vapor Retarder Over Granular Fill: Install compactible granular fill before placing vapor retarder as indicated on drawings. Do not use sand.

3.3 INSTALLING REINFORCEMENT AND OTHER EMBEDDED ITEMS

A. Comply with requirements of ACI SPEC-301. Clean reinforcement of loose rust and mill scale, and accurately position, support, and secure in place to achieve not less than minimum concrete coverage required for protection.

B. Install welded wire reinforcement in maximum possible lengths, and offset end laps in both directions. Splice laps with tie wire.

3.4 PLACING CONCRETE

A. Place concrete in accordance with ACI PRC-304.

B. Place concrete for floor slabs in accordance with ACI PRC-302.1.

C. Notify Architect not less than 24 hours prior to commencement of placement operations.

D. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.

E. Ensure reinforcement, inserts, waterstops, embedded parts, and formed construction joint devices will not be disturbed during concrete placement.

F. Place concrete continuously without construction (cold) joints wherever possible; where construction joints are necessary, before next placement prepare joint surface by removing laitance and exposing the sand and sound surface mortar, by sandblasting or high-pressure water jetting.

G. Finish floors level and flat, unless otherwise indicated, within the tolerances specified below.

H. Concrete slab areas shall be depressed 2" for ceramic tile setting bed in gang toilet rooms, 2” for quarry tile setting bed in kitchen areas, and 5" for freezer/cooler setting and leveling at kitchens. (Thin-set installation shall be used for ceramic tile at individual toilet rooms and at sink/wet areas in classrooms, and for all areas of porcelain tile flooring.)

I. Concrete floor slabs shall be formed level to within 1/8" in 10'-0", unless otherwise indicated.

3.5 SLAB JOINTING

A. Locate joints as indicated on drawings.

B. Anchor joint fillers and devices to prevent movement during concrete placement.

C. Isolation Joints: Use preformed joint filler with removable top section for joint sealant, total height equal to thickness of slab, set flush with top of slab.

D. Load Transfer Construction and Contraction Joints: Install load transfer devices as indicated; saw cut joint at surface as indicated for contraction joints.

E. Saw Cut Contraction Joints: Saw cut joints before concrete begins to cool, within 4 to 12 hours after placing; use 3/16 inch thick blade and cut at least 1 inch deep but not less than one quarter (1/4) the depth of the slab.

F. Construction Joints: Where not otherwise indicated, use metal combination screed and key form, with removable top section for joint sealant.

3.6 FLOOR FLATNESS AND LEVELNESS TOLERANCES

A. An independent testing agency, as specified in Section 014000, will inspect finished slabs for compliance with specified tolerances.

B. Minimum F(F) Floor Flatness and F(L) Floor Levelness Values:

1. Exposed to View and Foot Traffic: F(F) of 20; F(L) of 15, on-grade only.
2. Under Thick-Bed Tile: F(F) of 20; F(L) of 15, on-grade only.
3. Under Carpeting: F(F) of 25; F(L) of 20, on-grade only.
4. Under Thin Resilient Flooring and Thinset Tile: F(F) of 35; F(L) of 25, on-grade only.

C. Measure F(F) Floor Flatness and F(L) Floor Levelness in accordance with ASTM E1155/E1155M (ASTM E1155M), within 48 hours after slab installation; report both composite overall values and local values for each measured section.

D. Correct the slab surface if composite overall value is less than specified and if local value is less than two-thirds of specified value or less than F(F) 13/F(L) 10.

E. Correct defects by grinding or by removal and replacement of the defective work. Areas requiring corrective work will be identified. Re-measure corrected areas by the same process.

3.7 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 ACI PRC-302.1 and as follows:

1. Exterior Concrete:

a. All exterior concrete shall be floated, then receive a fine broom finish using a push broom with stiff bristles, perpendicular to the path of travel.

b. Any exterior concrete scheduled to receive a textured coating shall be closely monitored from specifications through construction to ensure that no materials or techniques are utilized that will inhibit in any manner the bond of the coating.

2. Interior Concrete:

a. All exposed interior concrete shall have a hard steel trowel finish and any curing compound/sealer used must not prohibit adhesion of any future floor finish or coatings, particularly elastomeric gym flooring.

3. Surfaces to Receive Thick Floor Coverings: "Wood float" as described in ACI PRC-302.1; thick floor coverings include quarry tile, ceramic tile, and Portland cement terrazzo with full bed setting system.

4. Surfaces to Receive Thin Floor Coverings: "Steel trowel" as described in ACI PRC-302.1; thin floor coverings include carpeting, resilient flooring, seamless flooring, resinous matrix terrazzo, thin set quarry tile, and thin set ceramic tile.

5. Decorative Exposed Surfaces: Trowel as described in ACI PRC-302.1; take measures necessary to avoid black-burnish marks; decorative exposed surfaces include surfaces to be stained or dyed, pigmented concrete, surfaces to receive liquid hardeners, surfaces to receive dry-shake hardeners, surfaces to be polished, and all other exposed slab surfaces.

6. Other Surfaces to Be Left Exposed: Trowel as described in ACI PRC-302.1, minimizing burnish marks and other appearance defects.

E. In areas with floor drains, maintain floor elevation at walls; pitch surfaces uniformly to drains at 1:100 nominal.

3.8 CURING AND PROTECTION

A. Comply with requirements of ACI PRC-308. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.

B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

1. Normal concrete: Not less than seven days.

C. Formed Surfaces: Cure by moist curing with forms in place for full curing period.

D. Surfaces Not in Contact with Forms:

1. Slabs and Floors To Receive Adhesive-Applied Flooring: Curing compounds and other surface coatings are usually considered unacceptable by flooring and adhesive manufacturers. If such materials must be used, either obtain the approval of the flooring and adhesive manufacturers prior to use or remove the surface coating after curing to flooring manufacturer's satisfaction.

2. Initial Curing: Start as soon as free water has disappeared and before surface is dry. Keep continuously moist for not less than three days by water ponding, water-saturated sand, water-fog spray, or saturated burlap.

    a. Spraying: Spray water over floor slab areas and maintain wet.
    b. Saturated Burlap: Saturate burlap-polyethylene and place burlap-side down over floor slab areas, lapping ends and sides; maintain in place.

3. Final Curing: Begin after initial curing but before surface is dry.

    a. Moisture-Retaining Sheet: Lap strips not less than 3 inches and seal with waterproof tape or adhesive; secure at edges.
    b. Curing Compound: Apply in two coats at right angles, using application rate recommended by manufacturer.

3.9 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 014000 - Quality Requirements.

B. Provide free access to concrete operations at project site and cooperate with appointed firm.

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 compliance with specified requirements.

E. Compressive Strength Tests: ASTM C39/C39M, for each test, mold and cure three concrete test cylinders. Obtain test samples for every 100 cubic yards or less of each class of concrete placed.

F. Take one additional test cylinder during cold weather concreting, cured on job site under same conditions as concrete it represents.

G. Perform one slump test for each set of test cylinders taken, following procedures of ASTM C143/C143M.

3.10 DEFECTIVE CONCRETE

A. Test Results: The testing agency shall report test results in writing to Architect and Contractor within 24 hours of test.

B. Defective Concrete: Concrete not complying with required lines, details, dimensions, tolerances or specified requirements.

C. Repair or replacement of defective concrete will be determined by the Architect. The cost of additional testing shall be borne by Contractor when defective concrete is identified.

D. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Architect for each individual area.

3.11 PROTECTION

A. Do not permit traffic over unprotected concrete floor surface until fully cured.

END OF SECTION 033000

SECTION 033543 – POLISHED CONCRETE FINISHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Liquid floor treatments.
   2. Polished concrete surface finish requirements.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Verification: Actual sample of finished products for each type of sealer.

1.3 QUALITY ASSURANCE

A. Polished Concrete Standards: Comply with ACI 310.1.

1.4 FIELD CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as needed for other construction activities.

B. Ambient Conditions: Ensure installation location and Project ambient conditions comply with manufacturers written instructions.

PART 2 - PRODUCTS

2.1 LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatments for Polished Concrete Finish: Clear liquid materials for the applications of cleaning solutions, densifiers, and sealers that strengthen or protect polished concrete surfaces.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. ARDEX Americas.
      b. Euclid Chemical Company; a subsidiary of RPM International, Inc.
      c. H & C Decorative Concrete Products; a brand of Sherwin-Williams Co.
      d. MAPEI Corporation.

2.2 POLISHED CONCRETE SURFACE FINISH REQUIREMENTS

A. Concrete Appearance Levels: Level 1: Flat (Ground) up to 100-grit polish; DOI 0 to 9; Haze Reading less than 10.

B. Slip Resistance: Minimum Dynamic Coefficient of Friction (DCOF) of 0.42. Provide required slip resistance based on final gloss level and determined by the Concrete Polishing Council.

2.3 ACCESSORIES

A. Repair Materials: As recommended in writing by manufacturer to repair and fill cracks, and repair surfaces compatible with polishing materials.

B. Water: Potable.

C. Cleaning Agents: As recommended in writing by manufacturer.

2.4 POLISHING EQUIPMENT

A. Equipment and Supplies: Provide equipment and supplies, not limited to, the concrete grinding and concrete sealing equipment for the concrete finishing Work.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that concrete substrates are acceptable for grinding, polishing and product installation as recommended by manufacturer.

B. Do not begin Work until unsatisfactory conditions have been addressed and corrected.

3.2 PREPARATION

A. Verify that concrete substrate preparation is in accordance with manufacturer's written instructions.

B. Clean surfaces free of dust, dirt and other contaminates incompatible with liquids applied products and polishing.

C. Clean and seal cracks as recommended by manufacturer.

D. Prepare, clean and fill joints with joint filler as recommended in writing by manufacturer.

E. Clean surface completely of any dust with cleaning solution as recommended in writing by manufacturer.

3.3 APPLICATION

A. Machine grind floor surfaces progressively to receive aggregate and apply sealers to levels indicated to match approved sample.

B. Complete edges of floor finish that adjoins surrounding floor areas in a sharp and clean manner.

C. Neutralize and clean sealed floor surfaces.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing and inspecting agency to perform tests at three random locations for areas up to 100 sq. ft. and inspections and to submit reports.

B. Verify compliance of slip resistance to comply with specified slip-resistance rating.

C. Prepare test and inspection reports.

3.5 CLEANING AND PROTECTION

A. Control and dispose of waste products produced by grinding and polishing operations.

B. Protect installed sealed concrete surfaces from damage during construction in accordance with manufacturer's written instructions.

END OF SECTION 033543

SECTION 033900 - SEALED CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Concrete Sealer.

1.2 ACTION SUBMITTALS

A. Product Data: Submit product data showing material proposed. Submit sufficient information to determine compliance with the Drawings and Specifications. Product data shall include, but shall not be limited to, manufacturer's descriptive literature and product technical data sheet, and product specifications for each product. Submit the following:
   1. Preparation and concrete grinding procedures.
   2. Joint filling, crack repair, and surface repair products and protocols.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1.4 FIELD CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as needed for other construction activities.

B. Ambient Conditions: Ensure installation location and Project ambient conditions comply with manufacturers written instructions.

PART 2 - PRODUCTS

2.1 SEALER

A. Concrete Sealer: Acrylic concrete sealer designed to seal and protect interior or exterior colored or uncolored concrete, stained concrete, or other cementitious surfaces with minimum film thickness.

B. VOC Content: For field applications that are inside the weatherproofing system, verify paints and coatings comply with VOC content limits of authorities having jurisdiction and the following VOC content limits:

   1. Primers, Sealers, and Undercoaters: 100 g/L.

2. Floor Coatings: 100 g/L.

2.2 ACCESSORIES

A. Repair Materials: As recommended in writing by manufacturer to repair and fill cracks, and repair surfaces compatible with polishing materials.

B. Water: Potable.

C. Cleaning Agents: As recommended in writing by manufacturer.

2.3 POLISHING EQUIPMENT

A. Equipment and Supplies: Provide equipment and supplies, not limited to, the concrete grinding and equipment for the concrete finishing Work.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that concrete substrates are acceptable for grinding, polishing and product installation as recommended by manufacturer.

B. Do not begin Work until unsatisfactory conditions have been addressed and corrected.

3.2 PREPARATION

A. Verify that concrete substrate preparation is in accordance with manufacturer's written instructions.

B. Clean surfaces free of dust, dirt and other contaminates.

C. Clean and seal cracks as recommended by manufacturer.

D. Prepare, clean and fill joints with joint filler as recommended in writing by manufacturer.

E. Clean surface completely of any dust with cleaning solution as recommended in writing by manufacturer.

3.3 APPLICATION

A. Machine grind floor surfaces progressively to receive aggregate appearance levels per manufacturer’s written instructions.

3.4 SEALER

A. Concrete Sealer: Install per manufacturer’s written installation instructions.

3.5 CLEANING AND PROTECTION

A. Control and dispose of waste products produced by grinding operations.

B. Protect installed sealed concrete surfaces from damage during construction in accordance with manufacturer's written instructions.

END OF SECTION 033900

SECTION 042000 - UNIT MASONRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Concrete masonry units.
2. Mortar and grout.
3. Steel reinforcing bars.
4. Masonry-joint reinforcement.
5. Ties and anchors.
6. Embedded flashing.
7. Miscellaneous masonry accessories.
8. Masonry-cell fill.

B. Products Installed but not Furnished under This Section:

1. Cast-stone trim in unit masonry.
2. Steel lintels in unit masonry.
3. Steel shelf angles for supporting unit masonry.
4. Cavity wall insulation.

1.3 DEFINITIONS

A. CMU(s): Concrete masonry unit(s).

B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.4 PREINSTALLATION MEETINGS

A. Pre-installation Conference: Conduct at the project site.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For the following:

1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
2. Stone Trim Units: Show sizes, profiles, and locations of each stone trim unit required.
3. Reinforcing Steel: Detail bending, lap lengths, and placement of unit masonry reinforcing bars. Comply with ACI 315. Show elevations of reinforced walls.
4. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.

C. Samples for Initial Selection:

1. Split Face CMU.
2. Colored mortar.
3. Weep holes/cavity vents.

D. Samples for Verification: For each type and color of the following:

1. Pigmented mortar. Make Samples using same sand and mortar ingredients to be used on Project.

1.6 INFORMATIONAL SUBMITTALS

A. List of Materials Used in Constructing Mockups: List generic product names together with manufacturers, manufacturers' product names, model numbers, lot numbers, batch numbers, source of supply, and other information as required to identify materials used. Include mix proportions for mortar and grout and source of aggregates.

1. Submittal is for information only. Receipt of list does not constitute approval of deviations from the Contract Documents unless such deviations are specifically brought to the attention of Architect and approved in writing.

B. Qualification Data: For testing agency.

C. Material Certificates: For each type and size of the following:

1. Masonry units.

a. Include material test reports substantiating compliance with requirements.
b. For masonry units, include data and calculations establishing average net-area compressive strength of units.

2. Integral water repellent used in CMUs.
3. Cementitious materials. Include name of manufacturer, brand name, and type.
4. Mortar admixtures.
5. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.

6. Grout mixes. Include description of type and proportions of ingredients.
7. Reinforcing bars.
8. Joint reinforcement.
9. Anchors, ties, and metal accessories.

D. Mix Designs: For each type of mortar. Include description of type and proportions of ingredients.

1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91/C 91M for air content.
2. Include test reports, according to ASTM C 1019, for grout mixes required to comply with compressive strength requirement.

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

F. Hot Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.7 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM C 1093 for testing indicated.

1.8 DELIVERY, STORAGE, AND HANDLING

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

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

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

1.9 FIELD CONDITIONS

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

1. Extend cover a minimum of 24 inches down both sides of walls, and hold cover securely in place.
2. Where one wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe, and hold cover in place.

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

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

1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
2. Protect sills, ledges, and projections from mortar droppings.
3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

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

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

E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

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

2.2 PERFORMANCE REQUIREMENTS

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

1. Determine net-area compressive strength of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to TMS 602/ACI 530.1/ASCE 6.
2. Determine net-area compressive strength of masonry by testing masonry prisms according to ASTM C 1314.

2.3 UNIT MASONRY, GENERAL

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

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

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

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

2.4 CONCRETE MASONRY UNITS

A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.

1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
2. Provide bullnose units for outside corners unless otherwise indicated.

B. CMUs: ASTM C 90

1. Density Classification: Normal weight unless otherwise indicated.
2. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.
3. Exposed Faces: Provide color and texture matching the range represented by Architect's sample.

2.5 CONCRETE AND MASONRY LINTELS

A. General: Provide one of the following:

B. Concrete Lintels: ASTM C 1623, matching CMUs in color, texture, and density classification; and with reinforcing bars indicated. Provide lintels with net-area compressive strength not less than that of CMUs.

C. Concrete Lintels: Precast or formed-in-place concrete lintels complying with requirements in Section 033000 "Cast-in-Place Concrete," and with reinforcing bars indicated.

D. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam CMUs matching adjacent CMUs in color, texture, and density classification, with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.

2.6 SPLIT FACE CMU VENEER

A. Decorative CMUs: ASTM C90, normal weight.

1. Decorative (split-face) CMU shall match the existing building's Decorative CMU.
2. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2800 psi.
3. Size (Width): Manufactured to dimensions specified in "CMUs" Paragraph above.
4. Pattern and Texture: shall match the existing building's Decorative CMU
5. Colors: As selected by Architect from manufacturer's full range. Shall match the existing building's Decorative CMU
6. Special Aggregate: shall match the existing building's Decorative CMU.

2.7 MORTAR AND GROUT MATERIALS

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

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

C. Portland Cement-Lime Mix: Packaged blend of Portland cement complying with ASTM C 150, Type I or Type III, and hydrated lime complying with ASTM C 207, Type S.

D. Masonry Cement: ASTM C 91/C 91M.

1. Available Manufacturers: Argos Magnolia Masonry Cement, Coosa Masonry Cements, Cemex, and Holcim

E. Mortar Cement: ASTM C 1329/C 1329M.

1. Available Manufacturers: Argos Magnolia Masonry Cement, Coosa Masonry Cements, Cemex, and Holcim

F. Colored Cement Products: Packaged blend made from portland cement and hydrated lime and mortar pigments, all complying with specified requirements, and containing no other ingredients.

1. Colored Portland Cement-Lime Mix:

a. Cemex, Argos, Coosa, Lafarge

2. Colored Masonry Cement:

a. Cemex, Argos, Coosa, Lafarge

3. Formulate blend as required to produce color indicated or, if not indicated, as selected from manufacturer's standard colors.
4. Pigments shall not exceed 10 percent of portland cement by weight.
5. Pigments shall not exceed 5 percent of masonry cement by weight.

G. Aggregate for Mortar: ASTM C 144.

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

H. Aggregate for Grout: ASTM C 404.

I. Water: Potable

2.8 REINFORCEMENT

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

B. Masonry-Joint Reinforcement, General: ASTM A 951/A 951M.

1. Interior Walls: Mill galvanized carbon steel.
2. Exterior Walls: Hot-dip galvanized carbon steel.
3. Wire Size for Side Rods: 0.148-inch diameter.
4. Wire Size for Cross Rods: 0.148-inch diameter.
5. Wire Size for Veneer Ties: 0.148-inch diameter.

6. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches o.c.
7. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units.

C. Masonry-Joint Reinforcement for Single-Wythe Masonry: Ladder type with single pair of side rods.

D. Masonry-Joint Reinforcement for Multiwythe Masonry:

1. Ladder type with one side rod at each face shell of hollow masonry units more than 4 inches wide, plus one side rod at each wythe of masonry 4 inches wide or less.
2. Tab type, either ladder or truss design, with one side rod at each face shell of backing wythe and with rectangular tabs sized to extend at least halfway through facing wythe, but with at least 5/8-inch cover on outside face.
3. Adjustable (two-piece) type, either ladder or truss design, with one side rod at each face shell of backing wythe and with separate adjustable ties with pintle-and-eye connections having a maximum horizontal play of 1/16 inch and maximum vertical adjustment of 1-1/4 inches. Size ties to extend at least halfway through facing wythe but with at least 5/8-inch cover on outside face. Ties have hooks

E. Masonry-Joint Reinforcement for Veneers Anchored with Seismic Masonry-Veneer Anchors: Single 0.187-inch-diameter, hot-dip galvanized carbon-steel continuous wire.

2.9 TIES AND ANCHORS

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

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

1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M, with ASTM A 153/A 153M, Class B-2 coating.

C. Individual Wire Ties: Rectangular units with closed ends and not less than 4 inches wide.

1. Z-shaped ties with ends bent 90 degrees to provide hooks not less than 2 inches long may be used for masonry constructed from solid units.
2. Where wythes do not align or are of different materials, use adjustable ties with pintle- and-eye connections having a maximum adjustment of 1-1/4 inches.
3. Wire: Fabricate from 3/16-inch diameter, hot-dip galvanized steel.

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

1. Anchor Section for Welding to Steel Frame: Crimped 1/4-inch-diameter, hot-dip

galvanized steel wire.

2. Tie Section: Triangular-shaped wire tie made from 0.187-inch diameter, hot-dip galvanized steel wire.

E. Adjustable Masonry-Veneer Anchors:

1. General: Provide anchors that allow vertical adjustment but resist a 100-lbf load in both tension and compression perpendicular to plane of wall without deforming or developing play in excess of 1/16 inch.
2. Screw-Attached, Masonry-Veneer Anchors: Units consisting of a wire tie and a metal anchor section, complying with the following requirements:

   Wire Tie Shape: Triangular

   Wire Tie Length: As required t extend 1 ½ Inches into masonry wythe of veneer face.

   Anchor Section: Assembly composed of manufacturer's standard street-metal plate with screw holes top and bottom for attachment to substrate, fabricated for installation and vertical adjustment of wire tie.

3. Stainless-Steel Drill Screws for Steel Studs: ASTM C 954 except manufactured with hex washer head and neoprene or EPDM washer, No. 10 diameter by length required to penetrate steel stud flange with not less than three exposed threads; either made from Type 410 stainless steel or made with a carbon-steel drill point and 300 Series stainless- steel shank.

2.10 MISCELLANEOUS ANCHORS

A. Anchor Bolts: Headed steel bolts complying with ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A 152/A 153M, Class C; of dimensions indicated.

B. Post installed Anchors: Provide chemical or torque-controlled expansion anchors, with capability to sustain, without failure, a load equal to six times the load imposed when installed in solid or grouted unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.
   1. Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B 633, Class FE/ZN 5 (5 microns) for Class SC 1 service condition (mild).
   2. Corrosion Protection: Stainless-steel components complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 (ASTM F 738M and ASTM F 836M, Alloy Group 1 or 4) for bolts and nuts; STRM A 666 or ASTM A 276, Type 304 or 315, for anchors.

2.11 EMBEDDED FLASHING MATERIALS

A. Metal Flashing: Provide metal flashing complying with SMACNA's "Architectural Sheet Metal Manual" and as follows:

1. Stainless Steel: ASTM A 240/A 240M or ASTM A 666, Type 304, 0.016 inch thick.
   a. Accessories: Provide preformed corners, end dams, other special shapes, and seaming materials produced by flashing manufacturer.
2. Fabricate continuous flashings in sections 96 inches long minimum, but not exceeding 12 feet. Provide splice plates at joints of formed, smooth metal flashing.
3. Fabricate through-wall metal flashing embedded in masonry from stainless steel, with ribs at 3-inch intervals along length of flashing to provide an integral mortar bond.
4. Fabricate through-wall flashing with snaplock receiver on exterior face where indicated to receive counterflashing.
5. Fabricate through-wall flashing with drip edge where indicated. Fabricate by extending flashing 1/2 inch out from wall, with outer edge bent down 30 degrees and hemmed.
6. Fabricate through-wall flashing with sealant stop where indicated. Fabricate by bending metal back on itself 3/4 inch at exterior face of wall and down into joint 1/4 inch to form a stop for retaining sealant backer rod.
7. Fabricate metal drip edges and sealant stops for ribbed metal flashing from plain metal flashing of same metal as ribbed flashing and extending at least 3 inches into wall with hemmed inner edge to receive ribbed flashing and form a hooked seam. Form hem on upper surface of metal so that completed seam sheds water.
8. Fabricate metal sealant stops from stainless steel. Extend at least 3 inches into wall and out to exterior face of wall. At exterior face of wall, bend metal back on itself for 3/4 inch and down into joint 1/4 inch to form a stop for retaining sealant backer rod.
9. Fabricate metal expansion-joint strips from stainless steel to shapes indicated.
10. Solder metal items at corners.

B. Flexible Flashing:

1. See specification section 076500 Flexible Wall Flashing.

C. Application: Unless otherwise indicated, use the following:

1. Where flashing is indicated to receive counterflashing, use metal flashing.
2. Where flashing is indicated to be turned down at or beyond the wall face, use metal flashing.
3. Where flashing is partly exposed and is indicated to terminate at the wall face, use metal flashing with a drip edge or flexible flashing with a metal drip edge.
4. Where flashing is fully concealed, use metal flashing or flexible flashing.
5. Where flashing is to extend into jamb, head and sill, use flexible flashing.

D. Solder and Sealants for Sheet Metal Flashings: As specified in Section 076200 "Sheet Metal Flashing and Trim."

1. Solder for Stainless Steel: ASTM B 32, Grade Sn60, with acid flux of type recommended

by stainless-steel sheet manufacturer.

2. Elastomeric Sealant: ASTM C 920, chemically curing urethane sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and remain watertight.

E. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

F. Termination Bars for Flexible Flashing: Stainless-steel sheet 0.019 inch by 1-1/2 inches with a 3/8 inch sealant flange at top.

2.12 MISCELLANEOUS MASONRY ACCESSORIES

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

B. Bond-Breaker Strips: Asphalt-saturated felt complying with ASTM D 226/D 226M, Type I (No. 15 asphalt felt).

C. Weep/Cavity Vent Products: Use the following unless otherwise indicated:

1. Cellular Plastic Weep/Vent: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, full height and width of head joint and depth 1/8 inch less than depth of outer wythe, in color selected from manufacturer's standard.

D. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.

1. Configuration: Provide one of the following:

a. Strips, full depth of cavity and 10 inches high, with dovetail-shaped notches 7 inches deep that prevent clogging with mortar droppings.

2.13 MASONRY CLEANERS

A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.

2.14 MORTAR AND GROUT MIXES

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

1. Do not use calcium chloride in mortar or grout.
2. Use portland cement-lime mortar unless otherwise indicated.
3. For exterior masonry, use portland cement-lime mortar.
4. For reinforced masonry, use portland cement-lime mortar.

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

C. Mortar for Unit Masonry: Comply with ASTM C 270, Property Specification. Provide the following types of mortar for applications stated unless another type is indicated

1. For masonry below grade or in contact with earth, use Type S.
2. For reinforced masonry, use Type S
3. For mortar parge coats, use Type S
4. For nonload-bearing veneer, use Type N.

D. Grout for Unit Masonry: Comply with ASTM C 476.

1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with TMS 602/ACI 530.1/ASCE 6 for dimensions of grout spaces and pour height.
2. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C 143/C 143M.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
2. Verify that foundations are within tolerances specified.
3. Verify that reinforcing dowels are properly placed.
4. Verify that substrates are free of substances that impair mortar bond.

B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.

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

3.2 INSTALLATION, GENERAL

A. Thickness: Build cavity and composite walls and other masonry construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated.

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

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

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

E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures. Mix units from several pallets or cubes as they are placed.

F. Matching Existing Masonry: Match coursing, bonding, color, and texture of existing masonry.

3.3 TOLERANCES

A. Dimensions and Locations of Elements:

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

B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 feet, or 1/2-inch maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet maximum.
3. For vertical lines and surfaces, do not vary from plumb by more than 3/8 inch in 20 feet, maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, maximum.
5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 feet, maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet, maximum.
7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch except due to warpage of masonry units within tolerances specified for

warpage of units.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.
4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch.
5. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch from one masonry unit to the next.

3.4 LAYING MASONRY WALLS

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

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

C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 2 inches. Bond and interlock each course of each wythe at corners. Do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.

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

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

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

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

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

I. Build nonload-bearing interior partitions full height of story to underside of solid floor or roof

structure above unless otherwise indicated.

1. Install compressible filler in joint between top of partition and underside of structure above.
2. Fasten partition top anchors to structure above and build into top of partition. Grout cells of CMUs solidly around plastic tubes of anchors and push tubes down into grout to provide 1/2-inch clearance between end of anchor rod and end of tube. Space anchors 48 inches o.c. unless otherwise indicated.
3. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Section 078443 "Joint Firestopping."

3.5 MORTAR BEDDING AND JOINTING

A. Lay CMUs as follows:

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

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

C. Set cast-stone trim units in full bed of mortar with full vertical joints. Fill dowel, anchor, and similar holes.

1. Clean soiled surfaces with fiber brush and soap powder and rinse thoroughly with clear water.
2. Allow cleaned surfaces to dry before setting.
3. Wet joint surfaces thoroughly before applying mortar.
4. Rake out mortar joints for pointing with sealant.

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

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

F. Cut joints flush where indicated to receive waterproofing, cavity, wall insulation and air barriers unless otherwise indicated.

3.6 CAVITY WALLS

A. Bond wythes of cavity walls together using one of the following methods:

1. Individual Metal Ties: Provide ties as shown installed in horizontal joints, but not less than one metal tie for 2.67 sq. ft. of wall area spaced not to exceed 24 inches o.c. horizontally and 16 inches o.c. vertically. Stagger ties in alternate courses. Provide additional ties within 12 inches of openings and space not more than 36 inches apart around perimeter of openings. At intersecting and abutting walls, provide ties at no more than 24 inches o.c. vertically.

    a. Where bed joints of wythes do not align, use adjustable-type (two-piece-type) ties.
    b. Where one wythe is of clay masonry and the other of concrete masonry, use adjustable-type (two-piece-type) ties to allow for differential movement regardless of whether bed joints align.

2. Masonry-Joint Reinforcement: Installed in horizontal mortar joints.

    a. Where bed joints of both wythes align, use ladder-type reinforcement extending across both wythes.
    b. Where bed joints of wythes do not align, use adjustable-type (two-piece-type) reinforcement with continuous horizontal wire in facing wythe attached to ties.
    c. Where one wythe is of clay masonry and the other of concrete masonry, use adjustable-type (two-piece-type) reinforcement with continuous horizontal wire in facing wythe attached to ties to allow for differential movement regardless of whether bed joints align.

3. Header Bonding: Provide masonry unit headers extending not less than 3 inches into each wythe. Space headers not more than 8 inches clear horizontally and 16 inches clear vertically.

4. Masonry-Veneer Anchors: Comply with requirements for anchoring masonry veneers.

B. Bond wythes of cavity walls together using bonding system indicated on Drawings.

C. Keep cavities clean of mortar droppings and other materials during construction. Bevel beds away from cavity, to minimize mortar protrusions into cavity. Do not attempt to trowel or remove mortar fins protruding into cavity.

D. Installing Cavity Wall Insulation: Place small dabs of adhesive, spaced approximately 12 inches o.c. both ways, on inside face of insulation boards, or attach with plastic fasteners designed for this purpose. Fit courses of insulation between wall ties and other confining obstructions in cavity, with edges butted tightly both ways. Press units firmly against inside wythe of masonry or other construction as shown.

    1. See Spec Section 072727 Spray Applied Insulating Air Barrier

3.7 ANCHORED MASONRY VENEERS

A. Anchor masonry veneers to wall framing and concrete and masonry backup with masonry-veneer anchors to comply with the following requirements:

1. Fasten screw-attached anchors through sheathing to wall framing and to concrete and masonry backup with metal fasteners of type indicated. Use two fasteners unless anchor design only uses one fastener.
2. Embed tie sections, connector sections and continuous wire in masonry joints.
3. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
4. Space anchors as indicated, but not more than 16 inches o.c. vertically and 25 inches o.c. horizontally, with not less than one anchor for each 3.5 sq. ft. of wall area. Install additional anchors within 12 inches of openings and at intervals, not exceeding 36 inches, around perimeter.

B. Provide not less than 2 inches of airspace between back of masonry veneer and face of insulation.

1. Keep airspace clean of mortar droppings and other materials during construction. Bevel beds away from airspace, to minimize mortar protrusions into airspace. Do not attempt to trowel or remove mortar fins protruding into airspace.

3.8 MASONRY-JOINT REINFORCEMENT

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

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

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

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

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

E. Cut and bend reinforcing units as directed by manufacturer for continuity at corners, returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.9 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE

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

1. Provide an open space not less than 1/2 inch wide between masonry and structural steel or

concrete unless otherwise indicated. Keep open space free of mortar and other rigid materials.

2. Anchor masonry with anchors embedded in masonry joints and attached to structure.
3. Space anchors as indicated, but not more than 16 inches o.c. vertically and 24 inches o.c. horizontally.

3.10 CONTROL AND EXPANSION JOINTS

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

B. Form control joints in concrete masonry using one of the following methods:

1. Fit bond-breaker strips into hollow contour in ends of CMUs on one side of control joint. Fill resultant core with grout, and rake out joints in exposed faces for application of sealant.

C. Provide horizontal, pressure-relieving joints by either leaving an airspace or inserting a compressible filler of width required for installing sealant and backer rod specified in Section 079200 "Joint Sealants," but not less than 3/8 inch.

1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.

3.11 LINTELS

A. Install steel lintels where indicated.

B. Provide masonry lintels where shown and where openings of more than 12 inches for brick-size units and 24 inches for block-size units are shown without structural steel or other supporting lintels.

C. Provide minimum bearing of 8 inches at each jamb unless otherwise indicated.

3.12 FLASHING, WEEP HOLES, AND CAVITY VENTS

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

B. Install flashing as follows unless otherwise indicated:

1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
2. At multiwythe masonry walls, including cavity walls, extend flashing through outer wythe, turned up a minimum of 4 inches, and 1-1/2 inches into the inner wythe

3. At masonry-veneer walls, extend flashing through veneer, across airspace behind veneer, and up face of sheathing at least 8 inches; with upper edge tucked under air barrier, lapping at least 4 inches. Fasten upper edge of flexible flashing to sheathing through termination bar.
4. At lintels and shelf angles, extend flashing a minimum of 6 inches into masonry at each end. At heads and sills, extend flashing 6 inches at ends and turn up not less than 2 inches to form end dams.
5. Interlock end joints of ribbed sheet metal flashing by overlapping ribs not less than 1-1/2 inches or as recommended by flashing manufacturer, and seal lap with elastomeric sealant complying with requirements in Section 079200 "Joint Sealants" for application indicated.
6. Install metal drip edges and sealant stops with ribbed sheet metal flashing by interlocking hemmed edges to form hooked seam. Seal seam with elastomeric sealant complying with requirements in Section 079200 "Joint Sealants" for application indicated.
7. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall, and adhere flexible flashing to top of metal drip edge.

C. Install single-wythe CMU flashing system in bed joints of CMU walls where indicated to comply with manufacturer's written instructions. Install CMU cell pans with upturned edges located below face shells and webs of CMUs above and with weep spouts aligned with face of wall. Install CMU web covers so that they cover upturned edges of CMU cell pans at CMU webs and extend from face shell to face shell.

D. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.

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

1. Use specified weep/cavity vent products to form weep holes.
2. Space weep holes horizontally 24 inches o.c. unless otherwise indicated.
3. Cover cavity side of weep holes with plastic insect screening at cavities insulated with loose-fill insulation.
4. Trim wicking material flush with outside face of wall after mortar has set.

3.13 REINFORCED UNIT MASONRY INSTALLATION

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

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

during construction.

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

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

1. Comply with requirements in TMS 602/ACI 530.1/ASCE 6 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
2. Limit height of vertical grout pours to not more than 60 inches.

3.14 FIELD QUALITY CONTROL

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

B. Inspections: Special inspections according to Level B in TMS 402/ACI 530/ASCE 5.

1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
3. Place grout only after inspectors have verified proportions of site-prepared grout.

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

D. Clay Masonry Unit Test: For each type of unit provided, according to ASTM C 67 for compressive strength.

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

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

G. Specified Compressive Strength shall be verified based upon the provisions of IBC Section 2105.2.2.1, unit strength method, or IBC 2105.2.2.2 Prism Test Method.

3.15 REPAIRING, POINTING, AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged

or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

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

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

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
3. Protect adjacent stone and non-masonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
5. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.

3.16 MASONRY WASTE DISPOSAL

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

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

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

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

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

END OF SECTION 042000

SECTION 047200 - CAST STONE MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Trim units.
   2. Mortar materials.
   3. Accessories.

B. Related Requirements:

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

   1. For cast stone units, include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Show fabrication and installation details for cast stone units. Include dimensions, details of reinforcement and anchorages if any, and indication of finished faces.

   1. Include building elevations showing layout of units and locations of joints and anchors.

C. Samples for Initial Selection: For colored mortar.

D. Samples for Verification:

   1. For each color and texture of cast stone required, 4 inches (100 mm) square in size.
   2. For each trim shape required, 4 inches (100 mm) in length.
   3. For colored mortar, make Samples using same sand and mortar ingredients to be used on Project. Label Samples to indicate types and amounts of pigments used.

E. Full-Size Samples: For each color, texture, and shape of cast stone unit required.

   1. Make available for Architect's review at Project site or at manufacturing plant, if acceptable to Architect.
   2. Make Samples from materials to be used for units used on Project.
   3. Approved Samples may be installed in the Work.

1.3 INFORMATIONAL SUBMITTALS

A. Material Test Reports: For each mix required to produce cast stone, based on testing according to ASTM C1364.

   1. Provide test reports based on testing within previous six months.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer of cast stone units similar to those indicated for this Project, that has sufficient production capacity to manufacture required units, and is a plant certified by CSI.

B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and to set quality standards for materials and execution.

1. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
2. 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. Coordinate delivery of cast stone with unit masonry work to avoid delaying the Work and to minimize the need for on-site storage.

B. Pack, handle, and ship cast stone units in suitable packs or pallets.

1. Lift with wide-belt slings; do not use wire rope or ropes that might cause staining. Move cast stone units if required, using dollies with wood supports.
2. Store cast stone units on wood skids or pallets with nonstaining, waterproof covers, securely tied. Arrange to distribute weight evenly and to prevent damage to units. Ventilate under covers to prevent condensation.

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

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

1.6 PROJECT CONDITIONS

A. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Comply with cold-weather construction requirements in TMS 602.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F (4 deg C) and above and will remain so until cast stone has dried, but no fewer than seven days after completing cleaning.

B. Hot-Weather Requirements: Comply with hot-weather construction requirements in TMS 602.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Cast Stone: Obtain cast stone units from single source from single manufacturer.

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

2.2 CAST STONE MATERIALS

A. General: Comply with ASTM C1364.

B. Portland Cement: ASTM C150/C150M, Type I or Type III, containing not more than 0.60 percent total alkali when tested according to ASTM C114. Provide natural color or white cement as required to produce cast stone color indicated.

C. Fine Aggregates: Natural sand or crushed stone complying with ASTM C33/C33M, gradation and colors as needed to produce required cast stone textures and colors.

D. Color Pigment: ASTM C979/C979M, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, free of carbon black, nonfading, and resistant to lime and other alkalis.

E. Reinforcement:

1. Deformed steel bars complying with ASTM A615/A615M, Grade 40 (Grade 280). Use galvanized or epoxy-coated reinforcement when covered with less than 1-1/2 inches (38 mm) of cast stone material.
   a. Galvanized Coating: ASTM A767/A767M.

2. Plain-Steel, Welded-Wire Reinforcement: ASTM A1064/A1064M, plain, fabricated from as-drawn steel wire into flat sheets.
3. Galvanized-Steel, Welded-Wire Reinforcement: ASTM A1064/A1064M, plain, fabricated from galvanized-steel wire into flat sheets.
4. Fiber Reinforcement: ASTM C1116/C1116M.

F. Embedded Anchors and Other Inserts: Fabricated from steel complying with ASTM A36/A36M and hot-dip galvanized to comply with ASTM A123/A123M.

2.3 CAST STONE UNITS

A. Cast Stone Units: Comply with ASTM C1364.

1. Units are manufactured using the manufacturer's selected method.

2. Trim units including window sills and items as indicated on Drawings.

B. Fabricate units with sharp arris and accurately reproduced details, with indicated texture on all exposed surfaces unless otherwise indicated.

1. Slope exposed horizontal surfaces 1:12 to drain unless otherwise indicated.
2. Provide raised fillets at backs of sills and at ends indicated to be built into jambs.
3. Provide drips on projecting elements unless otherwise indicated.

C. Fabrication Tolerances:

1. Variation in Cross Section: Do not vary from indicated dimensions by more than 1/8 inch (3 mm).
2. Variation in Length: Do not vary from indicated dimensions by more than 1/360 of the length of unit or 1/8 inch (3 mm), whichever is greater, but in no case by more than 1/4 inch (6 mm).
3. Warp, Bow, and Twist: Not to exceed 1/360 of the length of unit or 1/8 inch (3 mm), whichever is greater.
4. Location of Grooves, False Joints, Holes, Anchorages, and Similar Features: Do not vary from indicated position by more than 1/8 inch (3 mm) on formed surfaces of units and 3/8 inch (10 mm) on unformed surfaces.

D. Cure Units as Follows:

1. Cure units in enclosed, moist curing room at 95 percent relative humidity and temperature of 100 deg F (38 deg C) for 12 hours or 70 deg F (21 deg C) for 16 hours.
2. Keep units damp and continue curing to comply with one of the following:

a. No fewer than five days at mean daily temperature of 70 deg F (21 deg C) or above.
b. No fewer than seven days at mean daily temperature of 50 deg F (10 deg C) or above.

E. Acid etch units after curing to remove cement film from surfaces to be exposed to view.

F. Colors and Textures: As selected by Architect from manufacturer's full range.

2.4 MORTAR MATERIALS

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

B. Hydrated Lime: ASTM C207, Type S.

C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.

D. Masonry Cement: ASTM C91/C91M.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    a. Holcim (US) Inc.
    b. Lafarge North America Inc.
    c. Lehigh White Cement Company.

E. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C979/C979M. Use only pigments with a record of satisfactory performance in masonry mortar.

1. Products: Subject to compliance with requirements, provide one of the following:
    a. Davis Colors, True Tone Mortar Colors
    b. Euclid Chemical Company; an RPM company.
    c. Lanxess Corporation, Bayfoerrox Iron Oxide Pigments.
    d. Solomon Colors, Inc., SGS Mortar Colors.

F. Aggregate for Mortar: ASTM C144.

1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
2. For joints less than 1/4 inch (6 mm) thick, use aggregate graded with 100 percent passing the No. 16 (1.18-mm) sieve.

G. Water: Potable.

2.5 ACCESSORIES

A. Anchors: Type and size indicated, fabricated from steel complying with ASTM A36/A36M and hot-dip galvanized to comply with ASTM A123/A123M.

B. Dowels: 1/2-inch- (12-mm-) diameter round bars, fabricated from steel complying with ASTM A36/A36M and hot-dip galvanized to comply with ASTM A123/A123M.

2.6 SOURCE QUALITY CONTROL

A. Engage a qualified independent testing agency to sample and test cast stone units according to ASTM C1364.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

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

3.2 SETTING CAST STONE IN MORTAR

A. Set cast stone as indicated in TMS 604.

B. Set cast stone as indicated on Drawings. Set units accurately in locations indicated, with edges and faces aligned according to established relationships and indicated tolerances.

1. Install anchors, supports, fasteners, and other attachments indicated or necessary to secure units in place.
2. Coordinate installation of cast stone with installation of flashing specified in other Sections.

C. Wet joint surfaces thoroughly before applying mortar or setting in mortar.

D. Set units in full bed of mortar with full head joints unless otherwise indicated.

1. Set units with joints 1/4 to 3/8 inch (6 to 10 mm) wide unless otherwise indicated.
2. Build anchors and ties into mortar joints as units are set.
3. Fill dowel holes and anchor slots with mortar.
4. Fill collar joints solid as units are set.
5. Build concealed flashing into mortar joints as units are set.
6. Keep head joints in copings and between other units with exposed horizontal surfaces open to receive sealant.
7. Keep joints at shelf angles open to receive sealant.

E. Rake out joints for pointing with mortar to depths of not less than 3/4 inch (19 mm). Rake joints to uniform depths with square bottoms and clean sides. Scrub faces of units to remove excess mortar as joints are raked.

F. Point mortar joints by placing and compacting mortar in layers not greater than 3/8 inch (10 mm). Compact each layer thoroughly and allow it to become thumbprint hard before applying next layer.

G. Tool exposed joints slightly concave when thumbprint hard. Use a smooth plastic jointer larger than joint thickness.

H. Rake out joints for pointing with sealant to depths of not less than 3/4 inch (19 mm). Scrub faces of units to remove excess mortar as joints are raked.

I. Point joints with sealant to comply with applicable requirements in Section 079200 "Joint Sealants."

1. Prime cast stone surfaces to receive sealant and install compressible backer rod in joints before applying sealant unless otherwise indicated.

J. Provide sealant joints at head joints of copings and other horizontal surfaces; at expansion, control, and pressure-relieving joints; and at locations indicated.

1. Keep joints free of mortar and other rigid materials.
2. Build in compressible foam-plastic joint fillers where indicated.
3. Form joint of width indicated, but not less than 3/8 inch (10 mm).

4. Prime cast stone surfaces to receive sealant and install compressible backer rod in joints before applying sealant unless otherwise indicated.
5. Prepare and apply sealant of type and at locations indicated to comply with applicable requirements in Section 079200 "Joint Sealants."

3.3 SETTING ANCHORED CAST STONE WITH SEALANT-FILLED JOINTS

A. Set cast stone as indicated in TMS 604.

B. Set cast stone as indicated on Drawings. Set units accurately in locations indicated, with edges and faces aligned according to established relationships and indicated tolerances.

1. Install anchors, supports, fasteners, and other attachments indicated or necessary to secure units in place.
2. Shim and adjust anchors, supports, and accessories to set cast stone in locations indicated with uniform joints.

C. Keep cavities open where unfilled space is indicated between back of cast stone units and backup wall; do not fill cavities with mortar or grout.

D. Fill anchor holes with sealant.

1. Where dowel holes occur at pressure-relieving joints, provide compressible material at ends of dowels.

E. Set cast stone supported on clip or continuous angles on resilient setting shims. Use material of thickness required to maintain uniform joint widths. Hold shims back from face of cast stone a distance at least equal to width of joint.

F. Keep joints free of mortar and other rigid materials. Remove temporary shims and spacers from joints after anchors and supports are secured in place and cast stone units are anchored. Do not begin sealant installation until temporary shims and spacers are removed.

1. Form open joint of width indicated, but not less than 3/8 inch (10 mm).

G. Prime cast stone surfaces to receive sealant and install compressible backer rod in joints before applying sealant unless otherwise indicated.

H. Prepare and apply sealant of type and at locations indicated to comply with applicable requirements in Section 079200 "Joint Sealants."

3.4 INSTALLATION TOLERANCES

A. Variation from Plumb: Do not exceed 1/8 inch in 10 ft. (3 mm in 3 m) or 1/2 inch (12 mm) maximum.

B. Variation from Level: Do not exceed 1/8 inch in 10 ft. (3 mm in 3 m) or 1/2 inch (12 mm) maximum.

C. Variation in Joint Width: Do not vary joint thickness more than 1/8 inch in 36 inches (3 mm in 900 mm) or one-fourth of nominal joint width, whichever is less.

D. Variation in Plane between Adjacent Surfaces (Lipping): Do not vary from flush alignment with adjacent units or adjacent surfaces indicated to be flush with units by more than 1/16 inch (1.5 mm), except where variation is due to warpage of units within tolerances specified.

3.5 ADJUSTING AND CLEANING

A. Remove and replace stained and otherwise damaged units and units not matching approved Samples. Cast stone may be repaired if methods and results are approved by Architect.

B. Replace units in a manner that results in cast stone matching approved Samples, complying with other requirements, and showing no evidence of replacement.

C. In-Progress Cleaning: Clean cast stone as work progresses.

1. Remove mortar fins and smears before tooling joints.
2. Remove excess sealant immediately, including spills, smears, and spatter.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed cast stone as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on sample; leave one sample uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of cast stone.

END OF SECTION 047200

SECTION 051200 - STRUCTURAL STEEL FRAMING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Structural steel framing members.

B. Structural steel support members and struts.

C. Base plates, shear stud connectors and expansion joint plates.

D. Grouting under base plates.

1.2 RELATED REQUIREMENTS

A. Section 053100 - Steel Decking: Support framing for small openings in deck.

1. Decking shall be of types and gauges not less than those indicated on Structural Drawings. Decking shall have a G-90 hot dipped galvanized coating conforming to ASTM A525. Do not apply chemical Passivators of any kind to decking that will be field painted or will receive spray fireproofing. Test decking prior to applying paint or fireproofing.

B. Section 055000 - Metal Fabrications: Steel fabrications affecting structural steel work.

C. Section 078100 - Applied Fire Protection: Fireproof protection to framing and metal deck systems.

1.3 REFERENCE STANDARDS

A. AISC (MAN) - Steel Construction Manual; 2023.

B. AISC 303 - Code of Standard Practice for Steel Buildings and Bridges; 2022.

C. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

D. ASTM A108 - Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished; 2018.

E. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

F. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

G. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2021.

H. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2023.

I. ASTM A563/A563M - Standard Specification for Carbon and Alloy Steel Nuts (Inch and Metric); 2021a.

J. ASTM A572/A572M - Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel; 2021, with Editorial Revision.

K. ASTM A992/A992M - Standard Specification for Structural Steel Shapes; 2022.

L. ASTM C827/C827M - Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens of Cementitious Mixtures; 2023.

M. ASTM F436/F436M - Standard Specification for Hardened Steel Washers Inch and Metric Dimensions; 2019.

N. ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength; 2020.

O. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength; 2023.

P. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2020.

Q. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification; 2021, with Errata (2023).

R. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2023).

S. RCSC (HSBOLT) - Specification for Structural Joints Using High-Strength Bolts; Research Council on Structural Connections; 2020.

T. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 2004.

U. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic); 2019.

V. SSPC-SP 3 - Power Tool Cleaning; 2024.

1.4 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings:

1. Indicate profiles, sizes, spacing, locations of structural members, openings, attachments, and fasteners.
2. Connections.
3. Indicate cambers and loads.
4. Indicate welded connections with AWS A2.4 welding symbols. Indicate net weld lengths.

C. Manufacturer's Mill Certificate: Certify that products meet or exceed specified requirements.

D. Mill Test Reports: Indicate structural strength, destructive test analysis and non-destructive test analysis.

E. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated no more than 12 months before start of scheduled welding work.

F. Designer's Qualification Statement.

G. Fabricator's Qualification Statement.

1.5 QUALITY ASSURANCE

A. Fabricate structural steel members in accordance with AISC (MAN) "Steel Construction Manual."

B. Maintain one copy of each document on site.

C. Fabricator: Company specializing in performing the work of this section with minimum 5 years of documented experience.

D. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.1/D1.1M and no more than 12 months before start of scheduled welding work.

E. Erector: Company specializing in performing the work of this section with minimum 5 years of documented experience.

F. Design connections not detailed on drawings under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located.

1.6 TESTING

A. Structural testing of field welds and bolted connections shall be specified in the construction documents, and shall be performed by an independent testing laboratory selected by the Owner. All costs associated with the initial structural testing shall be the responsibility of the Owner. Any additional or secondary testing, that may be required due to improper installation and/or unsatisfactory test results, shall be the responsibility of the General Contractor.

1.7 PAINT

A. All structural steel shall receive primer. All exposed steel shall be finish painted per specification section 09 90 00.

B. Portions of structural steel to receive spray applied fireproofing shall receive one shop coat of rust inhibitive primer.

1.8 STEEL FRAME CANOPY

A. Canopies/walkway covers at the main entry/bus loading areas (and/or other areas where specifically instructed by Owner) of a typical school shall be a structural steel, single column, cantilever design with prefinished, standing seam metal roof and gutter system. Columns shall be wrapped with brick masonry to match the building exterior. Metal roofing and gutter colors shall be selected by Owner from manufacturer's full color range. Typical design shall be as shown on attached detail (Exhibit “A”).

PART 2 PRODUCTS

2.1 MATERIALS

A. Steel Angles and Plates: ASTM A36/A36M.

B. Steel W Shapes and Tees: ASTM A992/A992M.

C. Rolled Steel Structural Shapes: ASTM A992/A992M.

D. Steel Plates and Bars: ASTM A572/A572M, Grade 50 (345) high-strength, columbium-vanadium steel.

E. Cold-Formed Structural Tubing: ASTM A500/A500M, Grade B.

F. Shear Stud Connectors: Made from ASTM A108 Grade 1015 bars.

G. Structural Bolts and Nuts: Carbon steel, ASTM A307, Grade A and galvanized in compliance with ASTM A153/A153M Class C.

H. High-Strength Structural Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, with matching compatible ASTM A563/A563M nuts and ASTM F436/F436M washers.

I. Tension Control Bolts: Twist-off type; ASTM F3125/F3125M.

J. Unheaded Anchor Rods: ASTM F1554, Grade 36, plain, with matching ASTM A563/A563M nuts and ASTM F436/F436M Type 1 washers.

K. Headed Anchor Rods: ASTM F1554 Grade 36, plain.

L. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

M. Grout: ASTM C1107/C1107M; Non-shrink; premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents.

1. Minimum Compressive Strength at 48 Hours: 2,000 pounds per square inch.
2. Minimum Compressive Strength at 28 Days: 7,000 pounds per square inch.
3. Height Change, Plastic State; when tested according to ASTM C827/C827M:

a. Maximum: Plus 4 percent.
b. Minimum: Plus 1 percent.

N. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

O. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20 Type II - Organic, complying with VOC limitations of authorities having jurisdiction.

2.2 FABRICATION

A. Shop fabricate to greatest extent possible.

B. Fabricate connections for bolt, nut, and washer connectors.

C. Develop required camber for members.

2.3 FINISH

A. Prepare structural component surfaces in accordance with SSPC-SP 3.

B. Shop prime structural steel members. Do not prime surfaces that will be fireproofed, field welded, in contact with concrete, or high strength bolted.

C. Galvanize structural steel members where indicated on structural drawings to comply with ASTM A123/A123M. Provide minimum 1.7 oz/sq ft galvanized coating.

2.4 SOURCE QUALITY CONTROL

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that conditions are appropriate for erection of structural steel and that the work may properly proceed.

3.2 ERECTION

A. Erect structural steel in compliance with AISC 303.

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 and shear studs indicated on shop drawings.

D. Use carbon steel bolts only for temporary bracing during construction, unless otherwise specifically permitted on drawings. Install high-strength bolts in accordance with RCSC (HSBOLT) "Specification for Structural Joints Using High-Strength Bolts".

E. Do not field cut or alter structural members without approval of Architect.

F. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.

G. Grout solidly between column plates and bearing surfaces, complying with manufacturer's instructions for nonshrink grout. Trowel grouted surfaces smooth, splaying neatly to 45 degrees.

3.3 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.

3.4 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 014000 - Quality Requirements.

END OF SECTION 051200

SECTION 052100 - STEEL JOIST FRAMING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Open web steel joists, with bridging, attached seats and anchors.

B. Supplementary framing for floor and roof openings greater than 18 inches.

1.2 RELATED REQUIREMENTS

A. Section 051200 - Structural Steel Framing: Superstructure framing.

B. Section 053100 - Steel Decking: Support framing for openings less than 18 inches in decking.

C. Section 055000 - Metal Fabrications: Non-framing steel fabrications attached to joists.

D. Section 078100 - Applied Fire Protection: Fireproof protection of joist framing and metal deck systems.

1.3 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

B. ASTM A563/A563M - Standard Specification for Carbon and Alloy Steel Nuts (Inch and Metric); 2021a.

C. ASTM F436/F436M - Standard Specification for Hardened Steel Washers Inch and Metric Dimensions; 2019.

D. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength; 2023.

E. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification; 2021, with Errata (2023).

F. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2023).

G. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel AC172; 2019.

H. RCSC (HSBOLT) - Specification for Structural Joints Using High-Strength Bolts; Research Council on Structural Connections; 2020.

I. SJI 100 - Standard Specifications for K-Series, LH-Series, and DLH-Series Open Web Steel Joists, and for Joist Girders; 2020.

J. SJI Technical Digest No. 9 - Handling and Erection of Steel Joists and Joist Girders; 2008.

K. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 2004.

L. SSPC-SP 3 - Power Tool Cleaning; 2024.

M. UL (FRD) - Fire Resistance Directory; Current Edition.

1.4 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate standard designations, joist coding, configurations, sizes, spacings, cambers, locations of joists, joist leg extensions, bridging, connections, and attachments.

C. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated no more than 12 months before start of scheduled welding work.

D. Manufacturer's Qualification Statement.

E. Fabricator's Qualification Statement.

F. Erector's Qualification Statement.

1.5 QUALITY ASSURANCE

A. Design connections not detailed on drawings under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located.

B. Perform Work, including that for headers and other supplementary framing, in accordance with SJI 100 Standard Specifications Load Tables and SJI Technical Digest No. 9.

C. Manufacturer Qualifications: Company specializing in performing the work of this section with minimum 5 years documented experience.

D. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.1/D1.1M and dated no more than 12 months before start of scheduled welding work.

E. Fabricator Qualifications: A qualified steel fabricator that is accredited by the International Accreditation Service (IAS) Fabricator Inspection Program for Structural Steel in accordance with IAS AC172.

F. Erector Qualifications: Company specializing in performing the work of this section with minimum 5 years documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Transport, handle, store, and protect products to SJI requirements.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Steel Joists:

1. Canam Group Inc: www.canam-steeljoists.ws
2. New Millennium Building Systems: www.newmill.com/#sle.
3. Nucor-Vulcraft Group: www.vulcraft.com/#sle.
4. Substitutions: See Section 016000 - Product Requirements.

2.2 MATERIALS

A. Open Web Joists: SJI Type K Joists:

1. Provide bottom chord extensions as indicated.
2. Minimum End Bearing on Steel Supports: Comply with referenced SJI standard.
3. Finish: Shop primed unless noted to be fireproofed.

B. High-Strength Structural Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, with matching compatible ASTM A563/A563M nuts and ASTM F436/F436M washers.

C. Structural Steel For Supplementary Framing and Joist Leg Extensions: ASTM A36/A36M.

D. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

E. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

2.3 FINISH

A. Shop prime joists as specified.

1. Do not prime surfaces that will be fireproofed.

B. Prepare surfaces to be finished in accordance with SSPC-SP 3.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions prior to beginning work.

3.2 ERECTION

A. Erect joists with correct bearing on supports.

B. Allow for erection loads. Provide sufficient temporary bracing to maintain framing safe, plumb, and in true alignment.

C. After joist alignment and installation of framing, field weld joist seats to steel bearing surfaces.

D. Install supplementary framing for floor and roof openings greater than 18 inches.

E. Do not permit erection of decking until joists are braced, bridged, and secured or until completion of erection and installation of permanent bridging and bracing.

F. Do not field cut or alter structural members without approval of joist manufacturer.

G. After erection, prime welds, damaged shop primer, and surfaces not shop primed , except surfaces specified not to be primed.

3.3 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch.

B. Maximum Offset From True Alignment: 1/4 inch.

3.4 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 014000 - Quality Requirements.

END OF SECTION 052100

SECTION 053100 - STEEL DECKING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Roof deck.

B. Supplementary framing for openings up to and including 18 inches.

1.2 RELATED REQUIREMENTS

A. Section 051200 - Structural Steel Framing: Support framing for openings larger than 18 inches.

1.3 REFERENCE STANDARDS

A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.

B. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2023.

C. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification; 2021, with Errata (2023).

D. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2023).

E. AWS D1.3/D1.3M - Structural Welding Code - Sheet Steel; 2018, with Errata (2022).

F. FM DS 1-28 - Wind Design; 2015, with Editorial Revision (2026).

G. FM DS 1-29 - Roof Deck Securement and Above-Deck Roof Components; 2016, with Editorial Revision (2022).

H. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel AC172; 2019.

I. ICC-ES AC70 - Acceptance Criteria for Power-Actuated Fasteners Driven into Concrete, Steel and Masonry Elements; 2019, with Editorial Revision (2021).

J. SDI (DM) - Publication No.30, Design Manual for Composite Decks, Form Decks, and Roof Decks; 2007.

K. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 2004.

L. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic); 2019.

1.4 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittals procedures.

B. Product Data: Provide deck profile characteristics, dimensions, structural properties, and finishes.

C. Shop Drawings: Indicate deck plan, support locations, projections, openings, reinforcement, pertinent details, and accessories.

D. Certificates: Certify that products furnished meet or exceed specified requirements.

E. Submit manufacturer's installation instructions.

F. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated no more than 12 months before start of scheduled welding work.

G. Designer's Qualification Statement.

H. Fabricator's Qualification Statement: Provide documentation showing steel fabricator is accredited under IAS AC172.

1.5 QUALITY ASSURANCE

A. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.1/D1.1M and AWS D1.3/D1.3M and dated no more than 12 months before start of scheduled welding work.

B. Fabricator Qualifications: A qualified steel fabricator that is accredited by the International Accreditation Service (IAS) Fabricator Inspection Program for Structural Steel in accordance with IAS AC172.

C. Installer Qualifications: Company specializing in performing the work of this Section with minimum 5 years of experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Cut plastic wrap to encourage ventilation.

B. Separate sheets and store deck on dry wood sleepers; slope for positive drainage.

PART 2 PRODUCTS

2.1 STEEL DECK

A. Roof Deck: Non-composite type, fluted steel sheet:

1. Galvanized Steel Sheet: ASTM A653/A653M, Structural Steel (SS) Grade 80/550, Class 1, with G90/Z275 galvanized coating.
2. Primer: Shop coat of manufacturer's standard primer paint over cleaned and phosphatized substrate.
3. Formed Sheet Width: 36 inch.
4. Side Joints: Lapped, mechanically fastened.
5. End Joints: Lapped, mechanically fastened.

2.2 ACCESSORY MATERIALS

A. Fasteners: Galvanized hardened steel, self tapping.

B. Powder Actuated Mechanical Fasteners: Steel; with knurled shank and forged ballistic point. Comply with applicable requirements of ICC-ES AC70.

C. Mechanical Fasteners: Steel; hex washer head, self-drilling, self-tapping.

1. Design Requirements for Sidelap Connections: Provide number and type of fasteners that comply with the applicable requirements of SDI (DM) design method for roof deck and floor deck applications and FM DS 1-28 wind uplift resistance.
2. Fasteners for Steel Roof Decks Protected with Waterproofing Membrane: ASTM B633, SC1, Type III zinc electroplate.
3. Fasteners for Exposed Steel Roof Deck Application: Manufacturer's standard stainless steel with bonded neoprene washer.

D. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

E. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, complying with VOC limitations of authorities having jurisdiction.

F. Flute Closures: Closed cell foam rubber, 1 inch thick; profiled to fit tight to the deck.

2.3 FABRICATED DECK ACCESSORIES

A. Sheet Metal Deck Accessories: Metal closure strips and cover plates, 22 gauge, 0.0299 inch thick sheet steel; of profile and size as indicated; finished same as deck.

B. Roof Sump Pans: Formed sheet steel, 14 gauge, 0.0747 inch minimum thickness, flat bottom, sloped sides, recessed 1-1/2 inches below roof deck surface, bearing flange 3 inches wide, sealed watertight.

PART 3 EXECUTION

3.1 INSTALLATION

A. Erect metal deck in accordance with SDI Design Manual and manufacturer's instructions. Align and level.

B. On steel supports provide minimum 1-1/2 inch bearing.

C. At mechanically fastened male/female side laps fasten at 24 inches on center maximum.

D. Drive mechanical sidelap connectors completely through adjacent lapped sheets; positively engage adjacent sheets with minimum three-thread penetration.

E. Weld deck in accordance with AWS D1.3/D1.3M.

F. At deck openings from 6 inches to 18 inches in size, provide 2 by 2 by 1/4 inch steel angle reinforcement. Place angles perpendicular to flutes; extend minimum two flutes beyond each side of opening and fusion weld to deck at each flute.

G. Close openings above walls and partitions perpendicular to deck flutes with single row of foam cell closures.

H. Position roof drain pans with flange bearing on top surface of deck. Fusion weld at each deck flute.

I. Immediately after welding deck and other metal components in position, coat welds, burned areas, and damaged surface coating, with touch-up primer.

END OF SECTION 053100

SECTION 055000 - METAL FABRICATIONS

1.1 SUMMARY

A. Section Includes:

1. Miscellaneous framing and supports.
2. Shelf angles.
3. Metal ladders.
4. Miscellaneous steel trim.
5. Pipe and downspout guards.

B. Products furnished, but not installed, under this Section include the following:

1. Loose steel lintels.
2. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.
3. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.

1.2 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of metal fabrications that are anchored to or that receive other work. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.3 ACTION SUBMITTALS

A. Product Data:
1. Manufactured metal ladders.
2. Pipe and downspout guards.

B. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide Shop Drawings for the following:

1. Miscellaneous framing and supports for applications where framing and supports are not specified in other Sections.
2. Metal ladders.
3. Loose steel lintels.

C. Delegated Design Submittals: For ladders including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

A. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel in accordance with the following welding codes:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
3. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

1.6 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls, floor slabs, decks, and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer to design ladders.

B. Structural Performance of Aluminum Ladders: Ladders including landings are to withstand the effects of loads and stresses within limits and under conditions specified in ANSI/ASC A14.3.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.2 METALS

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

B. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

C. Stainless Steel Sheet, Strip, and Plate: ASTM A240/A240M or ASTM A666, Type 304.

D. Stainless Steel Bars and Shapes: ASTM A276/A276M, Type 304.

E. Steel Tubing: ASTM A500/A500M, cold-formed steel tubing.

F. Steel Pipe: ASTM A53/A53M, Standard Weight (Schedule 40) unless otherwise indicated.

G. Cast Iron: Either gray iron, ASTM A48/A48M, or malleable iron, ASTM A47/A47M, unless otherwise indicated.

H. Aluminum Plate and Sheet: ASTM B209 (ASTM B209M), Alloy 6061-T6.

I. Aluminum Extrusions: ASTM B221 (ASTM B221M), Alloy 6063-T6.

2.3 FASTENERS

A. General: Unless otherwise indicated, provide Type 304 stainless steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.

1. Provide stainless steel fasteners for fastening stainless steel.

B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A (ISO 898-1, Property Class 4.6); with hex nuts, ASTM A563 (ASTM A563M); and, where indicated, flat washers.

C. High-Strength Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325 (Grade A325M), Type 3, heavy-hex steel structural bolts; ASTM A563, Grade DH3, (ASTM A563M, Class 10S3) heavy-hex carbon-steel nuts; and where indicated, flat washers.

D. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A563 (ASTM A563M); and, where indicated, flat washers.

1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.

E. Anchors, General: Capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing in accordance with ASTM E488/E488M, conducted by a qualified independent testing agency.

F. Cast-in-Place Anchors in Concrete: Either threaded or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A47/A47M malleable iron or ASTM A27/A27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F2329/F2329M.

2.4 MISCELLANEOUS MATERIALS

A. Shop Primers: Provide primers that comply with Section 099113 "Exterior Painting." Section 099123 "Interior Painting."

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

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

D. Shrinkage-Resistant Grout: Factory-packaged, nonmetallic, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.5 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

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

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work with accurate angles and surfaces and straight edges.

E. Weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.

G. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

J. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches (3.2 by 38 mm), with a minimum 6-inch (150-

mm) embedment and 2-inch (50-mm) hook, not less than 8 inches (200 mm) from ends and corners of units and 24 inches (600 mm) o.c., unless otherwise indicated.

2.6 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.

1. Fabricate units from slotted channel framing where indicated.
2. Furnish inserts for units installed after concrete is placed.

2.7 SHELF ANGLES

A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch (19-mm) bolts, spaced not more than 6 inches (150 mm) from ends and 24 inches (600 mm) o.c., unless otherwise indicated.

1. Provide mitered and welded units at corners.
2. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately 2 inches (50 mm) larger than expansion or control joint.

B. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete.

C. Galvanize and prime shelf angles located in exterior walls.

D. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

2.8 METAL SHIPS' LADDERS AND PIPE CROSSOVERS

A. Provide metal ships' ladders and pipe crossovers where indicated. Fabricate of open-type construction with channel or plate stringers and pipe and tube railings unless otherwise indicated. Provide brackets and fittings for installation.

1. Treads are not to be less than 5 inches (127 mm) exclusive of nosing or less than 8-1/2 inches (216 mm) including the nosing, and riser height is not to be more than 9-1/2 inches (241 mm).
2. Fabricate ships' ladders and pipe crossovers, including railings from steel.
3. Fabricate treads and platforms from welded or pressure-locked steel bar grating. Limit openings in gratings to no more than 1/2 inch (12 mm) in least dimension.
4. Fabricate treads and platforms from rolled-steel floor plate.
5. Comply with applicable railing requirements in Section 055213 "Pipe and Tube Railings."

B. Galvanize and prime steel ships' ladders and pipe crossovers, including treads, railings, brackets, and fasteners.

C. Prime steel ships' ladders and pipe crossovers, including treads, railings, brackets, and fasteners.

2.9 MISCELLANEOUS STEEL TRIM

A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.

B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.

1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.

C. Galvanize and prime miscellaneous steel trim.

D. Prime miscellaneous steel trim.

2.10 PIPE AND DOWNSPOUT GUARDS

A. Fabricate pipe and downspout guards from 3/8-inch- (9.5-mm-) thick by 12-inch- (300-mm-) wide, stainless steel, ASTM A480/A480M, No. 4 finish plate, bent to fit flat against the wall or column at both ends and to fit around pipe with 2-inch (50-mm) clearance between pipe and pipe guard. Drill each end for two 3/4-inch (19-mm) anchor bolts.

B. Galvanize and prime steel guards.

2.11 LOOSE STEEL LINTELS

A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Fabricate in single lengths for each opening unless otherwise indicated. Weld adjoining members together to form a single unit where indicated.

B. Size loose lintels to provide bearing length at each side of openings equal to one-twelfth of clear span, but not less than 8 inches (200 mm) unless otherwise indicated.

C. Galvanize and prime loose steel lintels located in exterior walls.

2.12 GENERAL FINISH REQUIREMENTS

A. Finish metal fabrications after assembly.

B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.13 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A123M for other steel and iron products.

1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.

B. Preparation for Shop Priming Galvanized Items: After galvanizing, thoroughly clean galvanized surfaces of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.

C. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.

1. Shop prime with primers specified in Section 099113 "Exterior Painting" and primers specified in Section 099123 "Interior Painting" indicated.

D. Preparation for Shop Priming: Prepare surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
2. Items Indicated to Receive Primers: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
3. Other Steel Items: SSPC-SP 3, "Power Tool Cleaning."

E. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

2.14 ALUMINUM FINISHES

A. As-Fabricated Finish: AA-M12.

B. Clear Anodic Finish: AAMA 611, Class I, AA-M12C22A41.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations.

Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

F. Corrosion Protection: Coat concealed surfaces of aluminum that come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:

1. Cast Aluminum: Heavy coat of bituminous paint.
2. Extruded Aluminum: Two coats of clear lacquer.

3.2 INSTALLATION OF MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

B. Anchor shelf angles securely to existing construction with anchor bolts.

3.3 INSTALLATION OF SHELF ANGLES

A. Install shelf angles as required to keep masonry level, at correct elevation, and flush with vertical plane.

3.4 INSTALLATION OF METAL SHIPS' LADDERS AND PIPE CROSSOVERS

A. Secure top and bottom of ships' ladders to construction to comply with manufacturer's written instructions.

B. Secure pipe crossovers to construction to comply with manufacturer's written instructions.

3.5 INSTALLATION OF MISCELLANEOUS STEEL TRIM

A. Anchor to concrete construction to comply with manufacturer's written instructions.

3.6 INSTALLATION OF PIPE AND DOWNSPOUT GUARDS

A. Provide pipe guards at exposed vertical pipes in where not protected by curbs or other barriers. Install by bolting to wall or column with expansion anchors. Provide four 3/4-inch (19-mm) bolts at each pipe guard. Mount pipe guards with top edge 26 inches (660 mm) above driving surface.

3.7 REPAIRS

A. Touchup Painting:

1. Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

    a. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION 055000

SECTION 061000 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Rooftop equipment bases and support curbs.
   2. Wood blocking, cants, and nailers.
   3. Plywood backing panels.

1.3 DEFINITIONS

A. Boards or Strips: Lumber of less than 2 inches nominal size in least dimension.

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

C. Exposed Framing: Framing not concealed by other construction.

D. OSB: Oriented strand board.

E. Timber: Lumber of 5 inches nominal size or greater in least dimension.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

   1. Include data for wood-preservative 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 D 5664.
   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.

B. Fastener Patterns: Full-size templates for fasteners in exposed framing.

1.5 INFORMATIONAL SUBMITTALS

A. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.

B. Evaluation Reports: For the following, from ICC-ES:

1. Wood-preservative-treated wood.
2. Fire-retardant-treated wood.
3. Engineered wood products.
4. Shear panels.
5. Power-driven fasteners.
6. Post-installed anchors.
7. Metal framing anchors.

1.6 QUALITY ASSURANCE

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

1.7 DELIVERY, STORAGE, AND HANDLING

A. Stack wood products flat with spacers beneath and between each bundle to provide air circulation. Protect wood products 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, comply with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Grade lumber by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece or omit grade stamp and provide certificates of grade compliance issued by grading agency.
3. Dress lumber, S4S, unless otherwise indicated.

B. Maximum Moisture Content of Lumber: 19 percent for 2-inch nominal thickness or less; no limit for more than 2-inch nominal thickness unless otherwise indicated.

C. Engineered Wood Products: Acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that show compliance with building code in effect for Project.

1. Allowable design stresses, as published by manufacturer, shall meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

2.2 WOOD-PRESERVATIVE-TREATED LUMBER

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground.

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.
2. For exposed items indicated to receive a stained or natural finish, chemical formulations shall not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece or omit marking and provide certificates of treatment compliance issued by inspection agency.

D. Application: Treat all rough carpentry unless otherwise indicated.

1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
4. Wood framing members that are less than 18 inches above the ground in crawlspaces or unexcavated areas.
5. Wood floor plates that are installed over concrete slabs-on-grade.

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 E 84, 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. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.
4. Design Value Adjustment Factors: Treated lumber shall be tested according to ASTM D 5664 and design value adjustment factors shall be calculated according to ASTM D 6841. For enclosed roof framing, framing in attic spaces, and where high temperature fire-retardant treatment is indicated, provide material with adjustment factors of not less than 0.85 modulus of elasticity and 0.75 for extreme fiber in bending for Project's climatological zone.

C. Kiln-dry lumber after treatment to maximum moisture content of 19 percent. Kiln-dry plywood after treatment to maximum moisture content of 15 percent.

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

1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece or omit marking and provide certificates of treatment compliance issued by 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 all rough carpentry unless otherwise indicated.

1. Framing for raised platforms.
2. Framing for stages.
3. Concealed blocking.
4. Framing for non-load-bearing partitions.
5. Framing for non-load-bearing exterior walls.
6. Roof construction.
7. 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. Rooftop equipment bases and support curbs.
4. Cants.
5. Furring.
6. 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 WWPA.
5. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.
6. Western woods; WCLIB or WWPA.
7. Northern species; NLGA.
8. Eastern softwoods; NeLMA.

C. Concealed Boards: 19 percent maximum moisture content and 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 WWPA.
3. Spruce-pine-fir (south) or spruce-pine-fir; Construction or No. 2 Common grade; NeLMA, NLGA, WCLIB, or WWPA.
4. Eastern softwoods; No. 2 Common grade; NeLMA.
5. Northern species; No. 2 Common grade; NLGA.
6. Western woods; Construction or No. 2 Common grade; WCLIB or WWPA.

D. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.

E. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

F. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.5 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 1/2-inch nominal thickness.

2.6 FASTENERS

A. General: Fasteners shall be of size and type indicated and shall comply with requirements specified in this article for material and manufacture.

1. Where rough 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 A 153/A 153M.

B. Nails, Brads, and Staples: ASTM F 1667.

C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

D. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01, ICC-ES AC58, ICC-ES AC193, or ICC-ES AC308 as appropriate for the substrate.

1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.
2. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2.

2.7 MISCELLANEOUS MATERIALS

A. Sill-Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to suit width of sill members indicated.

B. Adhesives for Gluing Furring and Sleepers to Concrete or Masonry: Formulation complying with ASTM D 3498 that is approved for use indicated by adhesive manufacturer.

C. Water-Repellent Preservative: NWWDA-tested and -accepted formulation containing 3-iodo-2-propynyl butyl carbamate, combined with an insecticide containing chloropyrifos as its active ingredient.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

B. Framing with Engineered Wood Products: Install engineered wood products to comply with manufacturer's written instructions.

C. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry accurately to other construction. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.

D. 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.

E. Install shear wall panels to comply with manufacturer's written instructions.

F. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.

G. Install sill sealer gasket to form continuous seal between sill plates and foundation walls.

H. Do not splice structural members between supports unless otherwise indicated.

I. 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.

J. 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.
2. Fire block concealed spaces of wood-framed walls and partitions at each floor level, at ceiling line of top story, and at not more than 96 inches o.c. Where fire blocking is not inherent in framing system used, provide closely fitted solid wood blocks of same width as framing members and 2-inch nominal thickness.
3. Fire block concealed spaces between floor sleepers with same material as sleepers to limit concealed spaces to not more than 100 sq. ft. and to solidly fill space below partitions.
4. Fire block concealed spaces behind combustible cornices and exterior trim at not more than 20 feet o.c.

K. 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.

L. 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.

M. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

N. Securely attach rough 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 (IBC).
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.

O. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

P. For exposed work, arrange fasteners in straight rows parallel with edges of members, with fasteners evenly spaced, and with adjacent rows staggered.

1. Comply with approved fastener patterns where applicable. Before fastening, mark fastener locations, using a template made of sheet metal, plastic, or cardboard.
2. Use finishing nails unless otherwise indicated. Countersink nail heads and fill holes with wood filler.
3. Use common nails unless otherwise indicated. Drive nails snug but do not countersink nail heads.

3.2 WOOD BLOCKING, AND NAILER INSTALLATION

A. Install where indicated and where required for screeding o**r** 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 WOOD FURRING INSTALLATION

A. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.

B. Furring to Receive Plywood or Hardboard Paneling: Install 1-by-3-inch nominal-size furring horizontally and vertically at 24 inches o.c.

C. Furring to Receive Gypsum Board Plaster Lath: Install 1-by-2-inch nominal-size furring vertically at 16 inches o.c.

3.4 PROTECTION

A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

B. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet enough that moisture content exceeds that specified, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 061000

SECTION 070150.19 - PREPARATION FOR REROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. The Work of This Section Includes:
   1. Partial roof tear-off.
   2. Roof re-cover preparation.
   3. Base flashing removal.
   4. Fastener pull-out testing.
   5. Disposal.

1.2 DEFINITIONS

A. EPS: Molded (expanded) polystyrene.

B. Partial Roof Tear-off: Removal of selected components and accessories from existing roofing system.

C. Roofing Terminology: Definitions in ASTM D1079 and glossary of NRCA's "The NRCA Roofing Manual: Membrane Roof Systems" apply to work of this Section.

D. Roof Re-Cover Preparation: Existing roofing system is to remain and be prepared for new roof installed over it.

1.3 PREINSTALLATION MEETINGS

A. Preliminary Roofing Conference: Before starting removal Work, conduct conference at Project site.

   1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
   2. Review methods and procedures related to roofing tear-off, including, but not limited to, the following:

      a. Reroofing preparation, including roofing system manufacturer's written instructions.
      b. Temporary protection requirements for existing roofing system components that are to remain.
      c. Existing roof drains and roof drainage during each stage of reroofing, and roof-drain plugging and plug removal.
      d. Construction schedule and availability of materials, Installer's personnel, equipment, and facilities needed to avoid delays.
      e. Existing roof deck conditions requiring Architect notification.

f. Existing roof deck removal procedures and Owner notifications.
g. Condition and acceptance of existing roof deck and base flashing substrate for reuse.
h. Structural loading limitations of roof deck during reroofing.
i. Base flashings, special roofing details, drainage, penetrations, equipment curbs, and condition of other construction that affect reroofing.
j. HVAC shutdown and sealing of air intakes.
k. Shutdown of fire-suppression, -protection, and -alarm and -detection systems.
l. Asbestos removal and discovery of asbestos-containing materials.
m. Governing regulations and requirements for insurance and certificates if applicable.
n. Existing conditions that may require Architect notification before proceeding.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.
1. Include certificate that Installer is licensed to perform asbestos abatement.

B. Field Test Reports: Fastener pull-out test report.

C. Photographs or Video: Show existing conditions of adjoining construction and site improvements, including exterior and interior finish surfaces, that might be misconstrued as having been damaged by reroofing operations.

1. Submit before Work begins.

1.6 FIELD CONDITIONS

A. Existing Roofing System: Modified bituminous roofing.

B. Owner will occupy portions of building immediately below reroofing area.

1. Conduct reroofing so Owner's operations are not disrupted.
2. Provide Owner with not less than 72 hours' written notice of activities that may affect Owner's operations.
3. Coordinate work activities daily with Owner so Owner has adequate advance notice to place protective dust and water-leakage covers over sensitive equipment and furnishings, shut down HVAC and fire-alarm or -detection equipment if needed, and evacuate occupants from below work area.
4. Before working over structurally impaired areas of deck, notify Owner to evacuate occupants from below affected area.

a. Verify that occupants below work area have been evacuated before proceeding with work over impaired deck area.

C. Protect building to be reroofed, adjacent buildings, walkways, site improvements, exterior plantings, and landscaping from damage or soiling from reroofing operations.

D. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities.

E. Conditions existing at time of inspection for bidding will be maintained by Owner as far as practical.

1. A roof moisture survey of existing roofing system is available for Contractor's reference.
2. The results of an analysis of test cores from existing roofing system are available for Contractor's reference.
3. Construction Drawings[and Project Manual] for existing roofing system are provided for Contractor's convenience and information, but they are not a warranty of existing conditions. They are intended to supplement rather than serve in lieu of Contractor's own investigations. Contractor is responsible for conclusions derived from existing documents.

F. Limit construction loads on existing roof areas to remain, and existing roof areas scheduled to be reroofed to 20 psf for rooftop equipment wheel loads and 20 psf for uniformly distributed loads.

G. Weather Limitations: Proceed with reroofing preparation only when existing and forecasted weather conditions permit Work to proceed without water entering existing roofing system or building.

1. Remove only as much roofing in one day as can be made watertight in the same day.

PART 2 - PRODUCTS

2.1 TEMPORARY PROTECTION MATERIALS

A. EPS Insulation: ASTM C578.

B. Plywood: DOC PS 1, Grade CD, Exposure 1.

C. OSB: DOC PS 2, Exposure 1.

2.2 INFILL AND REPLACEMENT MATERIALS

A. Use infill materials matching existing roofing system materials unless otherwise indicated.

B. Steel deck is specified in Section 053100 "Steel Decking."

C. Wood blocking, curbs, and nailers are specified in Section 061000 "Rough Carpentry."

D. Fasteners: Factory-coated steel fasteners with metal or plastic plates listed in FM Approvals' RoofNav, and acceptable to new roofing system manufacturer.

2.3 AUXILIARY REROOFING MATERIALS

A. General: Use auxiliary reroofing preparation materials recommended by roofing system manufacturer for intended use and compatible with components of existing and new roofing system.

PART 3 - EXECUTION

3.1 PREPARATION

A. Seal or isolate windows that may be exposed to airborne substances created in removal of existing materials.

B. Shut off rooftop utilities and service piping before beginning the Work.

C. Test existing roof drains to verify that they are not blocked or restricted.

1. Immediately notify Architect of any blockages or restrictions.

D. Coordinate with Owner to shut down air-intake equipment in the vicinity of the Work.

1. Cover air-intake louvers before proceeding with reroofing work that could affect indoor air quality or activate smoke detectors in the ductwork.

E. Maintain roof drains in functioning condition to ensure roof drainage at end of each workday.

1. Prevent debris from entering or blocking roof drains and conductors.

a. Use roof-drain plugs specifically designed for this purpose.
b. Remove roof-drain plugs at end of each workday, when no work is taking place, or when rain is forecast.

2. If roof drains are temporarily blocked or unserviceable due to roofing system removal or partial installation of new roofing system, provide alternative drainage method to remove water and eliminate ponding.

a. Do not permit water to enter into or under existing roofing system components that are to remain.

3.2 INFILL MATERIALS INSTALLATION

A. Immediately after roof tear-off, and inspection and repair, if needed, of deck, fill in tear-off areas to match existing roofing system construction.

B. Install new roofing patch over roof infill area.

1. If new roofing is installed the same day tear-off is made, roofing patch is not required.

3.3 ROOF RE-COVER PREPARATION

A. Remove blisters, ridges, buckles, and other substrate irregularities from existing roofing that inhibit new recover boards from conforming to substrate.

1. Remove loose aggregate from aggregate-surfaced, built-up bituminous roofing with a power broom.
2. Power vacuum the existing roof surface.

a. If recommended by foam manufacturer, prime dried surface at recommended rate with recommended primer.

3.4 BASE FLASHING REMOVAL

A. Remove existing base flashings.

1. Clean substrates of contaminants, such as asphalt, sheet materials, dirt, and debris.

B. Remove existing parapet sheathing and replace with new parapet sheathing to comply with Section 061600 "Sheathing."

1. If parapet framing, wood blocking, curbs, or nailers have deteriorated, immediately notify Architect.

3.5 FASTENER PULL-OUT TESTING

A. Perform fastener pull-out tests according to SPRI FX-1, and submit test report to Architect and roofing manufacturer before installing new roofing system.

1. Obtain roofing manufacturer's approval to proceed with specified fastening pattern.

a. Roofing manufacturer may furnish revised fastening pattern commensurate with pull-out test results.

3.6 DISPOSAL

A. Collect demolished materials and place in containers.

1. Promptly dispose of demolished materials.
2. Do not allow demolished materials to accumulate on-site.
3. Storage or sale of demolished items or materials on-site is not permitted.

B. Transport and legally dispose of demolished materials off Owner's property.

END OF SECTION 070150.19

SECTION 072100 - THERMAL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Extruded polystyrene foam-plastic board insulation.
2. Molded (expanded) polystyrene foam-plastic board insulation.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

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 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Maximum flame-spread and smoke-developed indexes less than Class A, 25 and 450 when tested in accordance with ASTM E84.

B. Fire-Resistance Ratings: Comply with ASTM E119 or UL 263; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL's "Fire Resistance Directory" or from listings of another qualified testing agency.

C. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

D. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches (305 mm) and wider in width.

E. Thermal-Resistance Value (R-Value): R-value as indicated on Drawings in accordance with ASTM C518.

2.2 EXTRUDED POLYSTYRENE FOAM-PLASTIC BOARD INSULATION (XPS)

A. Extruded Polystyrene Board Insulation, Type IV, Drainage Panels: ASTM C578, Type IV, 25 psi (173 kPa) minimum compressive strength; unfaced.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. DiversiFoam Products.
   b. DuPont de Nemours, Inc.
   c. Owens Corning.
   d. The Dow Chemical Company.

B. Extruded Polystyrene Board Insulation, Type VII: ASTM C578, Type VII, 60 psi (414 kPa) minimum compressive strength.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. DiversiFoam Products.
   b. Kingspan Insulation LLC.
   c. Owens Corning.
   d. The Dow Chemical Company.

2.3 MOLDED (EXPANDED) POLYSTYRENE FOAM-PLASTIC BOARD INSULATION (EPS)

A. Molded (Expanded) Polystyrene Board Insulation, Type IV, Faced: ASTM C578, Type IV, 25 psi (173 kPa) minimum compressive strength.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. DiversiFoam Products.
   b. DuPont de Nemours, Inc.
   c. Owens Corning.

2. The Dow Chemical Company.

B. Molded (Expanded) Polystyrene Board Insulation, Type VII, Faced: ASTM C578, Type VII, 60 psi (414 kPa) minimum compressive strength.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. DiversiFoam Products.
   b. Kingspan Insulation LLC.
   c. Owens Corning.
   d. The Dow Chemical Company.

2.4 INSULATION FASTENERS

A. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of specified thickness securely in position with self-locking washer in place.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. AGM Industries, Inc.
   b. Gemco.
2. Plate: Perforated, galvanized carbon-steel sheet, 0.030 inch (0.762 mm) thick by 2 inches (50 mm) square.
3. Spindle: Copper-coated, low-carbon steel; fully annealed; 0.105 inch (2.67 mm) in diameter; length to suit depth of insulation.

B. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- (0.41-mm-) thick galvanized-steel sheet, with beveled edge for increased stiffness, sized as required to hold insulation securely in place, but not less than 1-1/2 inches (38 mm) square or in diameter.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. AGM Industries, Inc.
   b. Gemco.
2. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in the following locations:
   a. Ceiling plenums.

C. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates without damaging insulation, fasteners, or substrates.

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

D. Insulation Fastener Accessories: Provide double-pointed weld pins, lagging pins, quilting pins, duct liner pins, insulation hangers, specialty washers, special caps, j-hooks, capacitor discharge annular weld pins, capacitor discharge acoustical lagging pins, and other accessory materials that are recommended in writing by insulation fastener manufacturer to produce complete insulation supports.

2.5 ACCESSORIES

A. Miscellaneous Application Accessories:

1. Adhesive for Bonding Insulation: Product compatible with insulation and air and water barrier materials, and with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.
2. Crack Sealer: Closed-cell insulating foam in aerosol dispenser recommended in writing by insulation manufacturer for filling gaps in board insulation.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean substrates of substances that are harmful to insulation, including removing projections capable of puncturing insulation or vapor retarders, or those that interfere with insulation attachment.

3.2 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products, applications and applicable codes.

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 envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

E. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

3.3 INSTALLATION OF SLAB INSULATION

A. On vertical slab edge and foundation surfaces, set insulation units using manufacturer's recommended adhesive in accordance with manufacturer's written instructions.

B. On horizontal surfaces, loosely lay insulation units in accordance with manufacturer's written instructions. Stagger end joints and tightly abut insulation units.

1. If not otherwise indicated, extend insulation a minimum of 24 inches (610 mm) in from exterior walls.

3.4 INSTALLATION OF FOUNDATION WALL INSULATION

A. Butt panels together for tight fit.

B. Anchor Installation: Install board insulation on concrete substrates by adhesively attached, spindle-type insulation anchors as follows:

1. Fasten insulation anchors to concrete substrates with insulation anchor adhesive in accordance with anchor manufacturer's written instructions.
2. Space anchors in accordance with insulation manufacturer's written instructions for insulation type, thickness, and application.
3. After adhesive has dried, install board insulation by pressing insulation into position over spindles and securing it tightly in place with insulation-retaining washers, taking care not to compress insulation.

C. Adhesive Installation: Install with adhesive or press into tacky waterproofing or dampproofing in accordance with manufacturer's written instructions.

3.5 INSTALLATION OF CAVITY-WALL INSULATION

A. Foam-Plastic Board Insulation: Install pads of adhesive spaced approximately 24 inches (610 mm) o.c. both ways on inside face and as recommended in writing by manufacturer.

1. Fit courses of insulation between wall ties and other obstructions, with edges butted tightly in both directions, and with faces flush.
2. Press units firmly against inside substrates.

3.6 INSTALLATION OF BOARD INSULATION

A. Install board insulation in accordance with manufacturer's written instructions per project applications and conditions.

3.7 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes.

B. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 072100

SECTION 072726 - FLUID-APPLIED MEMBRANE AIR BARRIERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. High-build air barriers, vapor permeable.

1.2 DEFINITIONS

A. Air-Barrier Accessory: A transitional component of the air barrier that provides continuity.

B. Air-Barrier Assembly: The collection of air-barrier materials and accessories applied to an opaque wall, including joints and junctions to abutting construction, to control air movement through the wall.

C. Air-Barrier Material: A primary element that provides a continuous barrier to the movement of air.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

   1. Review air-barrier requirements and installation, special details, mockups, air-leakage and bond testing, air-barrier protection, and work scheduling that covers air barriers.

1.4 ACTION SUBMITTALS

A. Product Data: Include manufacturer's written instructions for evaluating, preparing, and treating each substrate; technical data; dry film thickness; and tested physical and performance properties of products.
   1. High-build air barriers, vapor permeable.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer. Include list of ABAA-certified installers and supervisors employed by Installer, who work on Project.

B. Product Certificates: From air-barrier manufacturer, certifying compatibility of air barriers and accessory materials with Project materials that connect to or that come in contact with the barrier.

C. Product Test Reports: For each air-barrier assembly, for tests performed by a qualified testing agency.

D. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1. Installer to be licensed by ABAA in accordance with ABAA's Quality Assurance Program and to employ ABAA-certified installers and supervisors on Project.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Remove and replace liquid materials that cannot be applied within their stated shelf life.

B. Protect stored materials from direct sunlight.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Apply air barrier within the range of ambient and substrate temperatures recommended in writing by air-barrier manufacturer.

1. Protect substrates from environmental conditions that affect air-barrier performance.
2. Do not apply air barrier to a damp or wet substrate or during snow, rain, fog, or mist.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain primary air-barrier materials and air-barrier accessories from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Air-Barrier Performance: Air-barrier assembly and seals with adjacent construction to be capable of performing as a continuous air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air-barrier assemblies to be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations, tie-ins to installed waterproofing, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.

B. Air-Barrier Assembly Air Leakage: Maximum 0.04 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft. (0.2 L/s x sq. m of surface area at 75 Pa), when tested in accordance with ASTM E2357.

C. Air Permeance: Maximum 0.004 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft. (0.02 L/s x sq. m of surface area at 75 Pa) pressure difference; ASTM E2178.

D. Ultimate Elongation: Minimum 250 percent; ASTM D412, Die C.

E. Adhesion to Substrate: Minimum 16 lbf/sq. in. (110 kPa) when tested in accordance with ASTM D4541.

F. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

G. UV Resistance: Can be exposed to sunlight for 30 days in accordance with manufacturer's written instructions.

2.3 HIGH-BUILD AIR BARRIERS, VAPOR PERMEABLE

A. High-Build, Vapor-Permeable Air Barrier, Synthetic Polymer Type: Synthetic polymer membrane with an installed dry film thickness, according to manufacturer's written instructions, of 35 mils (0.9 mm) or thicker over smooth, void-free substrates.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. DuPont de Nemours, Inc.
   b. GCP Applied Technologies, Inc.
   c. Henry Company.
   d. Tremco Incorporated.

B. Vapor Permeance: Minimum 5 perms (290 ng/Pa x s x sq. m); ASTM E96/E96M, Procedure B, Water Method.

2.4 ACCESSORY MATERIALS

A. Provide primers, transition strips, termination strips, joint reinforcing fabric and strips, joint sealants, counterflashing strips, flashing sheets and metal termination bars, termination mastic, substrate patching materials, adhesives, tapes, foam sealants, lap sealants, and other accessory materials that are recommended in writing by air-barrier manufacturer to produce a complete air-barrier assembly and that are compatible with primary air-barrier material and adjacent construction to which they may seal.

B. Primer: Liquid waterborne primer recommended for substrate by air-barrier material manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

1. Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.

2. Verify that substrates have cured and aged for minimum time recommended in writing by air-barrier manufacturer.
3. Verify that substrates are visibly dry and free of moisture. Test concrete substrates for capillary moisture by plastic sheet method in accordance with ASTM D4263.
4. Verify that masonry joints are flush and completely filled with mortar.

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

3.2 SURFACE PREPARATION

A. Clean, prepare, treat, fill, and seal substrate and joints and cracks in substrate in accordance with manufacturer's written instructions and details. Provide clean, dust-free, and dry substrate for air-barrier application.

B. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.

C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.

D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate-patching material.

E. Remove excess mortar from masonry ties, shelf angles, and other obstructions.

F. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.

G. Cover gaps in substrate plane and form a smooth transition from one substrate plane to another with stainless steel sheet mechanically fastened to structural framing to provide continuous support for air barrier.

H. Bridge expansion joints and discontinuous wall-to-wall, deck-to-wall, and deck-to-deck joints with air-barrier accessory material that accommodates joint movement in accordance with manufacturer's written instructions and details.

3.3 INSTALLATION OF ACCESSORIES

A. Install accessory materials in accordance with air-barrier manufacturer's written instructions and details to form a seal with adjacent construction and ensure continuity of air and water barrier.

1. Coordinate the installation of air barrier with installation of roofing membrane and base flashing to ensure continuity of air barrier with roofing membrane.
2. Install transition strip on roofing membrane or base flashing so that a minimum of 3 inches (75 mm) of coverage is achieved over each substrate.
3. Unless manufacturer recommends in writing against priming, apply primer to substrates at required rate and allow it to dry.

4. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by air-barrier material on same day. Reprime areas exposed for more than 24 hours.

B. Connect and seal exterior wall air-barrier material continuously to roofing-membrane air barrier, concrete below-grade structures, floor-to-floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.

C. At end of each working day, seal top edge of strips and transition strips to substrate with termination mastic.

D. Apply joint sealants forming part of air-barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

E. Wall Openings: Prime concealed, perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply transition strip or preformed silicone extrusion so that a minimum of 3 inches (75 mm) of coverage is achieved over each substrate. Maintain 3 inches (75 mm) of full contact over firm bearing to perimeter frames, with not less than 1 inch (25 mm) of full contact.

1. Transition Strip: Roll firmly to enhance adhesion.
2. Preformed Silicone Extrusion: Set in full bed of silicone sealant applied to walls, frame, and air-barrier material.

F. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, and doors, and miscellaneous penetrations of air-barrier material with foam sealant.

G. Seal strips and transition strips around masonry reinforcing or ties and penetrations with termination mastic.

H. Seal top of through-wall flashings to air barrier with an additional 6-inch- (150-mm-) wide, transition strip.

I. Seal exposed edges of strips at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.

J. Repair punctures, voids, and deficient lapped seams in strips and transition strips. Slit and flatten fishmouths and blisters. Patch with transition strips extending 6 inches (150 mm) beyond repaired areas in strip direction.

3.4 INSTALLATION OF PRIMARY AIR-BARRIER MATERIAL

A. Apply air-barrier material to form a seal with strips and transition strips and to achieve a continuous air barrier in accordance with air-barrier manufacturer's written instructions and details. Apply air-barrier material within manufacturer's recommended application temperature ranges.

1. Unless manufacturer recommends in writing against priming, apply primer to substrates at required rate and allow it to dry.
2. Limit priming to areas that will be covered by air-barrier material on same day. Reprime areas exposed for more than 24 hours.
3. Where multiple prime coats are needed to achieve required bond, allow adequate drying time between coats.

B. High-Build Air Barriers: Apply continuous unbroken air-barrier material to substrates according to the following thickness. Apply air-barrier material in full contact around protrusions such as masonry ties.
1. Vapor-Permeable, High-Build Air Barrier: Total dry film thickness as recommended in writing by manufacturer to comply with performance requirements, but not less than 35 mils (0.9 mm), applied in one or more equal coats.

C. Do not cover air barrier until it has been tested and inspected by testing agency.

D. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air-barrier components.

3.5 FIELD QUALITY CONTROL

A. ABAA Quality Assurance Program: Perform examinations, preparation, installation, testing, and inspections under ABAA's Quality Assurance Program.

B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

C. Inspections: Air-barrier materials, accessories, and installation are subject to inspection for compliance with requirements. Inspections may include the following:

1. Continuity of air-barrier system has been achieved throughout the building envelope with no gaps or holes.
2. Air-barrier dry film thickness.
3. Continuous structural support of air-barrier system has been provided.
4. Masonry and concrete surfaces are smooth, clean, and free of cavities, protrusions, and mortar droppings.
5. Site conditions for application temperature and dryness of substrates have been maintained.
6. Maximum exposure time of materials to UV deterioration has not been exceeded.
7. Surfaces have been primed, if applicable.
8. Laps in strips and transition strips have complied with minimum requirements and have been shingled in the correct direction (or mastic has been applied on exposed edges), with no fishmouths.
9. Termination mastic has been applied on cut edges.
10. Strips and transition strips have been firmly adhered to substrate.
11. Compatible materials have been used.
12. Transitions at changes in direction and structural support at gaps have been provided.
13. Connections between assemblies (air-barrier and sealants) have complied with requirements for cleanliness, surface preparation and priming, structural support, integrity, and continuity of seal.
14. All penetrations have been sealed.

D. Tests: As determined by testing agency from among the following tests:

1. Air-Leakage-Location Testing: Air-barrier assemblies will be tested for evidence of air leakage in accordance with [ASTM E1186, chamber pressurization or depressurization with smoke tracers.
2. Air-Leakage-Volume Testing: Air-barrier assemblies will be tested for air-leakage rate in accordance with ASTM E783 or ASTM E2357.
3. Adhesion Testing: Air-barrier assemblies will be tested for required adhesion to substrate in accordance with ASTM D4541 for each 600 sq. ft. (56 sq. m) of installed air barrier or part thereof.

E. Air barriers will be considered defective if they do not pass tests and inspections.

1. Apply additional air-barrier material, in accordance with manufacturer's written instructions, where inspection results indicate insufficient thickness.
2. Remove and replace deficient air-barrier components for retesting as specified above.

F. Repair damage to air barriers caused by testing; follow manufacturer's written instructions.

G. Prepare test and inspection reports.

3.6 CLEANING AND PROTECTION

A. Protect air-barrier system from damage during application and remainder of construction period, in accordance with manufacturer's written instructions.

1. Protect air barrier from exposure to UV light and harmful weather exposure as recommended in writing by manufacturer. If exposed to these conditions for longer than recommended, remove and replace air barrier or install additional, full-thickness, air-barrier application after repairing and preparing the overexposed materials in accordance with air-barrier manufacturer's written instructions.
2. Protect air barrier from contact with incompatible materials and sealants not approved by air-barrier manufacturer.

B. Clean spills, stains, and soiling from construction that would be exposed in the completed work using cleaning agents and procedures recommended in writing by manufacturer of affected construction.

C. Remove masking materials after installation.

END OF SECTION 072726

SECTION 075423 - THERMOPLASTIC-POLYOLEFIN (TPO) ROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Thermoplastic polyolefin (TPO) roofing system.
2. Accessory roofing materials.
3. Roof insulation.
4. Insulation accessories and cover board.
5. Walkways.

1.2 DEFINITIONS

A. Roofing Terminology: Definitions in ASTM D1079 and glossary in NRCA's "The NRCA Roofing Manual: Membrane Roof Systems" apply to Work of this Section.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Roofing Conference: Conduct conference at Project site.

1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, air barrier Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
3. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
5. Review structural loading limitations of roof deck during and after roofing.
6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.
7. Review governing regulations and requirements for insurance and certificates if applicable.
8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.

1.4 ACTION SUBMITTALS

A. Product Data:

1. Thermoplastic polyolefin (TPO) roofing system.
2. Accessory roofing materials.
3. Roof insulation.
4. Insulation accessories and cover board.
5. Walkways.

B. Shop Drawings: Include roof plans, sections, details, and attachments to other work, including the following:

1. Layout and thickness of insulation.
2. Base flashings and membrane termination details.
3. Flashing details at penetrations.
4. Tapered insulation layout, thickness, and slopes.
5. Roof plan showing orientation of steel roof deck and orientation of roof membrane, fastening spacings, and patterns for mechanically fastened roofing system.
6. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.
7. Tie-in with adjoining air barrier.

C. Samples for Verification: For the following products:

1. Roof membrane and flashings, of color required.
2. Walkway pads or rolls, of color required.

1.5 INFORMATIONAL SUBMITTALS

A. Manufacturer Certificates:

1. Performance Requirement Certificate: Signed by roof membrane manufacturer, certifying that roofing system complies with requirements specified in "Performance Requirements" Article.

a. Submit evidence of compliance with performance requirements.

B. Product Test Reports: For roof membrane and insulation, for tests performed by a qualified testing agency, indicating compliance with specified requirements.

C. Research Reports: For components of roofing system, from ICC-ES showing compliance with specified performance requirements.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roofing system to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that is listed in FM Approvals' RoofNav for roofing system identical to that used for this Project.

B. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.

B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.

1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.

C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

D. Handle and store roofing materials, and place equipment in a manner to avoid permanent deflection of deck.

1.9 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

1.10 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period.

1. Special warranty includes roof membrane, base flashings, roof insulation, fasteners, adhesives, cover boards, roof membrane, base flashing sheet, and other components of roofing system.
2. Warranty Period: 20 years from date of Substantial Completion.

B. Special Project Warranty: Submit roofing Installer's warranty, on warranty form at end of this Section, signed by Installer, covering the Work of this Section, including all components of roofing system such as roof membrane, base flashing, roof insulation, fasteners, adhesives, cover board, and walkway products for the following warranty period:

1. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Installed roofing system and flashings to withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roof system and flashings to remain watertight.

1. Accelerated Weathering: Roof to withstand 2000 hours of exposure when tested according to ASTM G152, ASTM G154, or ASTM G155.
2. Impact Resistance: Roof membrane to resist impact damage when tested according to ASTM D3746, ASTM D4272, or the "Resistance to Foot Traffic Test" in FM Approvals 4470.

B. Material Compatibility: Roofing materials to be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roof membrane manufacturer based on testing and field experience.

C. FM Approvals' RoofNav Listing: Roof membrane, base flashings, and component materials comply with requirements in FM Approvals 4450 or FM Approvals 4470 as part of a roofing system, and are listed in FM Approvals' RoofNav for Class 1 or noncombustible construction, as applicable. Identify materials with FM Approvals Certification markings.

1. Fire/Windstorm Classification: Class 1A-90.
2. Hail-Resistance Rating: FM Global Property Loss Prevention Data Sheet 1-34 SH.

D. Exterior Fire-Test Exposure: ASTM E108 or UL 790, Class A; for application and roof slopes indicated; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

E. Fire-Resistance Ratings: Comply with fire-resistance-rated assembly designs indicated. Identify products with appropriate markings of applicable testing agency.

2.2 THERMOPLASTIC POLYOLEFIN (TPO) ROOFING SYSTEM

A. TPO Sheet: ASTM D6878/D6878M, internally fabric- or scrim-reinforced, fabric-backed TPO sheet.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Carlisle Syntec Systems.
   b. Elevate; Holcim Building Envelope.
   c. Johns Manville; Berkshire Hathaway Company
2. Source Limitations: Obtain components for roofing system from roof membrane manufacturer or manufacturers approved by roof membrane manufacturer.
3. Thickness: 60 mils (1.5 mm), nominal.
4. Exposed Face Color: White.

2.3 ACCESSORY ROOFING MATERIALS

A. General: Accessory materials recommended by roofing system manufacturer for intended use and compatible with other roofing components.

1. Adhesive and Sealants: Comply with VOC limits of authorities having jurisdiction.

B. Sheet Flashing: Manufacturer's standard unreinforced TPO sheet flashing, 55 mils (1.4 mm) thick, minimum, of same color as TPO sheet.

C. Prefabricated Pipe Flashings: As recommended by roof membrane manufacturer.

D. Roof Vents: As recommended by roof membrane manufacturer.

1. Size: Not less than 4-inch (100-mm) diameter.

E. Bonding Adhesive: Manufacturer's standard.

F. Slip Sheet: Manufacturer's standard, of thickness required for application.

G. Metal Termination Bars: Manufacturer's standard, predrilled stainless steel or aluminum bars, approximately 1 by 1/8 inch (25 by 3 mm) thick; with anchors.

H. Metal Battens: Manufacturer's standard, aluminum-zinc-alloy-coated or zinc-coated steel sheet, approximately 1 inch wide by 0.05 inch thick (25 mm wide by 1.3 mm thick), prepunched.

I. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roofing components to substrate, and acceptable to roofing system manufacturer.

J. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, lap sealants, termination reglets, and other accessories.

2.4 ROOF INSULATION

A. General: Preformed roof insulation boards manufactured or approved by TPO roof membrane manufacturer, approved for use in FM Approvals' RoofNav listed roof assemblies.

B. Polyisocyanurate Board Insulation: ASTM C1289, Type II, Class 2, Grade 2, felt or glass-fiber mat facer on both major surfaces.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Carlisle Syntec Systems.
   b. Elevate; Holcim Building Envelope.
   c. John Manville; a Berkshire Hathaway company.
2. Compressive Strength: 20 psi (138 kPa).
3. Size: 48 by 96 inches (1219 by 2438 mm).
4. Thickness: Total R-Value of insulations shall achieve R-25 per current GA code.

C. Tapered Insulation: Provide factory-tapered insulation boards.

1. Material: Match roof insulation.
2. Minimum Thickness: 1/4 inch (6.35 mm).
3. Slope:

a. Roof Field: 1/4 inch per foot (1:48) unless otherwise indicated on Drawings.
b. Saddles and Crickets: 1/2 inch per foot (1:24) unless otherwise indicated on Drawings.

2.5 INSULATION ACCESSORIES AND COVER BOARD

A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with other roofing system components.

B. Insulation Adhesive: Insulation manufacturer's recommended adhesive formulated to attach roof insulation to substrate or to another insulation layer as follows:

C. Glass-Mat Gypsum Cover Board: ASTM C1177/C1177M, water-resistant gypsum board.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Georgia-Pacific Gypsum LLC; Dens Deck
2. Thickness: 1/2 inch (13 mm).
3. Surface Finish: Factory primed.

D. High-Density Polyisocyanurate Insulation Cover Board: ASTM C1289 Type II, Class 4, Grade 1, 1/2 inch (13 mm) thick, with a minimum compressive strength of 80 psi (551 kPa).

2.6 WALKWAYS

A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, slip-resisting, surface-textured walkway pads or rolls, approximately 3/16 inch (5 mm) thick and acceptable to roofing system manufacturer.

1. Size: Approximately36 by 60 inches (914 by 1524 mm).
2. Color: Contrasting with roof membrane.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

1. Verify that roof openings and penetrations are in place, curbs are set and braced, and roof-drain bodies are securely clamped in place.

2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
3. Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Section 053100 "Steel Decking."

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

3.2 PREPARATION

A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing system installation according to roofing system manufacturer's written instructions. Remove sharp projections.

B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

3.3 INSTALLATION OF ROOFING, GENERAL

A. Install roofing system according to roofing system manufacturer's written instructions, FM Approvals' RoofNav listed roof assembly requirements, and FM Global Property Loss Prevention Data Sheet 1-29.

B. Install roof membrane and auxiliary materials to tie in to existing roofing to maintain weathertightness of transition.

C. Coordinate installation and transition of roofing system component serving as an air barrier with air barrier specified under Section 072726 "Fluid-Applied Membrane Air Barriers."

3.4 INSTALLATION OF INSULATION

A. Coordinate installing roofing system components so insulation is not exposed to precipitation or left exposed at end of workday.

B. Comply with roofing system and roof insulation manufacturer's written instructions for installing roof insulation.

C. Installation Over Metal Decking:

1. Install base layer of insulation with end joints staggered not less than 12 inches (305 mm) in adjacent rows and with long joints continuous at right angle to flutes of decking.

    a. Locate end joints over crests of decking.
    b. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
    c. Make joints between adjacent insulation boards not more than 1/4 inch (6 mm) in width.

d. At internal roof drains, slope insulation to create a square drain sump with each side equal to the diameter of the drain bowl plus 24 inches (610 mm).

1) Trim insulation so that water flow is unrestricted.

e. Fill gaps exceeding 1/4 inch (6 mm) with insulation.
f. Cut and fit insulation within 1/4 inch (6 mm) of nailers, projections, and penetrations.

1) Fasten insulation according to requirements in FM Approvals' RoofNav for specified Windstorm Resistance Classification.
2) Fasten insulation to resist specified uplift pressure at corners, perimeter, and field of roof.

2. Install upper layers of insulation and tapered insulation with joints of each layer offset not less than 12 inches (305 mm) from previous layer of insulation.
   a. Install with long joints continuous and with end joints staggered not less than 12 inches (305 mm) in adjacent rows.
   b. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
   c. Make joints between adjacent insulation boards not more than 1/4 inch (6 mm) in width.
   d. At internal roof drains, slope insulation to create a square drain sump with each side equal to the diameter of the drain bowl plus 24 inches (610 mm).

      1) Trim insulation so that water flow is unrestricted.

   e. Fill gaps exceeding 1/4 inch (6 mm) with insulation.
   f. Cut and fit insulation within 1/4 inch (6 mm) of nailers, projections, and penetrations.

3.5 INSTALLATION OF COVER BOARDS

A. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches (150 mm) in each direction.

1. Trim cover board neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
2. At internal roof drains, conform to slope of drain sump.

   a. Trim cover board so that water flow is unrestricted.

3. Cut and fit cover board tight to nailers, projections, and penetrations.
4. Adhere cover board to substrate using adhesive according to FM Approvals' RoofNav listed roof assembly requirements for specified Windstorm Resistance Classification and FM Global Property Loss Prevention Data Sheet 1-29, as follows:
   a. Set cover board in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.

3.6 INSTALLATION OF ADHERED ROOF MEMBRANE

A. Adhere roof membrane over area to receive roofing according to roofing system manufacturer's written instructions.

B. Unroll roof membrane and allow to relax before installing.

C. Start installation of roofing in presence of roofing system manufacturer's technical personnel.

D. Accurately align roof membrane, and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.

E. Seams: Clean seam areas, overlap roof membrane, and hot-air weld side and end laps of roof membrane and sheet flashings, to ensure a watertight seam installation.

1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of roof membrane and sheet flashings.
2. Verify field strength of seams a minimum of twice daily, and repair seam sample areas.
3. Repair tears, voids, and lapped seams in roof membrane that do not comply with requirements.

F. Spread sealant bed over deck-drain flange at roof drains, and securely seal roof membrane in place with clamping ring.

3.7 INSTALLATION OF BASE FLASHING

A. Install sheet flashings and preformed flashing accessories, and adhere to substrates according to roofing system manufacturer's written instructions.

B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate, and allow to partially dry. Do not apply to seam area of flashing.

C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.

D. Clean seam areas, overlap, and firmly roll sheet flashings into the adhesive. Hot-air weld side and end laps to ensure a watertight seam installation.

E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

3.8 INSTALLATION OF WALKWAYS

A. Flexible Walkways:

1. Install flexible walkways at the following locations:
   a. Perimeter of each rooftop unit.
   b. Between each rooftop unit location, creating a continuous path connecting rooftop unit locations.

c. Between each roof hatch and each rooftop unit location or path connecting rooftop unit locations.
d. Top and bottom of each roof access ladder.
e. Between each roof access ladder and each rooftop unit location or path connecting rooftop unit locations.
f. Locations indicated on Drawings.
g. As required by roof membrane manufacturer's warranty requirements.

3.9 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and to inspect substrate conditions, surface preparation, roof membrane application, sheet flashings, protection, and drainage components, and to furnish reports to Architect.

B. Perform the following tests:

C. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion, in presence of Architect, and to prepare inspection report.

D. Repair or remove and replace components of roofing system where inspections indicate that they do not comply with specified requirements.

E. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.

3.10 PROTECTING AND CLEANING

A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction does not affect or endanger roofing system, inspect roofing system for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.

B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

3.11 ROOFING INSTALLER'S WARRANTY

A. WHEREAS _____ of _____, herein called the "Roofing Installer," has performed roofing and associated work ("work") on the following project:

1. Owner: Jackson County.
2. Owner Address: 4965 Jackson Parkway, Jefferson, GA 30549.
3. Building Name/Type: Jackson County Correctional Institution.

4. Building Address: 265 I W Davis Road, Jefferson, GA 30549.
5. Area of Work: Roof.
6. Acceptance Date: _____.
7. Warranty Period: 20 years from date of Substantial Completion.
8. Expiration Date: _____.

B. AND WHEREAS Roofing Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said work against leaks and faulty or defective materials and workmanship for designated Warranty Period,

C. NOW THEREFORE Roofing Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period Roofing Installer will, at Roofing Installer's own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in a watertight condition.

D. This Warranty is made subject to the following terms and conditions:

1. Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:

    a. lightning;
    b. peak gust wind speed exceeding <Insert mph (m/sec)>;
    c. fire;
    d. failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
    e. faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work;
    f. vapor condensation on bottom of roofing; and
    g. activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.

2. When work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.
3. Roofing Installer is responsible for damage to work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of work.
4. During Warranty Period, if Owner allows alteration of work by anyone other than Roofing Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void on date of said alterations, but only to the extent said alterations affect work covered by this Warranty. If Owner engages Roofing Installer to perform said alterations, Warranty shall not become null and void unless Roofing Installer, before starting said work, shall have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate work, thereby reasonably justifying a limitation or termination of this Warranty.
5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray-cooled surface, flooded basin, or other use or service more severe than originally specified, this Warranty shall

become null and void on date of said change, but only to the extent said change affects work covered by this Warranty.

6. Owner shall promptly notify Roofing Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.
7. This Warranty is recognized to be the only warranty of Roofing Installer on said work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of original work according to requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

E. IN WITNESS THEREOF, this instrument has been duly executed this _____ day of _____, _____.

1. Authorized Signature: _____.
2. Name: _____.
3. Title: _____.

END OF SECTION 075423

SECTION 076200 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Custom flashing and trim fabrications, made from the following:

1. Sheet metal materials.
2. Underlayment.
3. Miscellaneous materials.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review construction schedule. Verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Review special roof details, roof drainage, roof-penetration flashing, equipment curbs, and condition of other construction that affect sheet metal flashing and trim.
3. Review requirements for insurance and certificates if applicable.
4. Review sheet metal flashing observation and repair procedures after flashing installation.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For sheet metal flashing and trim.

1. Plans, elevations, sections, and attachment details.
2. Fabrication and installation layouts, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled Work.
3. Identification of material, thickness, weight, and finish for each item and location in Project.
4. Details for forming, including profiles, shapes, seams, and dimensions.
5. Details for joining, supporting, and securing, including layout and spacing of fasteners, cleats, clips, and other attachments. Include pattern of seams.
6. Details of termination points and assemblies.
7. Details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction from fixed points.
8. Details of roof-penetration flashing.
9. Details of edge conditions, including eaves, ridges, valleys, rakes, crickets, flashings, and counterflashings.
10. Details of special conditions.
11. Details of connections to adjoining work.
12. Formed flashing and trim at scale of not less than 1-1/2 inches per 12 inches (1:10).

C. Samples: For each exposed product and for each color and texture specified, 12 inches (300 mm) long by actual width.

D. Samples for Initial Selection: Manufacturer's standard color sheets, showing full range of available colors for each type of exposed finish.

E. Samples for Verification: Actual sample of finished products for each type of exposed finish for sheet metal and other metal accessories.

1. Sheet Metal Flashing and Trim: Manufacturers' standard size. Include finished seam with required profile. Include fasteners, cleats, clips, closures, and other attachments.
2. Anodized Aluminum Samples: Samples to show full range to be expected for each color required.

1.4 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each product, for tests performed by a qualified testing agency.

B. Research Reports: For copings and roof edge flashing, from an agency acceptable to authority having jurisdiction showing compliance with ANSI/SPRI/FM 4435/ES-1.

C. Qualification Statements: For fabricator.

D. Sample warranties.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For sheet metal flashing and trim, and its accessories.

1.6 QUALITY ASSURANCE

A. Fabricator Qualifications: Entity that employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.

B. For roof edge flashings and copings that are ANSI/SPRI/FM 4435/ES-1 tested and FM Approvals approved, shop is to be listed as able to fabricate required details as tested and approved.

1.7 MOCKUPS

A. Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.

1. Build mockup of typical roof edge, including fascia trim, approximately 10 ft. (3.0 m) long, including supporting construction cleats, seams, attachments, underlayment, and accessories.

2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage.

1. Store sheet metal flashing and trim materials away from uncured concrete and masonry.
2. Protect stored sheet metal flashing and trim from contact with water.

B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal flashing and trim installation.

1.9 COORDINATION

A. Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.

B. Coordinate sheet metal flashing and trim installation with adjoining roofing and wall materials, joints, and seams to provide leakproof, secure, and noncorrosive installation.

1.10 WARRANTY

A. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows 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 Delta E units when tested in accordance with ASTM D2244.
b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Sheet metal flashing and trim assemblies, including cleats, anchors, and fasteners, are to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim are not to rattle, leak, or loosen, and are to remain watertight.

B. Sheet Metal Standard for Flashing and Trim: Comply with NRCA's "The NRCA Roofing Manual: Architectural Metal Flashing, Condensation and Air Leakage Control, and Reroofing" and SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.2 SHEET METAL MATERIALS

A. Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.

B. Aluminum Sheet: Coil-coated sheet, ASTM B209/B209M, alloy as standard with manufacturer, with temper as required to suit forming operations and structural performance required.
1. Surface: Smooth, flat.
2. Exposed Coil-Coated Finish:

a. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

3. Color: As selected by Architect from manufacturer's full range.
4. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil (0.013 mm).

C. Stainless Steel Sheet: ASTM A240/A240M, Type 304, dead soft, fully annealed.
1. Surface: Smooth, flat.
2. Exterior Finish: ASTM A480/A480M, No. 2D (dull, cold rolled).

a. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
b. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.

D. Copper-Clad Stainless Steel Sheet: ASTM B506, annealed Temper O61.
   1. Nonpatinated, Exposed Finish: Mill.
   2. Nonpatinated, Exposed, Lacquered Finish: Finish designations for copper alloys comply with system defined in NAAMM/NOMMA AMP 500.

      a. Brushed Satin (Lacquered): M32-06x (Mechanical Finish: directionally textured, medium satin; with clear organic coating); coating of "Incralac," waterborne, methyl methacrylate copolymer lacquer with UV inhibitor, applied by air spray in two coats per manufacturer's written instructions to total thickness of 1 mil (0.025 mm).

2.3 UNDERLAYMENT

A. Self-Adhering, High-Temperature Sheet Underlayment: Provide self-adhering, cold-applied, sheet underlayment, a minimum of 30 mils (0.76 mm) thick, specifically designed to withstand high metal temperatures beneath metal roofing. Provide primer when recommended by underlayment manufacturer.

   1. Thermal Stability: Stable after testing at 240 deg F (116 deg C); ASTM D1970/D1970M.
   2. Low-Temperature Flexibility: Passes after testing at minus 20 deg F (minus 29 deg C) or lower; ASTM D1970/D1970M.
   3. Manufacturers: Subject to the compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Carlisle WIP Products; a brand of Carlisle Construction Materials.
      b. GCP Applied Technologies Inc.
      c. Henry Company; a Carlisle Company.
      d. Owens Corning.
      e. Protecto Wrap Company.

B. Slip Sheet: Rosin-sized building paper, 3 lb/100 sq. ft. (0.16 kg/sq. m) minimum, of type required for application.

2.4 MISCELLANEOUS MATERIALS

A. Provide materials and types of fasteners, solder, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.

B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.

   1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.

      a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.

b. Blind Fasteners: High-strength aluminum or stainless steel rivets suitable for metal being fastened.
c. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.

2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
3. Fasteners for Stainless Steel Sheet: Series 300 stainless steel.

C. Solder:
1. For Stainless Steel: ASTM B32, Grade Sn60 with acid flux of type recommended by stainless steel sheet manufacturer.

D. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.

E. Elastomeric Sealant: ASTM C920, elastomeric silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

F. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.

G. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.

H. Reglets: Units of type, material, and profile required, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated with factory-mitered and -welded corners and junctions and with interlocking counterflashing on exterior face, of same metal as reglet.
1. Surface-Mounted Type: Provide with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.

2. Finish: With manufacturer's standard color coating.

2.5 FABRICATION, GENERAL

A. Custom fabricate sheet metal flashing and trim to comply with details indicated and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required.

1. Fabricate sheet metal flashing and trim in shop to greatest extent possible.
2. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
3. Verify shapes and dimensions of surfaces to be covered and obtain field measurements for accurate fit before shop fabrication.

4. Form sheet metal flashing and trim to fit substrates without excessive oil-canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
5. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.

B. Fabrication Tolerances:

1. Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 ft. (6 mm in 6 m) on slope and location lines indicated on Drawings and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.
2. Fabricate sheet metal flashing and trim that is capable of installation to tolerances specified.

C. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.

1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with butyl sealant concealed within joints.
2. Use lapped expansion joints only where indicated on Drawings.

D. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal in accordance with cited sheet metal standard to provide for proper installation of elastomeric sealant.

E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

F. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard and by FM Global Property Loss Prevention Data Sheet 1-49 for application, but not less than thickness of metal being secured.

G. Seams:

1. Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.
2. Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. Rivet joints where necessary for strength.
3. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints where necessary for strength.

H. Do not use graphite pencils to mark metal surfaces.

2.6 ROOF-DRAINAGE SHEET METAL FABRICATIONS

A. Hanging Gutters:

1. Fabricate to cross section required, complete with end pieces, outlet tubes, and other accessories as required.
2. Fabricate in minimum 96-inch- (2400-mm-) long sections.

3. Fabricate expansion joints, expansion-joint covers, gutter bead reinforcing bars, and gutter accessories from same metal as gutters. Shop fabricate interior and exterior corners.
4. Gutter Profile: Style A in accordance with cited sheet metal standard.
5. Expansion Joints: Lap type.

B. Downspouts: Fabricate rectangular downspouts to dimensions indicated on Drawings, complete with mitered elbows. Furnish with metal hangers from same material as downspouts and anchors. Shop fabricate elbows.

1. Fabricated Hanger Style: Fig. 1-35J in accordance with SMACNA's "Architectural Sheet Metal Manual."

2.7 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

A. Roof Edge Flashing (Gravel Stop) and Fascia Cap: Fabricate in minimum 96-inch- (2400-mm-) long, but not exceeding 12 ft. (3.6 m) long sections. Furnish with 6-inch- (150-mm-) wide, joint cover plates. Shop fabricate interior and exterior corners.

1. Joint Style: Overlapped, 4 inches (100 mm) wide.
2. Fabricate from the following materials:
   a. Stainless Steel: 0.0188 inch (0.477 mm) thick.

B. Base Flashing: Shop fabricate interior and exterior corners. Fabricate from the following materials:
1. Aluminum: 0.040 inch (1.02 mm) thick.
2. Stainless Steel: 0.0188 inch (0.477 mm) thick.

C. Counterflashing: Shop fabricate interior and exterior corners. Fabricate from the following materials:
1. Aluminum: 0.032 inch (0.81 mm) thick.
2. Stainless Steel: 0.0188 inch (0.477 mm) thick.

D. Roof-Penetration Flashing: Fabricate from the following materials:
1. Stainless Steel: [0.0188 inch (0.477 mm)] <Insert dimension> thick.

E. Roof-Drain Flashing: Fabricate from the following materials:

1. Stainless Steel: [0.0156 inch (0.396 mm)] <Insert dimension> thick.

2.8 WALL SHEET METAL FABRICATIONS

A. Through-Wall Flashing: Fabricate continuous flashings in minimum 96-inch- (2400-mm-) long, but not exceeding 12 ft. (3.6 m) long, sections, under copings, and at shelf angles. Fabricate discontinuous lintel, sill, and similar flashings to extend 6 inches (150 mm) beyond each side of wall openings; and form with 2-inch- (50-mm-) high, end dams. Fabricate from the following materials:
1. Stainless Steel: 0.0156 inch (0.396 mm) thick.

2.9 MISCELLANEOUS SHEET METAL FABRICATIONS

A. Equipment Support Flashing: Fabricate from the following materials:
   1. Stainless Steel: 0.0188 inch (0.477 mm) thick.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, substrates, and other conditions affecting performance of the Work.

   1. Verify compliance with requirements for installation tolerances of substrates.
   2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
   3. Verify that air- or water-resistant barriers have been installed over substrate to prevent air infiltration or water penetration.

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

3.2 INSTALLATION OF UNDERLAYMENT

A. Self-Adhering, High-Temperature Sheet Underlayment:

   1. Install self-adhering, high-temperature sheet underlayment; wrinkle free.
   2. Prime substrate if recommended by underlayment manufacturer.
   3. Comply with temperature restrictions of underlayment manufacturer for installation; use primer for installing underlayment at low temperatures.
   4. Apply in shingle fashion to shed water, with end laps of not less than 6 inches (150 mm) staggered 24 inches (600 mm) between courses.
   5. Overlap side edges not less than 3-1/2 inches (90 mm). Roll laps and edges with roller.
   6. Roll laps and edges with roller.
   7. Cover underlayment within 14 days.

3.3 INSTALLATION OF SHEET METAL FLASHING AND TRIM, GENERAL

A. Install sheet metal flashing and trim to comply with details indicated and recommendations of cited sheet metal standard that apply to installation characteristics required unless otherwise indicated on Drawings.

   1. Install fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
   2. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of solder, welds, sealant.
   3. Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement.

4. Install sheet metal flashing and trim to fit substrates and to result in watertight performance.
5. Install continuous cleats with fasteners spaced not more than 12 inches (300 mm) o.c.
6. Space individual cleats not more than 12 inches (300 mm) apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
7. Install exposed sheet metal flashing and trim with limited oil-canning, and free of buckling and tool marks.
8. Do not field cut sheet metal flashing and trim by torch.
9. Do not use graphite pencils to mark metal surfaces.

B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.
1. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.

C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim.

1. Space movement joints at maximum of 10 ft. (3 m) with no joints within 24 inches (600 mm) of corner or intersection.
2. Use lapped expansion joints only where indicated on Drawings.

D. Fasteners: Use fastener sizes that penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.

E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.

F. Seal joints as required for watertight construction.

1. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."

G. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter.

1. Pretin edges of sheets with solder to width of 1-1/2 inches (38 mm); however, reduce pretinning where pretinned surface would show in completed Work.
2. Do not use torches for soldering.
3. Heat surfaces to receive solder, and flow solder into joint.

    a. Fill joint completely.
    b. Completely remove flux and spatter from exposed surfaces.

4. Stainless Steel Soldering:

    a. Tin edges of uncoated sheets, using solder for stainless steel and acid flux.
    b. Promptly remove acid-flux residue from metal after tinning and soldering.
    c. Comply with solder manufacturer's recommended methods for cleaning and neutralization.

H. Rivets: Rivet joints in uncoated aluminum where necessary for strength.

3.4 INSTALLATION OF ROOF-DRAINAGE SHEET METAL FABRICATIONS

A. Install sheet metal roof-drainage items to produce complete roof-drainage system in accordance with cited sheet metal standard unless otherwise indicated. Coordinate installation of roof perimeter flashing with installation of roof-drainage system.

B. Hanging Gutters:

1. Join sections with riveted and soldered joints or joints sealed with sealant.
2. Provide for thermal expansion.
3. Attach gutters at eave or fascia to firmly anchor them in position.
4. Provide end closures and seal watertight with sealant.
5. Slope to downspouts.
6. Fasten gutter spacers to front and back of gutter.
7. Anchor and loosely lock back edge of gutter to continuous cleat, eave or apron flashing.
8. Anchor gutter with spikes and ferrules spaced not more than 24 inches (600 mm) apart.
9. Install gutter with expansion joints at locations indicated on Drawings, but not exceeding, 50 ft. (15.2 m) apart. Install expansion-joint caps.

C. Downspouts:

1. Join sections with 1-1/2-inch (38-mm) telescoping joints.
2. Provide hangers with fasteners designed to hold downspouts securely to walls.
3. Locate hangers at top and bottom and at approximately 60 inches (1500 mm) o.c.
4. Provide elbows at base of downspout to direct water away from building.

D. Splash Pans:

1. Install where downspouts discharge on low-slope roofs.
2. Set in elastomeric sealant compatible with the substrate.

3.5 INSTALLATION OF SLOPED ROOF SHEET METAL FABRICATIONS

A. Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and cited sheet metal standard.

1. Provide concealed fasteners where possible, and set units true to line, levels, and slopes.
2. Install work with laps, joints, and seams that are permanently watertight and weather resistant.

B. Roof Edge Flashing:

1. Install roof edge flashings in accordance with ANSI/SPRI/FM 4435/ES-1.
2. Anchor to resist uplift and outward forces in accordance with recommendations in FM Global Property Loss Prevention Data Sheet 1-49 for FM Approvals' listing for required windstorm classification.

C. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending minimum of 4 inches (100 mm) over base flashing. Install stainless steel draw band and tighten.

D. Counterflashing: Coordinate installation of counterflashing with installation of base flashing.

1. Insert counterflashing in reglets or receivers and fit tightly to base flashing.
2. Extend counterflashing 4 inches (100 mm) over base flashing.
3. Lap counterflashing joints minimum of 4 inches (100 mm).
4. Secure in waterproof manner by means of snap-in installation and sealant or lead wedges and sealant unless otherwise indicated.

E. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with elastomeric sealant and clamp flashing to pipes that penetrate roof.

3.6 INSTALLATION OF WALL SHEET METAL FABRICATIONS

A. Install sheet metal wall flashing to intercept and exclude penetrating moisture in accordance with cited sheet metal standard unless otherwise indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.

B. Opening Flashings in Frame Construction: Install continuous head, sill, jamb, and similar flashings to extend 4 inches (100 mm) beyond wall openings.

3.7 INSTALLATION OF MISCELLANEOUS SHEET METAL FABRICATIONS

A. Equipment Support Flashing:

1. Coordinate installation of equipment support flashing with installation of roofing and equipment.
2. Weld or seal flashing with elastomeric sealant to equipment support member.

B. Overhead-Piping Safety Pans:

1. Suspend pans from structure above, independent of other overhead items such as equipment, piping, and conduit, unless otherwise indicated on Drawings.
2. Pipe and install drain line to plumbing waste or drainage system.

3.8 INSTALLATION TOLERANCES

A. Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 ft. (6 mm in 6 m) on slope and location lines indicated on Drawings and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

3.9 CLEANING

A. Clean and neutralize flux materials. Clean off excess solder.

B. Clean off excess sealants.

3.10 PROTECTION

A. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions.

B. On completion of sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended in writing by sheet metal flashing and trim manufacturer.

C. Maintain sheet metal flashing and trim in clean condition during construction.

D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures, as determined by Architect.

END OF SECTION 076200

SECTION 076500 — FLEXIBLE WALL FLASHING

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. Flexible flashing embedded in wall construction.

B. Related Sections:

1. Division 04 Section "Masonry", “Cast Stone” installing flexible flashing integral with masonry.
2. Division 07 Section "Formed Metal Wall Panels", “Metal Soffit Panels”, “Sheet Metal Flashing & Trim” installing flexible flashing integral with metal panels.

1.3 COORDINATION

A. Coordinate installation of embedded flashing in construction as work progresses. Participate in related preinstallation conferences. Allow for inspection of embedded flashing prior to concealing with subsequent work.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site in conjunction with conferences for assemblies in which specified items will be installed.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.

B. Shop Drawings: Show fabrication and installation layouts of sheet metal flashing and trim, including plans, elevations, expansion-joint locations, and keyed details. Distinguish between shop- and field- assembled work. Include the following:

1. Identification of material, thickness, weight, and finish for each item and location in Project.

2. Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.

3. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.

C. Samples for Verification: For each type of exposed finish.

1. Sheet Metal Flashing: 12 inches long by actual width of unit, including finished seam and in required profile. Include fasteners, cleats, clips, closures, and other attachments.

2. Trim, Metal Closures, Expansion Joints, Joint Intersections, and Miscellaneous Fabrications: 12 inches long and in required profile. Include fasteners and other exposed accessories.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified fabricator.

B. Maintenance Data: For sheet metal flashing, trim, and accessories to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate embedded flashing similar to that required for this Project and whose products have a record of successful in-service performance.

B. Installer Qualifications: Firm experienced in installation of flashing and waterproofing materials employing skilled workers experienced in work similar to Work of this Project with a record of successful in-service performance.

C. Preinstallation Conference: Conduct conference at Project site.

D. Sheet Metal Flashing and Trim Standard:

1. Comply with applicable "The NRCA Roofing and Waterproofing Manual" plates.

E. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation. Build mockups within mockup assemblies specified in other sections.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Do not store embedded flashing materials in contact with other materials that might cause staining, denting, or other surface damage. Store embedded flashing materials away from uncured concrete and masonry.

B. Protect strippable protective covering on embedded flashing from exposure to sunlight and high humidity, except to the extent necessary for the period of embedded flashing installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General: Flexible flashing assemblies shall withstand structural movement and thermally induced movement without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed flexible flashing shall remain watertight.

2.2 EMBEDDED FLASHING MATERIALS

A. Flexible Flashing: Use the following unless otherwise indicated:

1. Stainless Steel Fabric Flashing: Class A material consisting of a layer of polymeric fabric with a single sheet of 304 stainless steel bonded on one side. Use where flashing is fully concealed in masonry.

B. Basis of Design Product: Subject to compliance with requirements, provide Mighty-Flash T* by Hohmann & Barnard, Inc; or comparable products by one of the following:

1. York Manufacturing, Inc.; Multi-Flash SS
2. Illinois Products, Inc.; IPCO Stainless Steel Fabric Flashing
3. Prosoco, Inc.; R-Guard SS ThruWall
4. STS Coatings, Inc.; Wall Guardian Stainless Steel TWF
5. TK Products, Inc.; TK TWF

C. Accessories: Provide outside and inside corner material, end dams, stainless steel drip plates, termination bars, splicing tapes and sealants provided by flashing manufacturer.

2.3 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required for complete embedded flashing installation and recommended by manufacturer of flashing unless otherwise indicated.

B. Elastomeric Sealant: ASTM C 920, elastomeric polymer sealant compatible with adjacent materials; low modulus; of type, grade, class, and use classifications required to seal joints in embedded metal or flexible flashing and trim and remain watertight.

C. Rubberized Asphalt Mastic: Manufacturer's recommended trowel grade material for detailing, compatible with rubberized asphalt flashing.

D. Primer: Manufacturer's recommended primer for rubberized asphalt ftashing substrate.

2.4 FABRICATION, GENERAL

A. General: Custom fabricate embedded flashing to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, geometry, metal thickness, and other characteristics of item indicated. Fabricate items at the shop to greatest extent possible.

1. Fabricate embedded flashing in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.

2. Obtain field measurements for accurate fit before shop fabrication.

3. Form embedded flashing without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.

4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not

allowed on faces exposed to view.

B. Fabrication Tolerances: Fabricate embedded flashing that is capable of installation to a tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

C. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant.

D. At overbuild flashing detail, use stainless steel sheet with all welded joints.

E. Expansion Provisions: Where lapped expansion provisions cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.

F. Seams: Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions and other conditions affecting performance of the Work.

1. Verify compliance with requirements for installation tolerances of substrates.

2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

B. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

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

3 2 INSTALLATION, GENERAL

A. General: Anchor embedded flashing and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete embedded flashing system.

1. Install embedded flashing in accordance with details indicated.

2. Install embedded flashing true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.

3. Install embedded flashing to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.

4. Install exposed embedded flashing without excessive oil canning, buckling, and tool marks.

5. Torch cutting of embedded flashing is not permitted.

B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by SMACNA.

C. 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 comer or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.

D. Seal joints as shown and as required for watertight construction.

1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F.

2. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants."

3.3 INSTALLING EMBEDDED FLASHING IN MASONRY

A. Place flashing on masonry surfaces that are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar. Before flashing is covered with mortar, seal penetrations in flashing with adhesive or sealant as recommended by flashing manufacturer.

B. At multiwythe masonry walls, including cavity walls, extend flashing through outer wythe, turned up a minimum of 8 inches, and through inner wythe to within 1/2 inch of the interior face of wall in exposed masonry. Where the interior face of wall is to receive furring or framing, carry flashing completely through inner wythe and turn flashing up approximately 2 inches on interior face.

1. Fully support flexible flashing across cavity.

C. At masonry-veneer walls, extend flashing through veneer, across air space behind veneer, and up face of sheathing at least 8 inches; with upper edge terminated with metal termination bar, lapped at least 4 inches by application of specified dampproofing or air barrier.

1. Fully support flexible flashing across cavity.

D. At lintels and shelf angles, extend flashing a minimum of 6 inches into masonry at each end. At heads and sills, extend flashing 6 inches at ends and turn up not less than 2 inches to form end dams.

3.4 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align embedded flashing within installed tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8-inch offset of adjoining faces

and of alignment of matching profiles.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections and prepare test reports.

B. Inspections: Flexible flashing materials and installation are subject to inspection for compliance with requirements. Inspections may include the following:

1. Continuity of flexible flashing has been achieved throughout the building envelope with no gaps or holes.

2. Maximum exposure time of materials to UV deterioration has not been exceeded.

3. Protection of temporarily exposed flexible flashing prior to installation of final masonry wythe.

4. Laps comply with minimum requirements and have been shingled in the correct direction, with no fishmouths.

5. Termination bars, sealants, and mastic has been applied on cut edges.

6. Compatible materials have been used.

7. Transitions at changes in direction and structural support at gaps have been provided.

8. Connections between assemblies have complied with requirements for cleanliness, preparation and priming of surfaces, structural support, integrity, and continuity of seal.

9. All penetrations have been sealed.

C. Remove and replace deficient flexible flashing components and retest as specified above.

3.6 CLEANING AND PROTECTION

A. Clean and neutralize flux materials. Clean off excess solder.

B. Clean off excess sealants.

C. Remove temporary protective coverings and strippable films as embedded flashing are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of installation, remove unused materials and clean finished surfaces. Maintain in a clean condition during construction.

D. Replace embedded flashing that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 076500

SECTION 077200 - ROOF ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Manufactured units for the following applications:
   1. Equipment supports.
   2. Roof hatches.
   3. Pipe portals.
   4. Preformed flashing sleeves.
   5. Miscellaneous materials.

B. Related Requirements:

   1. Section 055000 "Metal Fabrications" for metal vertical ladders, ships' ladders, and stairs for access to roof hatches.
   2. Section 061000 "Rough Carpentry" for roof cants, nailers, blocking, and other pressure-preservative-treated wood.
   3. Section 077100 "Roof Specialties" for manufactured copings, roof-edge specialties, roof-edge drainage systems, reglets, and counterflashing.
   4. Section 077253 "Snow Guards" for prefabricated devices designed to hold snow on the roof surface, allowing it to melt and drain off slowly.
   5. Section 079200 "Joint Sealants" for field-applied sealants between roof accessories and adjacent materials.
   6. Section 099113 "Exterior Painting" for field painting of roof accessories.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of roof accessory.

   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For roof accessories.

   1. Include plans, elevations, keyed details, and attachments to other work. Indicate dimensions, loadings, and special conditions. Distinguish between plant- and field-assembled work.

   2. Detail mounting, securing, and flashing of roof-mounted items to roof structure. Indicate coordinating requirements with roof membrane system.
   3. Wind-Restraint Details: Detail fabrication and attachment of wind restraints. Show anchorage details and indicate quantity, diameter, and depth of penetration of anchors.

C. Samples: For each type of roof accessory and for each color and texture specified.

D. Samples for Initial Selection: For each type of roof accessory indicated with factory-applied color finishes.

E. Samples for Verification: Include Samples of each type of roof accessory to verify finish and color selection, in manufacturer's standard sizes.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Roof plans, drawn to scale, and coordinating penetrations and roof-mounted items. Show the following:

1. Size and location of roof accessories specified in this Section.
2. Method of attaching roof accessories to roof or building structure.
3. Other roof-mounted items, including mechanical and electrical equipment, ductwork, piping, and conduit.
4. Required clearances.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For roof accessories.

1.5 QUALITY ASSURANCE

A. Delegated Design Engineer Qualifications: A professional engineer who is legally qualified to practice in The State of Georgia where Project is located and who is experienced in providing engineering services of the type indicated.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not store roof accessories in contact with other materials that might cause staining, denting, or other surface damage. Store roof accessories in accordance with manufacturer's instructions.

B. Store materials off ground in dry location and in accordance with manufacturer's instructions in well-ventilated area.

C. Store and protect roof accessories from nicks, scratches, and blemishes.

1.7 FIELD CONDITIONS

A. Field Measurements: Verify profiles and tolerances of roof-accessory substrates by field measurements before fabrication, and indicate measurements on Shop Drawings.

1.8 COORDINATION

A. Coordinate layout and installation of roof accessories with roofing membrane and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Roof accessories to withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

B. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design roof curbs and equipment supports to comply with wind performance requirements, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

C. Wind-Restraint Performance: As indicated on Drawings.

2.2 EQUIPMENT SUPPORTS

A. Internally reinforced perimeter or Rail-type metal equipment supports capable of supporting superimposed live and dead loads between structural supports, including equipment loads and other construction indicated on Drawings, spanning between structural supports; capable of meeting performance requirements; with welded or mechanically fastened and sealed corner joints, integral metal cant, stepped integral metal cant to raise the thickness of roof insulation, and integrally formed structure-mounting flange at bottom.

B. Size: Coordinate dimensions with roughing-in information or Shop Drawings of equipment to be supported.

C. Supported Load Capacity: Coordinate load capacity with information on Shop Drawings of equipment to be supported.

D. Steel: Zinc-coated (galvanized), Aluminum-zinc alloy-coated steel sheet, 0.079 inch (2.01 mm) thick.

1. Finish: Mill phosphatized, Powder coat.
2. Color: As selected by Architect from manufacturer's full range.

E. Aluminum: 0.125 inch thick sheet.

1. Finish: Mill, Powder coat.
2. Color: As selected by Architect from manufacturer's full range.

F. Stainless Steel: 0.0781 inch thick sheet.

1. Finish: Manufacturer's standard.

G. Construction:

1. Curb Profile: Manufacturer's standard compatible with roofing system.
2. Insulation: Factory insulated with 1-1/2-inch thick glass-fiber board insulation.
3. Liner: Same material as equipment support, of manufacturer's standard thickness and finish.
4. Nailer: Factory-installed continuous wood nailers 3-1/2 inches or 5-1/2 inches wide on top flange of equipment supports or under top flange on side of curb, continuous around support perimeter.
5. Wind-Restraint Straps and Base Flange Attachment: Provide wind-restraint straps, welded strap connectors, and base flange attachment to roof structure at perimeter of curb of size and spacing required to comply with wind-uplift requirements.
6. Platform Cap: Where portion of equipment support is not covered by equipment, provide weathertight platform cap formed from 3/4-inch- (19-mm-) thick plywood covered with metal sheet of same type, thickness, and finish as required for curb.
7. Metal Counterflashing: Manufacturer's standard, removable, fabricated of same metal and finish as equipment support.
8. On ribbed or fluted metal roofs, form deck-mounting flange at perimeter bottom to conform to roof profile.
9. Fabricate equipment supports to minimum height of 12 inches above roofing surface unless otherwise indicated.
10. Sloping Roofs: Where roof slope exceeds 1/4 inch per 12 inches (1:48), fabricate each support with height to accommodate roof slope so that tops of supports are level with each other. Equip supports with water diverters or crickets on sides that obstruct water flow.

2.3 ROOF HATCHES

A. Metal roof-hatch units with lids and insulated double-walled curbs, welded or mechanically fastened and sealed corner joints, continuous lid-to-curb counterflashing and weathertight perimeter gasketing, straight sides, integral metal cant, stepped integral metal cant to raise the thickness of roof insulation, and integrally formed deck-mounting flange at perimeter bottom.

B. Type and Size:

1. Single-leaf lid, 30 by 36 inches.

C. Loads: Minimum 40 lbf/sq. ft. external live load and 20 lbf/sq. ft. internal uplift load.

D. Hatch Material, Aluminum:

1. Thickness: Manufacturer's standard thickness for hatch size indicated.
2. Finish: Powder coat.
3. Color: As selected by Architect from manufacturer's full range.

E. Construction:

1. Insulation: 1-inch- (25-mm-) thick, cellulosic-fiber board.

a. R-Value: 2.78 in accordance with ASTM C1363.

2. Nailer: Factory-installed wood nailer continuous around hatch perimeter.
3. Hatch Lid: Opaque, insulated, and double walled, with manufacturer's standard metal liner of same material and finish as outer metal lid.
4. Curb Liner: Manufacturer's standard, of same material and finish as metal curb.
5. On ribbed or fluted metal roofs, form flange at perimeter bottom to conform to roof profile.
6. Fabricate curbs to minimum height of 12 inches above roofing surface unless otherwise indicated.

F. Hardware: Spring operators, hold-open arm, stainless steel spring latch with turn handles, stainless steel butt- or pintle-type hinge system, and padlock hasps inside and outside.

G. Safety Railing System: Roof-hatch manufacturer's standard system, including rails, clamps, fasteners, safety barrier at railing opening, and accessories required for a complete installation; attached to roof hatch and complying with 29 CFR 1910.23 requirements and authorities having jurisdiction.

1. Height: 42 inches above finished roof deck.
2. Posts and Rails: Galvanized-steel pipe, 1-1/4 inches (31 mm) in diameter or galvanized-steel tube, in diameter.
3. Flat Bar: Galvanized steel, 2 inches (50 mm) high by 3/8 inch (9 mm) thick.
4. Maximum Opening Size: System constructed to prevent passage of a sphere 21 inches (533 mm) in diameter.
5. Self-Latching Gate: Fabricated of same materials and rail spacing as safety railing system. Provide manufacturer's standard hinges and self-latching mechanism.
6. Post and Rail Tops and Ends: Weather resistant, closed or plugged with prefabricated end fittings.
7. Provide weep holes or another means to drain-entrapped water in hollow sections of handrail and railing members.
8. Fabricate joints exposed to weather to be watertight.
9. Fasteners: Manufacturer's standard, finished to match railing system.
10. Finish: Manufacturer's standard.

a. Color: As selected by Architect from manufacturer's full range.

2.4 METAL MATERIALS

A. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheer complying with minimum ASTM A653/A653M, G90 (Z275) coating designation or aluminum-zinc alloy-coated steel sheet complying with minimum ASTM A792/A792M, Class AZ50 (Class AZM150) coating designation; structural quality.

1. Mill-Phosphatized Finish: Manufacturer's standard for field painting.
2. Factory Prime Coating: Where field painting is indicated, apply pretreatment and white or light-colored, factory-applied, baked-on epoxy primer coat, with a minimum dry film thickness of 0.2 mil (0.005 mm).

3. Powder Coat Finish: After cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat to a minimum dry film thickness of 2 mils (0.05 mm).
4. Concealed Finish: Pretreat with 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 (0.013 mm).

B. Aluminum Sheet: ASTM B209/B209M, manufacturer's standard alloy for finish required, with temper to suit forming operations and performance required.

1. Mill Finish: As manufactured.
2. Factory Prime Coating: Where field painting is indicated, apply pretreatment and white or light-colored, factory-applied, baked-on epoxy primer coat, with a minimum dry film thickness of 0.2 mil (0.005 mm).
3. Clear Anodic Finish: AAMA 611, [AA-M12C22A41, Class I, 0.018 mm] [AA-M12C22A31, Class II, 0.010 mm] or thicker.
4. Color Anodic Finish: AAMA 611, [AA-M12C22A42/A44, Class I, 0.018 mm] [AA-M12C22A32/A34, Class II, 0.010 mm] or thicker.
5. Powder Coat Finish: AAMA 2603. After cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat to a minimum dry film thickness of 2 mils (0.05 mm).
6. Concealed Finish: Pretreat with 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 (0.013 mm).

C. Aluminum Extrusions and Tubes: ASTM B221 (ASTM B221M), manufacturer's standard alloy and temper for type of use, finished to match assembly where used; otherwise mill finished.

D. Stainless Steel Sheet and Shapes: ASTM A240/A240M or ASTM A666, Type 304.

E. Steel Shapes: ASTM A36/A36M, hot-dip galvanized in accordance with ASTM A123/A123M unless otherwise indicated.

F. Steel Tube: ASTM A500/A500M, round tube.

G. Galvanized-Steel Tube: ASTM A500/A500M, round tube, hot-dip galvanized in accordance with ASTM A123/A123M.

H. Steel Pipe: ASTM A53/A53M, galvanized.

2.5 MISCELLANEOUS MATERIALS

A. Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.

B. Cellulosic-Fiber Board Insulation: ASTM C208, Type II, Grade 1, thickness as indicated.

C. Glass-Fiber Board Insulation: ASTM C726, nominal density of 3 lb/cu. ft. (48 kg/cu. m), thermal resistivity of 4.3 deg F x h x sq. ft./Btu x in. at 75 deg F (29.8 K x m/W at 24 deg C), thickness as indicated.

D. Polyisocyanurate Board Insulation: ASTM C1289, thickness and thermal resistivity as indicated.

E. Wood Nailers: Softwood lumber, pressure treated with waterborne preservatives for aboveground use, acceptable to authorities having jurisdiction,[containing no arsenic or chromium,] and complying with AWPA C2; not less than 1-1/2 inches (38 mm) thick.

F. Fasteners: Roof accessory manufacturer's recommended fasteners, designed to comply with performance requirements, suitable for application and metals being fastened. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners. Furnish the following unless otherwise indicated:

1. Fasteners for Metallic-Coated Steel Sheet: Series 300 stainless steel or hot-dip zinc-coated steel in accordance with ASTM A153/A153M or ASTM F2329/F2329M.
2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
3. Fasteners for Stainless Steel Sheet: Series 300 stainless steel.

G. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, PVC, or silicone or a flat design of foam rubber, sponge neoprene, or cork.

H. Elastomeric Sealant: ASTM C920, elastomeric [polyurethane] [silicone] polymer sealant as recommended by roof accessory manufacturer for installation indicated; low modulus; of type, grade, class, and use classifications required to seal joints and remain watertight.

I. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for expansion joints with limited movement.

J. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

2.6 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM/NOMMA AMP 500, "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.

B. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

C. Verify dimensions of roof openings for roof accessories.

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

3.2 INSTALLATION, GENERAL

A. Install roof accessories in accordance with manufacturer's written instructions.

1. Install roof accessories level; plumb; true to line and elevation; and without warping, jogs in alignment, buckling, or tool marks.
2. Anchor roof accessories securely in place so they are capable of resisting indicated loads.
3. Use fasteners, separators, sealants, and other miscellaneous items as required to complete installation of roof accessories and fit them to substrates.
4. Install roof accessories to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals.

B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended in writing by manufacturer's written installation instructions.

1. Coat concealed side of [uncoated aluminum] [and] [stainless steel] roof accessories with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
2. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof accessories for waterproof performance.

3.3 INSTALLATION OF ROOF ACCESSORIES

A. Roof Curb: Install each roof curb so top surface is level.

B. Equipment Support: Install equipment supports so top surfaces are level with each other.

C. Roof-Hatch:

1. Verify that roof hatch operates properly. Clean, lubricate, and adjust operating mechanism and hardware.
2. Attach safety railing system to roof-hatch curb.
3. Attach ladder-assist post in accordance with manufacturer's written instructions.

D. Pipe and Duct Support: Comply with MSS SP-58. Install supports and attachments as required to properly support piping. Arrange for grouping of parallel runs of horizontal piping, and support together.

1. Pipes of Various Sizes: Space supports for smallest pipe size or install intermediate supports for smaller-diameter pipes as specified for individual pipe hangers.

E. Preformed Flashing-Sleeve and Flashing-Pipe Portal: Secure flashing sleeve to roof membrane in accordance with flashing-sleeve manufacturer's written instructions; flash sleeve flange to surrounding roof membrane in accordance with roof membrane manufacturer's instructions.

3.4 CLEANING AND PROTECTION

A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing in accordance with ASTM A780/A780M.

B. Touch up factory-primed surfaces with compatible primer ready for field painting in accordance with Section 099113 "Exterior Painting."

C. On completion of installation, clean exposed surfaces in according with manufacturer's written instructions. Clean off excess sealants.

D. Remove temporary protective coverings and strippable films as roof accessories are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain roof accessories in a clean condition during construction.

E. Replace roof accessories that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures, as determined by Architect.

END OF SECTION 077200

SECTION 078413 - PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Penetration firestopping systems.
2. Penetrations in fire-resistance-rated walls.
3. Penetrations in horizontal assemblies.
4. Penetrations in smoke barriers.
5. Exposed penetration firestopping systems.
6. Joint Sealants" for sealing joints in sound-rated construction.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Unlisted Firestopping Systems: Obtain an Engineering Judgment (EJ) from firestopping manufacturer where no UL, FM Approvals, or other listed assembly is available for particular firestop configuration. Follow International Firestop Council (IFC) recommended guidelines for evaluating firestopping systems in EJs.

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

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

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Listed System Designs: For each penetration firestopping system, for tests performed by a qualified testing agency.

1.5 CLOSEOUT SUBMITTALS

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

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Entity that has been approved by FM Approvals in accordance with FM Approvals 4991 or been evaluated by UL and found to comply with UL's "UL Solutions Qualified Firestop Contractor Program."

B. Manufacturer Qualifications: Entity that has received UL's "Firestop Movement Certification," which demonstrates that manufacturer's firestopping products designated with M-Ratings are based on exposure to cyclic movement and UL 1479 fire test evaluation when tested in accordance with ASTM E3037.

1.7 FIELD CONDITIONS

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

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

1.8 COORDINATION

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

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

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain penetration firestopping systems for each type of opening indicated from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics:

1. A qualified testing agency, acceptable to authorities having jurisdiction, will perform penetration firestopping system tests.
2. Test in accordance with testing standards referenced in "Penetration Firestopping Systems" Article. Provide rated systems complying with the following requirements:

    a. Penetration firestopping systems installed with products bearing the classification marking of a qualified testing agency.

        1) UL in its online directory "Product iQ."
        2) Intertek Group in its "Directory of Building Products."
        3) FM Approvals in its "Approval Guide."

B. Provide components for each penetration firestopping system that, upon curing, do not re-emulsify, dissolve, leach, break down, or otherwise deteriorate over time from exposure to atmospheric moisture, sweating pipes, ponding water, or other forms of moisture characteristic during and after construction.

C. Provide components for each penetration firestopping system that do not contain ethylene glycol.

D. Provide components for each penetration firestopping system that are sufficiently flexible to accommodate movement, such as pipe vibration, water hammer, thermal expansion, and other normal building movement without damage.

E. Provide components for each penetration firestopping system that are appropriately tested for the thickness and type of insulation utilized.

2.3 PENETRATION FIRESTOPPING SYSTEMS

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

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. 3M Building and Construction.
    b. Hilti, Inc.
    c. Specified Technologies, Inc.
    d. Tremco Incorporated.
    e. Johns Manville.

B. Penetrations in Fire-Resistance-Rated Walls: Penetration firestopping systems with ratings determined in accordance with ASTM E814 or UL 1479.

1. F-Rating: Not less than the fire-resistance rating of the wall penetrated.
2. Membrane Penetrations: Install recessed fixtures such that the required fire resistance will not be reduced.

C. Penetrations in Horizontal Assemblies: Penetration firestopping systems with ratings determined in accordance with ASTM E814 or UL 1479.

1. F-Rating: At least one hour, but not less than the fire-resistance rating of the floor penetrated.

D. Penetrations in Smoke Barriers: Penetration firestopping systems with ratings determined in accordance with UL 1479.

E. Exposed Penetration Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, when tested in accordance with ASTM E84 or UL 723.

2.4 ACCESSORIES

A. Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping system manufacturer and approved by qualified testing and inspecting agency for conditions indicated, including but not limited to:

1. Permanent forming/damming/backing materials.
2. Substrate primers.
3. Collars.
4. Steel sleeves.

2.5 FILL MATERIALS

A. Cast-in-Place Firestopping Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer sleeve lined with an intumescent strip, a flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.

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

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

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

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

F. Intumescent Wrap Strips: Single-component intumescent elastomeric strips for use around combustible penetrants.

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

H. Pillows/Bags: Compressible, removable, and reusable intumescent pillows encased in fire-retardant polyester or glass-fiber cloth. Where exposed, and when required by a listed system, cover openings with steel-reinforcing wire mesh to protect pillows/bags from being easily removed or dislodged.

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

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

K. Thermal and Endothermic Wraps: Flexible, insulating, and fire-resistant protective wraps tested and listed for up to 2-hour fire ratings in accordance with ASTM E814 or UL 1479; for protecting membrane penetrations of utility boxes, critical electrical circuits, communications lines, and fuel lines, and for thermal barrier and circuit integrity protection in accordance with ASTM E1725 or UL 1724.

L. Fire-Rated Cable Sleeve Kits: Complete kits designed for new or existing cable penetrations through walls which accept standard accessories.

M. Fire-Rated Cable Pathways: Single or gangable device modules composed of a steel raceway with integral intumescent material and requiring no additional action in the form of plugs, twisting closure, putty, pillows, sealant, or otherwise to achieve fire and air-leakage ratings.

1. Fire-rated cable pathway devices are the preferred product for data, video, and communications cable penetrations. Install these devices in locations where frequent cable moves, add-ons, and changes will occur. Such devices must be:

    a. Capable of retrofit around existing cables.
    b. Designed so that two or more devices can be ganged together.
    c. Maintenance-free so no action is required to activate the smoke- and fire-sealing mechanism.

2. Where fire-rated cable pathway devices are not practical, openings within walls and floors designed to accommodate data, video, and communications cabling must be provided with re-enterable products specifically designed for retrofit, such as retrofit devices for cable bundles, firestopping putty, plugs, or pillows.

N. Retrofit Device for Cable Bundles: Factory-made, intumescent, collar-like device for firestopping existing over-filled cable sleeves and capable of being installed around projecting sleeves and cable bundles.

O. Wall-Opening Protective Materials: Intumescent, non-curing putty pads or self-adhesive inserts for protection of electrical switch and receptacle boxes.

P. Fire-Rated HVAC Retaining Angles: Steel angle system with integral intumescent firestopping gasket for use around rectangular steel HVAC ducts without fire dampers.

Q. Firestopping Plugs: Flexible, re-enterable, intumescent, foam-rubber plug for use in blank round openings and cable sleeves.

R. Fire-Rated Cable Grommet: Molded two-piece grommet made of plenum-grade polymer and foam inner core for sealing small cable penetrations in gypsum walls up to 1/2 inch (13 mm) in diameter.

S. Closet Flange Gasket: Molded, single-component, flexible, intumescent gasket for use beneath a water closet (toilet) flange in floor applications.

2.6 MIXING

A. Penetration Firestopping Materials: For those products requiring mixing before application, comply with penetration firestopping system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

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

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

3.2 PREPARATION

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

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

B. Prime substrates in accordance with penetration firestopping system manufacturer's written installation instructions, using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

3.3 INSTALLATION

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

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

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

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

1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items to achieve required fire-resistance ratings.
2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

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

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

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

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

3.5 FIELD QUALITY CONTROL

A. Owner will engage a qualified inspection agency to conduct and report on inspections in accordance with ASTM E2174.

B. Where deficiencies are found or penetration firestopping system is damaged or removed because of testing, repair or replace penetration firestopping system to comply with requirements.

C. Proceed with enclosing penetration firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

3.6 CLEANING AND PROTECTION

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

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

END OF SECTION 078413

SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Silicone joint sealants.
2. Nonstaining silicone joint sealants.
3. Urethane joint sealants.
4. Immersible joint sealants.
5. Silane-modified polymer joint sealants.
6. Mildew-resistant joint sealants.
7. Polysulfide joint sealants.
8. Butyl joint sealants.
9. Latex joint sealants.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Silicone joint sealants.
2. Nonstaining silicone joint sealants.
3. Urethane joint sealants.
4. Immersible joint sealants.
5. Silane-modified polymer joint sealants.
6. Mildew-resistant joint sealants.
7. Polysulfide joint sealants.
8. Butyl joint sealants.
9. Latex joint sealants.

B. Samples for Initial Selection: Manufacturer's standard 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 type and color of joint sealant required, provide Samples with joint sealants in 1/2-inch- (13-mm-) wide joints formed between two 6-inch- (150-mm-) 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.

2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.
4. Joint-sealant color.

1.4 INFORMATIONAL SUBMITTALS

A. 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.

B. Preconstruction Laboratory Test Reports: For each joint sealant and substrate material to be tested 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.

C. 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.

D. Field Quality-Control Reports: For field-adhesion-test reports, for each sealant application tested.

E. Sample warranties.

1.5 CLOSEOUT SUBMITTALS

A. Manufacturers' special warranties.

B. Installer's special warranties.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Authorized representative who is trained and approved by manufacturer.

B. Testing Agency Qualifications: Qualified in accordance with ASTM C1021 to conduct the testing indicated.

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. Submit manufacturer's recommended number of pieces of each type of material, including joint substrates, joint-sealant backings, and miscellaneous materials.
4. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
5. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures, including use of specially formulated primers.
6. 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 in accordance with 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 (5 deg C).
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. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

C. 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. 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.

B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.3 SILICONE JOINT SEALANTS

A. Silicone, S, NS, 100/50, NT: Single-component, nonsag, plus 100 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 100/50, Use NT.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Adfast Corp.
      b. GE Construction Sealants; Momentive Performance Materials Inc.
      c. GSSI Sealants.
      d. Sika Corporation.
      e. Tower Sealants, Inc.

B. Silicone, S, NS, 25, T, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 25, Uses T and NT.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. GE Construction Sealants; Momentive Performance Materials Inc.
      b. Pecora Corporation.
      c. Permathane; ITW Polymer Sealants North America.
      d. Polymeric Systems, Inc.
      e. Sherwin-Williams Company.
      f. The Dow Chemical Company.

2.4 NONSTAINING SILICONE JOINT SEALANTS

A. Nonstaining Joint Sealants: No staining of substrates when tested in accordance with ASTM C1248.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Adfast Corp.
      b. Pecora Corporation.
      c. Sika Corporation.
      d. Tremco, Inc.

B. Silicone, Nonstaining, M, NS, 50, NT: Nonstaining, multicomponent, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type M, Grade NS, Class 50, Use NT.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Tremco, Inc.

2.5 MILDEW-RESISTANT JOINT SEALANTS

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

B. Silicone, Mildew Resistant, Acid Curing, S, NS, 25, NT: Mildew-resistant, single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Adfast Corp.
      b. GE Construction Sealants; Momentive Performance Materials Inc.
      c. Pecora Corporation.
      d. Soudal USA.
      e. The Dow Chemical Company.
      f. Tremco, Inc.

2.6 BUTYL JOINT SEALANTS

A. Butyl-Rubber-Based Joint Sealants: ASTM C1311.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Bostik, Inc.
      b. Everkem Diversified Products, Inc.
      c. Pecora Corporation.

2.7 LATEX JOINT SEALANTS

A. Acrylic Latex: Acrylic latex or siliconized acrylic latex, ASTM C834, Type OP, Grade NF.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Adfast Corp.
      b. Everkem Diversified Products, Inc.
      c. Franklin International.
      d. Pecora Corporation.
      e. Sherwin-Williams Company.
      f. Tremco, Inc.

2.8 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), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

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.

2.9 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.

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. Exterior insulation and finish systems.

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.

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 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 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 in accordance with 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 in accordance with Figure 8A in ASTM C1193 unless otherwise indicated.
4. Provide flush joint profile in accordance with Figure 8B in ASTM C1193.
5. Provide recessed joint configuration of recess depth in accordance with Figure 8C in ASTM C1193.

    a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

3.4 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:

    a. Extent of Testing: Test completed and cured sealant joints as follows:

        1) Perform 10 tests for the first 1000 ft. (300 m) of joint length for each kind of sealant and joint substrate.
        2) Perform one test for each 1000 ft. (300 m) of joint length thereafter or one test per each floor per elevation.

    b. Test Method: Test joint sealants in accordance with Method A, Tail Procedure, in ASTM C1521.

        1) 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.

    c. Inspect tested joints and report on the following:

        1) Whether sealants filled joint cavities and are free of voids.
        2) Whether sealant dimensions and configurations comply with specified requirements.
        3) 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.

    d. 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.
    e. 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.

2. 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.

B. Prepare test and inspection reports.

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 079200

SECTION 083113 - ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Access doors and frames.
2. Fire-rated access doors and frames.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, fire ratings, material descriptions, dimensions of individual components and profiles, and finishes.

B. Samples: For each type of access door and frame and for each finish specified, complete assembly minimum 6 by 6 inches (150 by 150 mm) in size.

C. Product Schedule: For access doors and frames.

1.3 CLOSEOUT SUBMITTALS

A. Record Documents: For fire-rated doors, list of applicable room name and number in which access door is located.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Rated Access Doors and Frames: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection and temperature-rise limit ratings indicated, according to NFPA 252 or UL 10B.

2.2 ACCESS DOORS AND FRAMES

A. Flush Access Doors with Exposed Flanges:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
a. ACUDOR Products, Inc.
b. Babcock-Davis.

c. Elmdor/Stoneman Manufacturing Company; a division of Acorn Engineering Company.
d. Karp Associates, Inc.
e. Larsens Manufacturing Company.
f. Milcor; a division of Hart & Cooley, Inc.
g. Nystrom.
h. Williams Bros. Corporation of America.

2. Description: Face of door flush with frame, with exposed flange and concealed hinge.
3. Locations: Wall and ceiling.
4. Uncoated Steel Sheet for Door: Nominal 0.060 inch (1.52 mm), 16 gage, factory finished.
5. Frame Material: Same material, thickness, and finish as door.
6. Latch and Lock: Cam latch, key operated.

2.3 FIRE-RATED ACCESS DOORS AND FRAMES

A. Fire-Rated, Flush Access Doors with Exposed Flanges:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
a. ACUDOR Products, Inc.
b. Babcock-Davis.
c. Elmdor/Stoneman Manufacturing Company; a division of Acorn Engineering Company.
d. Karp Associates, Inc.
e. Larsens Manufacturing Company.
f. Milcor; a division of Hart & Cooley, Inc.
g. Nystrom.
h. Williams Bros. Corporation of America.
2. Description: Door face flush with frame, with a core of mineral-fiber insulation enclosed in sheet metal; with exposed flange, self-closing door, and concealed hinge.
3. Optional Features: Gasketing.
4. Locations: Wall and ceiling.
5. Fire-Resistance Rating: Not less than that of adjacent construction.
6. Temperature-Rise Rating: 450 deg F (250 deg C) at the end of 30 minutes.
7. Uncoated Steel Sheet for Door: Nominal 0.036 inch (0.91 mm), 20 gage, factory finished.
8. Frame Material: Same material, thickness, and finish as door.
9. Latch and Lock: Self-latching door hardware, operated by key.

2.4 MATERIALS

A. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

B. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A879/A879M, with cold-rolled steel sheet substrate complying with ASTM A1008/A1008M, Commercial Steel (CS), exposed.

C. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

2.5 FABRICATION

A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.

B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish mounting holes, attachment devices and fasteners of type required to secure access doors to types of supports indicated.

D. Latch and Lock Hardware:

1. Quantity: Furnish number of latches and locks required to hold doors tightly closed.
2. Keys: Furnish two keys per lock and key all locks alike.
3. Mortise Cylinder Preparation: Where indicated, prepare door panel to accept cylinder specified in Section 087100 "Door Hardware."

2.6 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Painted Finishes: Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

1. Factory Primed: Apply manufacturer's standard, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.
2. Factory Finished: Apply manufacturer's standard baked-enamel or powder-coat finish immediately after cleaning and pretreating, with minimum dry-film thickness of 1 mil (0.025 mm) for topcoat.

a. Color: As selected by Architect from full range of industry colors.

PART 3 - EXECUTION

3.1 EXAMINATION

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

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

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installing access doors and frames.

3.3 FIELD QUALITY CONTROL

A. Inspection Agency: Engage a qualified inspector to perform inspections and to furnish reports to Architect.

B. Inspections:

1. Fire-Rated Door Inspections: Inspect each fire-rated access door in accordance with NFPA 80, Section 5.2.

C. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.

D. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

E. Prepare and submit separate inspection report for each fire-rated access door indicating compliance with each item listed in NFPA 80 and NFPA 101.

3.4 ADJUSTING

A. Adjust doors and hardware, after installation, for proper operation.

END OF SECTION 083113

SECTION 083463 – DETENTION HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. This Section includes detention hollow metal products as shown in the contract documents.

1.2 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

A. Product Data: For each type of product.

   1. Security hollow metal detention doors, swinging type with specified fire and/or bullet resistant ratings as shown in the door schedule. Sliding type doors shall be provided where indicated. Doors shall be of the types and sizes shown on the contract drawings and as specified herein.

B. Security hollow metal detention frames with specified fire and/or bullet resistant ratings as shown in the door schedule. Frames shall be of the types and sizes shown on the contract drawings and as specified herein.

C. Security hollow metal detention panels where shown, similar in construction to the security detention doors.

1.3 RELATED PRODUCTS FURNISHED BY OTHERS BUT NOT SPECIFIED IN THIS SECTION

A. Hardware.

B. Security Glass and Glazing.

C. Gaskets and Weatherstrips.

1.4 REFERENCES

A. ASTM A 366/A 366M-91, Specification for Steel, Carbon, Cold Rolled Sheet, Commercial Quality

B. ASTM A 526/A 526M-85, Specification for Steel Sheet, Zinc-coated (Galvanized) by the Hot Dipped Process, Commercial Quality

C. ASTM A 569/A 569M-91a, Specification for Steel, Carbon (0.15 Maximum Percent), Hot Rolled Sheet and Strip, Commercial Quality

D. ASTM B 117-90, Method of Salt Spray (Fog) Testing

E. ASTM D 1735-87, Standard Practice for Testing Water Resistance of Coatings Using Water Fog Apparatus

F. ASTM E 152-81a, Method for Fire Tests of Door Assemblies

G. ASTM F 1450-92, Standard Test Methods for Hollow Metal Swinging Door Assemblies for Detention Facilities

H. NAAMM Hollow Metal Manual, Sections 801 through 863

I. ANSI: American National Standards Institute, Inc.

J. ASTM: American Society for Testing and Materials

K. NAAMM: National Association of Architectural Metal Manufacturers

1.5 TESTING AND PERFORMANCE

A. Static Load Test
   1. The test specimen shall be a 3’0” x 7’0” flush panel without hardware preparation or other options, otherwise built in compliance with Paragraph 2.01.
   2. With the door mounted, a centrally applied load of 14,000 lbs. at quarter points shall be applied. The maximum midspan deflection shall not exceed 0.58 in. After release of load, deformation shall not exceed 0.10 in.

B. Rack Test
   1. The test specimen shall be a 3’0” x 7’0” flush panel without hardware preparation or other options, otherwise built in compliance with Paragraph 2.01.
   2. With the door mounted, a concentrated load of 7,500 lbs. shall be applied on one unsupported corner of the door. The maximum deflection shall not exceed 3.5 in. There shall be no buckling or failure of welds.

C. Impact Load Test
   1. A standard 3’0” x 7’0” flush door with hardware constructed in accordance with Paragraph 2.01 and with frame constructed in accordance with Paragraph 2.03 shall be mounted in the vertical position so that the door and locking hardware are operable. The door shall swing on 3 full mortised butt hinges and shall be locked using a door mounted, pocket type detention security lock with bolt size not to exceed 2” high x ¾” wide and latch throw not to exceed 5/8”.
   2. A door ram pendulum system capable of delivering consistent impacts of up to 200 ft-lbs. shall be constructed so that impacts may be delivered to any area of the assembly.
   3. The ram pendulum system shall be positioned opposite the door side of the assembly so that the door swings away from the ram. While hanging at rest, the ram shall be positioned so that the striking nose just touches the target area of the door. The striking nose of the ram shall be made of C1010 or C1020 low carbon steel and the ram shall weigh 80 lbs. ±1 lb. The striking surface area of the nose shall be 4.0 sq. in. ± 0.10 sq. in. at the start of the test.

4. With the door closed and locked, and the above testing arrangement secured, the following series of impacts shall be delivered to the assembly. The ram shall be raised to a height so that when released it will strike the door with 200 ft-lbs. of energy with each impact.
    a. 400 impacts on the door within 6" of the bolt.
    b. On the door within 6" of the top hinge, middle hinge, and bottom hinge, 6 cycles of 25 hits per hinge yielding 150 total blows per hinge.
5. The door shall remain closed and locked throughout the testing Procedure, and the assembly shall not be damaged to the extent that forcible egress can be obtained. After testing is completed the door shall be capable of being unlocked and by applying any amount of force by any means to the key, without the key breaking, and operated to provide egress.

D. Removable Glazing Stop Test
1. A rectangular view window test frame shall be constructed with a glass opening size of 28" x 33" x ± 1". The frame shall be constructed in accordance with Paragraph 2.03.
2. A steel plate of 3/8" minimum thickness shall be glazed in place using the specified glass stop.
3. The test frame assembly, constructed in accordance with these specifications, shall be rigidly mounted in the vertical position with the removable glass stop located on the opposite side of the 3/8" plate from the impact ram.
4. A target on the impact side of the 3/8" plate shall be marked in one corner no more than 6" away from the stops.
5. Using the door ram pendulum system specified in Paragraph 1.06.C.2 deliver 400 impacts of up to 200 ft-lbs. each on the target area. Removable glass stops and the 3/8" plate shall remain firmly in place so that removal cannot be accomplished without removing the retaining screws. There shall be no more than one (1) broken screw in the assembly after impact testing.

1.6 QUALITY ASSURANCE

A. Manufacturer's Qualifications
1. Manufacturer shall provide evidence of having personnel and plant equipment capable of fabricating hollow metal door and frame assemblies of the type specified herein.
2. Manufacturer shall provide a list of representative detention security projects for which he has supplied detention security hollow metal products including dates of project completion.

B. Quality Criteria
1. All door and frame construction shall be in accordance with construction of assemblies, which meet the requirements of Section 1.06 "Testing and Performance".
    a. The detention hollow metal manufacturer shall submit a notarized certificate stating that the construction, materials, and methods used are in accordance with these specifications and have been proven to meet performance standards described in Section 1.06 "Testing Performance".
2. Fabrication methods and product quality shall meet standards set by the Hollow Metal Manufacturers Association, HMMA, a division of the National Association of Architectural Metal Manufacturers, NAAMM, as set forth in these specifications.
3. Fire rated doors and frames shall be provided for those openings indicated in the schedule as requiring fire protection ratings. Such doors and frames shall be constructed as tested

in accordance with ASTM E 152 and approved by a recognized testing agency having a factory inspection service.

a. If any door or frame specified in the contract documents to be fire- rated cannot qualify for appropriate labeling because of its design, hardware or any other reason, fabrication of the affected item shall not begin until the issue is satisfactorily resolved and the resolution is approved.

1.7 SUBMITTALS

A. Submittal Drawings:
   1. Show door and frame elevations, sections and construction.
   2. Show listing of opening descriptions including quantities, gages, locations, and anchors.
   3. Identify materials on the submittal such that they may be referenced by markings used on the contract drawings.

B. Samples:
   1. Door: 1'-0" x 1'-0" corner section with hinge preparation showing top and internal construction.
   2. Frame: 1'-0" x 1'-0" corner section showing weld joint of head to jamb. Include hinge mortise, reinforcement and mortar guard in one rabbet, and glazing stop applied as specified in the opposite rabbet. Glazing stop shall be applied to both head and jamb section to show corner joint.
   3. All samples submitted shall be of the production type and shall represent in all respects the minimum quality of work to be furnished by the manufacturer. No work represented by the samples shall be fabricated until the samples are approved, and any downgrading of quality demonstrated by comparison with the samples may be cause for rejection of the work.

1.8 WARRANTY

A. All hollow metal work shall be warranted from defects in workmanship and quality for a period of one (1) year from shipment.

PART 2 - PRODUCTS

2.1 ACCEPTABLE 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:
   a. American Steel Products – Swainsboro, GA.
   b. Trussbilt – Huron, SD.
   c. Habersham Metal Products – Cornelia, GA
   d. Titan Steel Door – Lavonia, GA

2.2 HOLLOW METAL DOORS

A. Materials:
1. Doors shall be constructed of commercial quality, level, cold-rolled steel conforming to ASTM A 366/A 366M or hot rolled, pickled and oiled steel conforming to ASTM A 569/A 569M. The steel shall be free of scale, pitting, coil breaks or other surface blemishes. The steel shall also be free of buckles, waves or any other defects caused by the use of improperly leveled sheets.
2. Exterior Doors: Face sheets shall be 14 gage or 12 gage minimum thickness as indicated in the schedule, and shall have a zinc coating applied by the hot-dip process conforming to ASTM A 653/A 653M (A60).
3. Interior Doors:
   a. Face sheets shall be 14 gage or 12 gage minimum thickness, as indicated in the schedule.
   b. For areas subject to severe corrosion (shower areas), face sheets shall be 14 or 12 gage minimum thickness as indicated in the schedule, and shall have a zinc coating applied by the hot-dip process conforming to ASTM A 653/A 653M (A60).

B. Construction:
1. All doors shall be of the types, sizes, and grades shown in the contract documents and on the approved submittal drawings. Doors shall be constructed in accordance with these specifications and as tested in accordance with the applicable performance requirements of Section 1.06.
2. Door thickness shall be 2" minimum. Doors shall be neat in appearance and free from warpage and buckle. Edge bends shall be true and straight and of minimum radius for the material used.
3. Door face sheets shall be joined at their vertical edges by a continuous weld extending the full height of the door.
4. Door face sheets shall be vertically stiffened by formed steel sections which are continuous and upon assembly, shall span the full thickness of the interior space between door faces. These stiffeners shall be 18 gage minimum thickness, spaced so that the vertical interior webs shall be no more than 6" apart and securely attached to both face sheets by spot welds spaced a maximum of 3" o.c. vertically. Spaces between stiffeners shall be filled with 6 lbs./cu.ft. density mineral rockwool batt-type material, minimum.
5. The vertical edges shall be reinforced by a continuous steel channel, not less than 10 gage thickness extending the full height of the door. Channel which is notched or broken at the hinge mortises shall not be acceptable. Non-continuous channel at the lock edge shall be acceptable only to accommodate hardware options. In such cases, hardware reinforcements shall be welded to the channel such that they become an integral part of the channel. The top and bottom edges shall be closed with a continuous channel not less than 10 gage thickness. The vertical channels shall be spot welded 3" o.c. The 10 gage closing end channel shall be spot welded to both face sheets 3" o.c. maximum and continuously welded to the vertical reinforcing channel at all four corners producing a fully welded perimeter reinforcing channel.
6. The end channels shall be fitted with an additional flush closing channel of not less than 12 gage thickness. The flush closing channel shall be welded in place at the corners with continuous 1 1/2" long welds, 12" o.c. maximum along the length, on both sides. Installation of closing channel using screws, security or otherwise, shall be unacceptable. The end channel and flush closing channel shall be installed so they are permanent and non-removable.
7. Edge profiles shall be provided on both vertical edges of doors as follows:

a. Single acting doors - beveled 1/8" in 2" profile

8. Hardware reinforcements:
   a. Doors shall be mortised, reinforced, drilled and tapped at the factory for fully templated mortised hardware only, in accordance with the final approved hardware schedule and templates provided by the hardware supplier. Where surface mounted, or non-templated mortised hardware is to be applied, doors shall be reinforced only and all drilling and tapping shall be done by others in the field.
   b. Minimum thickness of hardware reinforcements shall be as follows:
      1) Full mortise hinges and pivots: 7 gage
      2) Surface applied maximum security hinges: 1/4"
      3) Reinforcements for lock fronts, concealed holders: 7 gage
      4) Internal reinforcements for other surface applied hardware: 7 gage
      5) Reinforcements for factory drill and tap applications for surface mounted closers: 12 gage extruded to 3/16" and tapped
      6) Reinforcements for field drill and tap applications for surface mounted closers: 7 gage
   c. Where electrically operated hardware is required, and as shown on approved submittal drawings, hardware enclosures and junction boxes for doors shall be provided and shall be interconnected using U.L. approved 1/2" conduit, elbows, and connectors. Also, where shown on approved submittal drawings, junction boxes with access plates shall be provided to facilitate the proper installation of wiring. Access plates shall be the same gage as the door and fastened with a minimum of four 8-32 torx drive tamper resistant screws, not to exceed 6" o.c.
9. Glass moldings and stops:
   a. Where specified, doors shall be provided with steel moldings to secure glazing by others, in accordance with glass sizes and thicknesses provided by the contractor and shown on approved submittal drawings.
   b. Fixed glazing molding shall be not less than 12 gage, and shall be spotwelded to both face sheets 5" o.c. maximum.
   c. Removable glazing stop in detention hollow metal doors shall be pressed steel angle, not less than 10 gage thickness. Angle stops shall be notched and tight fitting at the corner joints, and secured in place using 1/4-20 SAE grade #8 button head tamper resistant screws, spaced 9" o.c. maximum. Glazing stops and screws shall satisfy the performance criteria outlined in Section 1.06.B.
   d. Where glass thickness dictates, 12 gage offset surface mounted glazing stop shall be used. The corners shall be tight fitting mitered, welded and ground smooth. The glass stop shall be secured to the face of the door using 1/4-20 SAE grade #8, button head tamper resistant screws spaced 9" o.c. maximum.
   e. The metal surfaces to which glazing stops are secured shall be chemically treated for maximum paint adhesion and painted with a rust inhibitive primer prior to installation in the door.
10. Speaking devices shall consist of a rectangular pattern of round holes, no more than 1/4" diameter, in both face sheets directly across from each other. The minimum size of the rectangular hole pattern shall be 1" high x 4" wide with a minimum of two rows of holes spaced no more than 1" o.c. The interior of the door between the rectangular hole patterns shall be baffled using pressed steel sections, not less than 14 gage, so that no objects can be passed through.

2.3 HOLLOW METAL FRAMES

A. Materials.
1. Frames shall be constructed of commercial quality, cold rolled steel conforming to ASTM A 366/A 366M or hot rolled, pickled and oiled steel conforming to ASTM A 569/A 569M. The steel shall be free of scale, pitting, coil breaks or other surface defects.
2. Exterior openings: Steel for these openings shall be 12 gage minimum thickness and shall have a zinc coating applied by the hot-dip process conforming to ASTM A 653/A 653M (A60).
3. Interior openings: Steel for these openings shall be 12 gage minimum thickness. Where scheduled, interior frames shall have a zinc coating conforming to ASTM A 653/A 653M (A60).

B. Construction.
1. All frames shall have integral stops and be welded units of the sizes and types shown in the contract documents and on the approved submittal drawings. Frames shall be constructed in accordance with these specifications and as tested in accordance with applicable performance criteria specified in Section 1.06.
2. All finished work shall be neat in appearance, square, and free of defects, warp or buckle. Pressed steel members shall be straight and of uniform profile throughout their lengths.
3. Jamb, header, mullion and sill profiles shall be in accordance with the contract drawings and as shown on the approved submittal drawings.
4. Corner joints shall have all contact edges closed tight with faces mitered and stops butted. Corner joints shall be continuously welded and faces finished smooth. The use of gussets or splice plates shall not be acceptable.
5. Minimum height of stops in door openings shall be 5/8". Height of stops in security glass or panel openings shall be as shown on approved submittal drawings. Cut-off stops, where scheduled, shall be capped as detailed on the contract drawings at the heights shown. Meeting edges of jambs below cut-off stops shall be free of burrs and tightly joined to form a smooth hairline joint.
6. Frames for multiple openings shall have mullion members which, after fabrication, are closed tubular shapes conforming to profiles shown on approved submittal drawings, and having no visible seams or joints. All joints between faces of abutted members shall be continuously welded and finished smooth. All joints between stops of abutted members shall be welded along the height of the stop and shall be left neat and uniform in appearance.
7. When shipping limitations dictate, frames for large openings shall be fabricated in sections designed for assembly in the field by others. Alignment plates or angles shall be installed at the corners of the profile, and shall extend at least 4" on either side of the joint. Such components shall be the same gage as the frame. Field joints shall be made in accordance with the approved submittal drawings. The contractor responsible for installation shall provide for welding and finishing all field joints between faces of abutted members.
8. Hardware Reinforcement and Preparation:
    a. Frames shall be mortised, reinforced, drilled and tapped for all templated mortised hardware only, in accordance with the final approved hardware schedule and templates provided by the hardware supplier. Where surface mounted hardware is to be applied, frames shall be reinforced, and others shall do all drilling and tapping in the field.
    b. Minimum thickness of hardware reinforcing plates shall be as follows:
        1) Hinge and pivot reinforcements: gage x 1 1/2" x 10" length

2) Strike reinforcements: 7 gage
3) Closer reinforcements: 7 gage
4) Flush bolt reinforcements: 7 gage
5) Reinforcements for surface applied hardware: 12 gage

c. In cases where electrically operated hardware is required, and as shown on approved submittal drawings, hardware enclosures and junction boxes for frames shall be provided, and shall be interconnected using UL approved 3/4" minimum conduit, elbows, and connectors. Also, where shown on submittal drawings, junction boxes with access plates shall be provided to facilitate the proper installation of wiring. Access plates shall be the same gage as the frame and fastened with a minimum of four 8-32 torx drive tamper resistant screws, not to exceed 6" o.c.

9. Grout guards shall be provided at all hardware preparations, glazing stop screws and silencer preparations. Grout guards shall be sufficient to protect preparations from grout of a 4" maximum slump consistency, which is hand troweled into place.
10. Floor Anchors:
    a. Floor anchors provided with two holes for fasteners shall be secured inside jambs with four (4) spot welds per anchor minimum.
    b. Where scheduled, adjustable floor anchors, providing not less than 2" height adjustment, shall be secured inside jambs with four (4) spot welds per anchor minimum.
    c. Material thickness of floor anchors shall be the same as frame.
11. Jamb Anchors:
    a. Frames for installation in masonry walls shall be provided with adjustable jamb anchors of the strap and stirrup type made from the same gage steel as the frame. Straps shall be not less than 2" x 10" in size and perforated. The number of anchors provided jamb shall be as follows:
        1) Door frames: 2 anchors plus 1 for each 18" or fraction thereof over 4'-6", spaced at 18" maximum between anchors (fire ratings may require additional anchors)
    b. Embedment Masonry Type
        1) Frames for installation in pre-finished masonry or concrete openings shall be provided with removable faces at the jambs, and 3/16" x 2" x 2" angle anchors 4" long spaced as described in Paragraph 2.02B.11.a. The frame anchors shall be located to coincide with matching embedded anchors that shall be provided by others for installation in the wall.
        2) Angle anchors shall each be secured to jamb and to embed plate with two 1" long arc welds at each end of the anchor. Anchors shall be shipped loose.
        3) The complete anchorage system shall provide that the jamb faces be removed from the frames in the field by the contractor responsible for installation, and the frames be moved into the opening until the frame anchors contact and match the embedded anchors. The contractor responsible for installation shall field weld all anchors and install the jamb faces in place. Embedment anchoring details shall be provided on approved submittal drawings.
    c. Expansion Bolt Type
        1) Frames for installation in existing masonry or concrete walls shall be prepared for expansion bolt type anchors. The preparation shall consist of a countersunk hole for a 3/8" diameter bolt and a spacer from the unexposed surface of the frame to the wall. The spacer shall be welded to the frame and the preparation spaced as described in Paragraph 2.03.B.11.a.

2) After sufficient tightening of the bolt, the bolt head shall be welded by the installation contractor so as to provide a non- removable condition. The welded bolt head shall be ground, dressed and finished smooth.

d. Frames to be installed in pre-finished concrete, masonry or steel openings, shall be constructed and provided with anchoring systems of suitable design as shown on the approved submittal drawings.

12. Frames indicated to be installed in prefinished openings and required to have jambs grouted shall be provided with grout holes at each jamb to allow for grouting after installation.
    a. Grout holes shall consist of a 1 1/4" square hole in the face of each jamb at the top of the frame. The square hole shall be backed up by a plate with a 1 1/4" round hole to allow for grouting. Frames shall be furnished with plugs to be installed by the responsible contractor after grouting. Plugs shall be welded in place and finished smooth.
    b. Precautions shall be taken by the installation contractor to protect all frame preparations from grout leakage resulting from the use of a light consistency grout (greater than a 5" slump).
13. All frames shall be provided with two temporary steel spreaders welded to the bottom of the jambs to serve as bracing during shipping and handling. Spreaders shall be removed prior to installation.
14. Removable glazing stops:
    a. Removable glazing stop in detention hollow metal frames shall be pressed steel angle, not less than 10 gage thickness. Angle stops shall be notched and tight fitting at the corner joints, and secured in place using 1/4-20 SAE grade #8 button head tamper resistant screws spaced 9" o.c. maximum. Glazing stops and screws shall satisfy the performance criteria outlined in Section 1.06.B.
    b. The metal surfaces to which glazing stops are secured shall be chemically treated for maximum paint adhesion and painted with a rust inhibitive primer prior to installation in the frame.

2.4 CLEARANCES AND TOLERANCES

A. Edge clearances for swinging doors shall not exceed the following:
    1. Between doors and frames at head and jambs: 1/8”
    2. Between edges of pairs of doors: 1/8”
    3. At door sills where a threshold is used: 3/8”
    4. At door sills where no threshold is used: 3/4”
    5. Between door bottom and nominal surface of floor coverings as provided in NFPA 80 - 1992, Paragraph 2-2.7: 1/2”
        a. Finished floor is defined as the top surface of floor, except when resilient tile or carpet is used, when it is the top of the concrete slab.

B. Manufacturing tolerance shall be maintained within the following limits:
    1. Frames for single or pair of doors:
        a. Width measured between rabbets at the head: Nominal opening width +1/16", -1/32".
        b. Height (total length of jamb rabbet): Nominal opening height ±3/64".
        c. Cross sectional profile dimensions:
            1) Face: ±1/32”
            2) Stop: ±1/32”

3) Rabbet: ±1/32”
4) Depth: ±1/32”
5) Throat: ±1/16”. Frames overlapping walls to have throat dimension 1/8"greater than dimensioned wall thickness to accommodate irregularities in wall construction.

2. Doors:
   a. Width: ±3/64”
   b. Height: ±3/64”
   c. Thickness: ±1/16”
   d. Hardware cutout dimensions: Template dimensions +0.015”-0”
   e. Hardware location: ±1/32”
   f. Bow / Flatness: ±1/8”

2.5 HARDWARE LOCATIONS

A. The location of hardware on doors and frames shall be as listed below. All dimensions except the hinge locations are referenced from the finished floor as defined in Paragraph 2.03.A. When hollow metal frames only are specified for use with doors to be furnished by others, the hardware preparation on the door is to be governed by its location on the frame. The door supplier is responsible for coordinating hardware locations.

B. Hinges:
   1. Top: 5" from frame head to top of hinge
   2. Bottom: 10" from finished floor to bottom of hinge
   3. Intermediate: centered between top and bottom hinges
   4. Unit and integral type locks and latches: 40 5/16" to centerline of strike
   5. Deadlocks: 48" to centerline of strike
   6. Exit hardware: 38" to centerline of cross bar
   7. Door pulls: 42" to centerline of grip
   8. Push/pull bars: 42" to centerline of bar
   9. Arm pulls: 47" to centerline
   10. Push plates: 48" to centerline of plate

2.6 FINISHES

A. After fabrication, all tool marks and surface imperfections shall be filled and sanded as required to make exposed surfaces smooth and free from irregularities. After appropriate metal preparation, all exposed surfaces of doors and frames shall receive a rust inhibitive primer that meets or exceeds ASTM B 117 Salt Spray for 150 hours.

PART 3 - EXECUTION

3.1 SITE STORAGE AND PROTECTION OF MATERIALS

A. The contractor responsible for installation shall remove wraps or covers from doors and frames upon delivery at the building site. The contractor responsible for installation shall see that any

scratches or disfigurement caused in shipping or handling are promptly sanded smooth, cleaned and touched up with a compatible rust inhibitive primer.

B. The contractor responsible for installation shall see that materials are properly stored on planks in a dry location. Doors shall be stored in a vertical position and spaced by blocking. Materials shall be covered to protect them from damage but in such a manner as to permit air circulation.

3.2 INSTALLATION

A. The Contractor responsible for installation shall perform the following in accordance with HMMA 840.

B. Prior to installation, all frames shall be checked for size, swing, and with temporary spreaders removed, corrected for squareness, alignment, twist and plumbness. Permissible installation tolerances shall not exceed the following:
   1. Squareness: ± 1/16" measured on a line, 90 degrees from one jamb, at the upper corner of the other jamb.
   2. Alignment: ± 1/16" measured on jambs on a horizontal line parallel to the plane of the wall.
   3. Twist: ± 1/16" measured on jambs on horizontal lines perpendicular to the plane of the wall.
   4. Plumbness: ± 1/16" measured on the jamb at the floor.

C. These tolerances provide a guideline for proper installation of hollow metal frames. The cumulative affect of the tolerances at their maximum levels will result in sufficient misalignment to prevent the door from functioning properly. Installers should take care not to create a tolerance buildup. Tolerance buildup occurs when more than one dimension is at or near its maximum tolerance.

D. Frame jambs shall be fully grouted to provide added security protection against battering, wedging, spreading and other means of forcing open the door. Jamb mounted lock preparations, grout guards for hardware preparations, glazing stop screws, and junction boxes are intended to protect hardware mortises, tapped mounting holes, and exposed removable screws from masonry grout of 4" maximum slump consistency which is hand troweled in place. If a light consistency grout (greater than 5" slump when tested in accordance with ASTM C 143) is to be used, special precautions shall be taken in the field by the installation contractor to provide protection from grout.
   1. Frames shall not be used as forms for grout or concrete. Grouting of hollow metal frames shall be done in “lifts” or precautions shall be otherwise taken by the contractor to insure that frames are not deformed or damaged by this process.

E. Proper door clearances shall be maintained in accordance with 2.04 of these specifications, except for special conditions otherwise noted. Where necessary, metal hinge shims, furnished by the contractor responsible for installation, are acceptable to maintain clearances.

F. Hardware shall be applied in accordance with hardware manufacturer's templates and instructions.

G. Any grout or other bonding material shall be cleaned off of frames or doors immediately following installation. Hollow metal surfaces shall be kept free of grout, tar, or other bonding material or sealer.

H. Primed or painted surfaces which have been scratched or otherwise marred during installation (including field welding) and/or cleaning shall promptly be finished smooth, cleaned, treated for maximum paint adhesion and touched up with a rust inhibitive primer.

END OF SECTION 083463

SECTION 086600 – SERIES HOT ROLLED STEEL DETENTION WINDOWS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Furnish all labor and materials to complete the fabrication of windows as shown on architect's drawings and as specified herein. Other bidders must be approved by the architect at least ten days prior to the bid date, through submission of samples and evidence showing that the bidder has been fabricating window products of this type and quality for at least five years. All windows must be domestically manufactured in the U.S.A. All work shall include, but not be limited to, the following:
      a. Double weather-stripped windows project-out.
      b. All window, mullions, covers and trim and anchors.
      c. Insect screens for all operating ventilators. (optional).
      d. Factory applied powder coat finish.

1.2 DEFINITIONS

A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

B. Glass Thicknesses: Indicated by thickness designations in millimeters in accordance with ASTM C1036.

C. IBC: International Building Code.

D. Interspace: Space between lites of an insulating-glass unit.

1.3 REFERENCES

A. AWS C2.23M/C2.23:2003, the application of Zinc and their alloys for the corrosion protection of steel.

B. BS 2569-2, specification for metal coatings protection of iron and steel against corrosion.

C. SSPC-SP 10/NACE No.2, surface preparation of near white metal finish.

D. ANSI/AWS C2.18, zinc coating and thickness.

E. ASTM E283 - Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Difference Across Specimen.

F. ASTM E330 - Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.

G. ASTM E331 - Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.

H. AAMA 603, Specifications for organic coatings on architectural extrusions.

I. Additional references:
   1. CPSC 16 CFR 1201, consumer product safety commission for architectural glazing.
   2. FGMA – glazing manual, Flat Glass Marketing Association.
   3. SWI, The Steel Window Institute.

1.4 PERFORMANCE REQUIREMENTS

A. Design and install windows to withstand dead and live loads caused by positive and negative wind pressure acting normal to plane of wall in accordance with ASTM E330. Limit deflection of framing members to L/175.

B. Maximum air infiltration (ASTM E283) shall not exceed .037 cubic foot per minute per foot of crack length when subjected to a pressure differential across the window of 1.56 psf.

C. Water penetration test (ASTM E331) no water penetration for 15 minutes when the window is subjected to a rate of flow of 5 gal/hr/sq.ft with a pressure differential of 2.86 psf, (as per the SWI standards).

D. Tool resisting steel bars (when specified), meets & or exceeds ASTM A627-88 and A629-88.

E. Impact test, meets or exceeds ASTM F1592-01.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Glass Samples: 12 inches (300 mm) square.

C. Shop drawings showing layout, configurations, profiles, dimensions, wall opening tolerances, hardware, and adjacent related work. Provide large scale details showing method of anchoring and sealing units in rough openings.

1.6 INFORMATIONAL SUBMITTALS

A. Product Certificates: For glass.

B. Product Test Reports: For fabricated glass and glazing sealants, for tests performed by a qualified testing agency.

   1. For glazing sealants, provide test reports based on testing current sealant formulations within previous 36-month period.

C. Manufacturer’s installation and maintenance instructions.

1.7 QUALITY ASSURANCE

A. Fabricated-Glass Manufacturer Qualifications: A qualified manufacturer of fabricated glass units who is approved by primary glass manufacturer.

B. Manufacturer shall not have less than 10 years experience in the fabrication of custom steel windows and doors and be a member of The Steel Window Institute (SWI).

C. Installer shall not have less than 10 years experience in the installation and glazing of hot rolled steel windows and doors.

D. Mockups: Build mockups to provide sample for comparison of products as well as installation method.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer’s standard unopened packaging until ready for installation.

B. Protect glazing materials in accordance with manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

C. Comply with insulating-glass manufacturer's written instructions for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Glazing Accessories: For each product and installation method, obtain from single source from single manufacturer.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. American Steel Products – Swainsboro, GA
   2. Hope’s Windows.
   3. Kane Innovations.
   4. Optimum Window Manufacturing Corporation.
   5. Titan Steel USA.
   6. Trussbilt – Huron, SD

2.2 GLASS PRODUCTS, GENERAL

A. Framing sections:
   1. Frame section to be fabricated from 12 gauge galvannealed steel.
   2. Ventilator sections to be fabricated from hot rolled steel with a weight of 1.9lbs per LF.
   3. Ventilator head rail shall be specially formed from galvannealed steel not less than 12 gauge.

4. Detention bars shall be 7/8” round and or ¼”x2” flat steel bars. Moderate detention bars shall be mild steel and maximum detention bars are tool resistant.
5. Glazing beads shall be extruded aluminum alloy 6063-T5.
6. Weather-stripping shall be OWM’s std neoprene.
7. The power unit shall be worm gear self locking type with bronze bearings and provide continuous operation in either direction.
8. All vertical connecting bars shall be steel not less than 3/16" x 1-1/4" and located at both jambs of each unit.
9. Brass or bronze bearings shall be provided at all wearing points on the pivotal bars and linkage mechanism. Bead and trim screws shall be tamper resisting #10 truss or button head plated steel.
10. L Anchors shall be 3/16" plated steel angle or plate.

B. Window units:
1. Type: Fixed/ Project out type fabricated from both formed and hot rolled steel sections.
2. Grade: Maximum / Moderate Top Pivoted Awning Detention Window in accordance with SWI.
3. Size, shape, and configuration: As indicated on Drawings.
4. Frame corners: Mitered, welded, and finished smooth and flush with adjacent surfaces.
5. Muntins: As indicated on drawings.
6. Glazing beads: Mechanically fastened type.
7. Insect screens: Provide screens for all operable windows.
   a. Frame: Steel with welded corners to lie flat against window frame without bow or screen sag. Finish to match window color.
   b. Screen: Stainless steel mesh.
8. Trim: Provide mullion covers, attachment clips, and other trim required for complete, finished installation as detailed on Drawings and approved shop drawings.
9. Factory glaze windows in accordance product manufacturer's standard procedures.

2.3 FABRICATION OF GLAZING UNITS

A. Fabricate windows in accordance with the approved shop drawings.

B. Frame members shall be mitered and/or coped, face or back welded at the corners the full depth of the frame. Exposed face welds shall be dressed smooth.

C. All removable covers or trim, either exterior or interior, shall be field attached with screws, spaced not more than 9" on centers at the interior and spaced not more than 12" on centers at the exterior.

D. The horizontal 7/8" round detention bars, spaced not more than 6" on centers, shall penetrate the vertical 14" x 2" flat detention bars concealed within the jambs.

E. The ventilator jamb and sill bars shall be solidly welded and all exposed face welds and welds on contact surfaces dressed smooth. The head rail shall be coped and welded to the jamb bars. The jamb and head bars shall be welded to the 7/8" round pivotal bars.

F. Operating Hardware:

1. The 7/8" round pivotal bar shall be continuous and have a weld linkage arm near each end. The linkage arm at each jamb shall be attached to a flat connecting bar by a pivot pin controlling the ventilator in unison to a maximum opening of 50 degrees.
2. The linkage arms of the lower ventilator shall be connected to bell cranks at each jamb by means of adjustable links, which provide for adjustment of ventilators.
3. A bell crank shall be welded to each end of the 3/4"diameter power shaft.
4. The power unit shall be located and concealed within the subframe of the window.
5. Opening and closing of the ventilator shall be accomplished by rotating the operating cone or crank in either direction.
6. The 3/4" diameter shaft, power unit, bell cranks, and adjustable links shall be removable from the window.

G. Weather-stripping shall be factory applied in a groove and in the same plane around the interior contact surface of the ventilator.

H. All windows shall be designed for outside glazing.

I. Screens (optional) - See separate screen section for available screen types and specifications.

J. Anchors shall be welded to the perimeter frame member or the 14" x 2" detention flat at a maximum spacing of 18" on center.

K. After assembly:
1. Fabrication tolerances to be plus or minus 1/8 inch (3mm).
2. All welded joinery to be ground smooth.
3. Shot blast all frames sashes and miscellaneous components after fabrication as per SSPC-SP 10/NACE No.2.
4. All material processed through 5 stage pre-treatment.
5. Zinc Rich Epoxy Primer applied directly onto all substrates.
6. Final finish coat is a Super Durable Powder Paint as per AAMA 6043 with a minimum film thickness of 6 to 9 mils baked at 400 deg for 20 minutes.
7. Color to be chosen by architect from manufacturer’s standard, unless otherwise specified.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that wall openings are ready to receive windows.

B. Insulate dissimilar metals to prevent electrolysis and other forms of corrosion with bituminous paint or non-absorptive gasket to prevent contact.

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that leave visible marks in the completed Work.

3.3 GLAZING, GENERAL

A. Install windows in accordance with approved shop drawings and manufacturer's instructions.

B. Use anchorage devices to securely attach frames in rough openings. Align window units plumb, level, and free of warp or twist.

C. Apply backing material and sealant in perimeter joints to ensure weather tight installation.

D. Glazing windows to comply with FGMA - Glazing Manual and CPSC 16 CFR.
   1. Install with setting blocks, spacers, gaskets, glazing tape, and sealant as indicated on approved shop drawings.
   2. Only install glass with clean cut edges. Do not bump, drag, or brush edges against sash or hard objects. Avoid scratching.

E. Securely attach insect screens with clips and screws.

F. Adjust operating hardware to provide smooth operation, tight fit, and weather tight closure.

3.4 CLEANING

A. Remove excess sealant by moderate use of mineral spirits or other solvent acceptable to sealant manufacturer.

B. Exercise care in removing mortar, cementitious materials, and sand from glass and frames. Do not wipe surfaces in order to avoid scratching.

C. Touch up damaged or abraded factory finish with enamel to match type and color of original finish.

D. Wash exposed surfaces with solution of mild detergent applied with soft cloth. Take care to remove dirt from corners. Wipe surfaces clean.

END OF SECTION 086600

SECTION 088853 – SECURITY GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Laminated polycarbonate security glazing for the following applications:
   1. Detention Windows.
   2. Interior Windows.

1.2 DEFINITIONS

A. Glass Manufacturers: Firms that produce primary glass, monolithic plastic glazing, or fabricated security glazing, as defined in referenced glazing publications.

B. Glass Thicknesses: Indicated by thickness designations in millimeters in accordance with ASTM C1036.

C. IBC: International Building Code.

D. Interspace: Space between lites of air-gap security glazing or insulating security glazing.

1.3 COORDINATION

A. Coordinate glazing channel dimensions to provide necessary bite on security glazing, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

   1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   2. Review temporary protection requirements for security glazing during and after installation.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Security Glazing Samples: Two (2) for each type of security glazing; 12-inches square.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installers.

B. Product Certificates: For each type of product indicated by the manufacturer.

C. Product Test Reports: For each type of security glazing accessory not listed on the Security Glazing manufactures approved list.

1. Provide test reports based on testing current sealant formulations within the previous 36-month period.

D. Preconstruction adhesion and compatibility test report.

E. Security Glazing Schedule: List security glazing types and thicknesses for each size opening and location. Use the same designations indicated on Drawings. Indicate coordinated dimensions of security glazing and construction that receives security glazing, including clearances and glazing channel dimensions.

F. Sample Warranties: For special warranties.

G. Glazing Detail: Submit drawing showing intended installation method, list all tapes, caulks, setting blocks with documentation from Security Glazing manufacturer that all are compatible with the specified glazing material.

1.7 QUALITY ASSURANCE

A. Manufacture Qualifications: A company specializing in the manufacture of security glass, types as specified, with minimum documented (10) years' experience.

B. Installer Qualifications: A qualified installer with a minimum of 5 years' experience in the installation of security glazing in correctional facilities or a glazier that is certified under the National Glass Association Glazier Certification Program as Level 2 (Senior Glaziers) or Level 3 (Master Glaziers).

C. Security Glazing Testing Agency Qualifications: Subject to compliance with requirements, testing agency is one of the following:
1. H. P. White Laboratory, Inc.
2. Underwriters Laboratories, Inc.
3. Intertek
4. Wiss, Janney, Eistner Associates, Inc.

D. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C1021 to conduct the testing indicated.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials in accordance with manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. Comply with insulating-glass manufacturer's written instructions for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or are below 40 deg F (4.4 deg C).

1.10 WARRANTY

A. Manufacturer's Special Warranty for Laminated Polycarbonate: Manufacturer agrees to replace laminated polycarbonate that deteriorates within specified warranty period. Deterioration of laminated polycarbonate is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated polycarbonate contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glazing, blemishes exceeding those allowed by referenced laminated polycarbonate standard, yellowing, and loss of light transmission.

1. Warranty Period: Five years from date of Manufacture.

B. Manufacturer's Special Warranty for Insulating Security Glazing: Manufacturer agrees to replace insulating security glazing that deteriorates within specified warranty period. Deterioration of insulating security glazing is defined as defects in individual lites developed from normal use or failure of hermetic seal under normal use. Deterioration does not include defects in individual lites or failure of hermetic seal that is attributed to glass breakage or to maintaining and cleaning insulating security glazing contrary to manufacturer's written instructions.

1. Defects in coated glass lites include peeling, cracking, and other indications of deterioration in coating.

2. Defects in laminated-glass lites include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.

3. Defects in glass-clad polycarbonate lites include edge separation, delamination materially obstructing vision through glazing, blemishes exceeding those allowed by referenced glass-clad polycarbonate standard, yellowing, and loss of light transmission.

4. Evidence of hermetic seal failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glazing.

5. Warranty Period: Five years from date of Manufacture.

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:
   1. Global Security Glazing – Selma, AL
   2. Dlubak – Blairsville, PA
   3. Oldcastle – Telford, PA

B. Source Limitations for Glazing Accessories: For each product and installation method, obtain from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Installed security glazing shall withstand security-related loads and forces without damage to the glazing beyond that allowed by referenced standards.

C. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined in accordance with the IBC and ASTM E1300:

   1. Design Wind Pressures: Determine design wind pressures applicable to Project in accordance with ASCE/SEI 7, based on heights above grade indicated on Drawings.

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on glazing framing members and glazing components.
   1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

E. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.

2.3 GLASS PRODUCTS, GENERAL

A. Glazing Publications: Comply with published recommendations of security glazing and glazing material manufacturers and organizations below unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or

in referenced standards Retain publications in four subparagraphs below that apply to glazing products specified.

1. GANA Publications: "Laminated Glazing Reference Manual" and "Glazing Manual."
2. AAMA Publications: AAMA GDSG-1, "Glass Design for Sloped Glazing," and AAMA TIR- A7, "Sloped Glazing Guidelines."
3. IGMA Publication for Sloped Glazing: IGMA TB-3001, "Guidelines for Sloped Glazing."
4. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."

B. Plastic Glazing Labeling: Identify plastic sheets with appropriate markings of applicable testing and inspecting agency, indicating compliance with required fire-test-response characteristics.

C. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the Safety Glazing Certification Council. Label shall indicate manufacturer’s name, type of glazing, glass thickness and safety glazing standard with which glazing complies.

D. Ballistics Resistance: Provide glazing materials capable of resisting ballistic impact at levels indicated as determined from testing identical materials according to UL 752.

E. Attack Resistance: Provide glazing materials capable of resisting attack of type and at security-grade levels indicated as determined from testing identical materials according to ASTM F 1915- 05.

F. Human Impact Load Resistance: Provide Category II glazing materials based on complying and testing requirements in 16 CFR 1201.

G. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on glazing framing members and glazing components.
   1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

H. Fire-Test-Response Characteristics of Polycarbonate Sheets: As determined by testing polycarbonate sheets identical to those used in security glazing products by a qualified testing agency acceptable to authorities having jurisdiction.
   1. Self-ignition temperature of 650 deg F or more when tested according to ASTM D 1929 on plastic sheets in thicknesses indicated for the Work.
   2. Smoke-Developed Index of 450 or less when tested according to ASTM E 84, or smoke density of 75 or less when tested according to ASTM D 2843 on plastic sheets in thicknesses indicated for the Work.
   3. Burning extent of 1 inch or less when tested according to ASTM D 635 at a nominal thickness of 0.060 inch or thickness indicated for the Work.

I. Thermal and Optical Performance Properties: Provide security glazing with performance properties specified, as indicated in manufacturer's published test data, based on construction products indicated and on procedures indicated below:
   1. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F.
   2. Solar-Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
   3. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

2.4 POLYCARBONATE SECURITY GLAZING

A. Laminated Polycarbonate: Polycarbonate sheets laminated with clear urethane interlayer that complies with ASTM C 1349, Appendix X2, and has a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation. Provide laminated units that comply with requirements of ASTM C 1349 for maximum allowable laminating process blemishes and haze.

2.5 GLAZING SEALANTS

A. General:

1. Compatibility: Provide glazing sealants that are compatible with one another and with other materials they contact, including security glazing, seals of insulating security glazing and air-gap security glazing, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
3. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range of industry colors.

B. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.
1. Manufacturers: Subject to compliance with requirements, and compatible with glazing materials; provide products by one of the following:
    a. Dow Corning Corporation.
    b. GE Construction Sealants; Momentive Performance Materials Inc.

C. Security Sealant: Manufacturer's standard, nonsag, tamper-resistant sealant for joints with low movement complying with ASTM C 920, Grade NS, Class 12.5 or 25, Use NT, and with a Shore A hardness of at least 45 when tested according to ASTM C 661.
1. Manufacturers: Subject to compliance with requirements, and compatible with glazing materials.

2.6 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C1281 and AAMA 800 for products indicated below:
1. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:

1. AAMA 810.1, Type 1, for glazing applications in which tape acts as primary sealant.

2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.7 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, recommended in writing by manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks:

1. Elastomeric material with Shore A durometer hardness of 85, plus or minus 5.

D. Spacers:

1. Elastomeric blocks or continuous extrusions of hardness required by security glazing manufacturer to maintain security glazing lites in place for installation indicated.

E. Edge Blocks:

1. Elastomeric material of hardness to limit security glazing lateral movement (side walking).

2.8 FABRICATION OF SECURITY GLAZING

A. Fabricate security glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
2. Presence and functioning of weep systems.
3. Minimum required face and edge clearances.
4. Minimum required bite.
5. Effective sealing between joints of glass-framing members.

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

3.2 PREPARATION

A. Clean glazing channels and other framing members receive security glazing immediately before glazing. Remove coatings not firmly bonded to substrates.

B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that leave visible marks in the completed Work.

3.3 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of security glazing, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Protect edges of security glazing from damage during handling and installation. Damaged security glazing includes units with edge or face damage or other imperfections that, when installed, could weaken security glazing, and impair performance and appearance.

C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

E. Do not exceed edge pressures stipulated by security glazing manufacturers for installing lites.

F. Provide spacers for glass lites where length plus width is larger than 50 inches (1270 mm).

1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
2. Provide 1/8-inch- (3-mm-) minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and in accordance with requirements in referenced glazing publications.

H. Set security glazing in each series with uniform pattern, draw, bow, and similar characteristics.

I. Set coated security glazing with proper orientation so that coatings and films face exterior or interior as specified.

J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended in writing by gasket manufacturer.

3.4 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by security glazing, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Cover vertical framing joints by applying tapes to heads and sills first, then to jambs. Cover horizontal framing joints by applying tapes to jambs, then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Do not remove release paper from tape until right before each glazing unit is installed.

F. Apply heel bead of elastomeric sealant.

G. Center security glazing in openings on setting blocks, and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

H. Apply cap bead of elastomeric sealant over exposed edge of tape. Verify if areas with inmates are required to be included.

3.5 CLEANING AND PROTECTION

A. Immediately after installation, remove nonpermanent labels and clean surfaces.

B. Protect security glazing from contact with contaminating substances resulting from construction operations, including weld splatter. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.

1. If, despite such protection, contaminating substances do contact with security glazing, remove substances immediately as recommended in writing by security glazing manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.

C. To be completed at time of building final cleaning - Wash security glazing on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash security glazing as recommended in writing by security glazing manufacturer.

3.6 LAMINATED POLYCARBONATE GLAZING SCHEDULE

A. Clear Laminated Polycarbonate (ASTM F1915-05 Grade 2, 40 min. Attack)

1. Basis-of-Design Product: Subject to compliance with requirements, provide “1/2” Lexgard® MPC 500” as manufactured by Global Security Glazing or a comparable product.

3.7 IMPACT TEST CRITERIA

A. ASTM F 1915 Standard Test Methods for Glazing for Detention Facilities.
1. Security Grade 1: 60 minutes
2. Security Grade 2: 40 minutes
3. Security Grade 3: 20 minutes
4. Security Grade 4: 10 minutes

B. Glass Stop Height: Provide 1/4-inch edge plus 1” bite

END OF SECTION 088853

SECTION 092216 - NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Suspension systems.

1.2 ACTION SUBMITTALS

A. Product Data:
   1. Suspension systems.

1.3 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of code-compliance certification for studs and tracks.

B. Evaluation Reports: For firestop tracks, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

1.4 QUALITY ASSURANCE

A. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of the Steel Framing Industry Association.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Notify manufacturer of damaged materials received prior to installation.

B. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

C. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling as required by AISI S202, "Code of Standard Practice for Cold-Formed Steel Structural Framing."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, in accordance with ASTM E119 by an independent testing agency.

B. Design Loads: As indicated on architectural Drawings or 5 lbf/sq. ft. (239 Pa) minimum as required by the IBC.

2.2 SUSPENSION SYSTEMS

A. Tie Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.062-inch- (1.59-mm-) diameter wire, or double strand of 0.048-inch- (1.21-mm-) diameter wire.

B. Wire Hangers: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.16 inch (4.12 mm) in diameter.

C. Flat Hangers: Steel sheet, 1 by 3/16 inch (25 by 5 mm) by length indicated.

D. Carrying Channels (Main Runners): Cold-rolled, commercial-steel sheet with a base-steel thickness of 0.0538 inch (1.367 mm) and minimum 1/2-inch- (13-mm-) wide flanges.

1. Depth: 1-1/2 inches (38 mm).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.

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

3.2 PREPARATION

A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.

1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

3.3 INSTALLATION, GENERAL

A. Installation Standard: ASTM C754.
   1. Gypsum Board Assemblies: Also comply with requirements in ASTM C840 that apply to framing installation.

B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, toilet accessories, furnishings, or similar construction.

C. Install bracing at terminations in assemblies.

D. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.4 INSTALLATION OF SUSPENSION SYSTEMS

A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.

   1. Hangers: 48 inches (1219 mm) o.c.
   2. Carrying Channels (Main Runners): 48 inches (1219 mm) o.c.
   3. Furring Channels (Furring Members): 16 inches (406 mm) o.c.

B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.

C. Suspend hangers from building structure as follows:

   1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.

      a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.

   2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.

      a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.

   3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
   4. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
   5. Do not attach hangers to steel roof deck.

6. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
7. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
8. Do not connect or suspend steel framing from ducts, pipes, or conduit.

D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.

3.5 FIELD QUALITY CONTROL

A. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet (3 mm in 3.6 m) measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION 092216

SECTION 092900 - GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior gypsum board.

1.2 ACTION SUBMITTALS

A. Product Data: For the following:
1. Gypsum ceiling board.
2. Mold-resistant gypsum board.
3. Interior trim.
4. Aluminum trim.
5. Joint treatment materials.

B. Shop Drawings: Show locations and installation of control and expansion joints, including plans, elevations, sections, details of components, and attachments to other work.

C. Samples: For the following products:

1. Trim Accessories: Full-size Sample in 12-inch- (300-mm-) long length for each trim accessory indicated.

1.3 DELIVERY, STORAGE AND HANDLING

A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.4 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C840 requirements or gypsum board manufacturer's written instructions, whichever are more stringent.

B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain each type of gypsum panel and joint finishing material from single source with resources to provide products of consistent quality in appearance and physical properties.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated in accordance with ASTM E119 by an independent testing agency.

2.3 GYPSUM BOARD, GENERAL

A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.4 INTERIOR GYPSUM BOARD

A. Gypsum Ceiling Board: ASTM C1396/C1396M.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Certainteed; SAINT-GOBAIN.
   b. Georgia-Pacific Gypsum, LLC.
   c. Gold Bond Building Products, LLC provided by National Gypsum Company.
   d. USG Corporation.
2. Thickness: 1/2 inch (12.7 mm).
3. Long Edges: Tapered.

B. Mold-Resistant Gypsum Board: ASTM C1396/C1396M. With moisture- and mold-resistant core and paper surfaces.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Certainteed; SAINT-GOBAIN.
   b. Georgia-Pacific Gypsum, LLC.
   c. Gold Bond Building Products, LLC provided by National Gypsum Company.
   d. USG Corporation.
2. Core: 5/8 inch (15.9 mm), Type X.
3. Long Edges: Tapered.
4. Mold Resistance: ASTM D3273, score of 10 as rated in accordance with ASTM D3274.

2.5 TRIM ACCESSORIES

A. Interior Trim: ASTM C1047.

1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
2. Shapes:

    a. Cornerbead.
    b. Bullnose bead.
    c. LC-Bead: J-shaped; exposed long flange receives joint compound.
    d. L-Bead: L-shaped; exposed long flange receives joint compound.
    e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
    f. Expansion (control) joint.
    g. Curved-Edge Cornerbead: With notched or flexible flanges.

B. Aluminum Trim: Extruded accessories of profiles and dimensions indicated.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    a. Fry Reglet Corporation.
    b. Gordon Inc.
    c. Pittcon Industries.
2. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B221 (ASTM B221M), Alloy 6063-T5.
3. Finish: Corrosion-resistant primer compatible with joint compound and finish materials specified.

2.6 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C475/C475M.

B. Joint Tape:

1. Interior Gypsum Board: Paper.

C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use compound.

    a. Use setting-type compound for installing paper-faced metal trim accessories.

3. Fill Coat: For second coat, use drying-type, all-purpose compound.
4. Finish Coat: For third coat, use drying-type, all-purpose compound.
5. Skim Coat: For final coat of Level 5 finish, use drying-type, all-purpose compound.

2.7 AUXILIARY MATERIALS

A. Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.

B. Thermal Insulation: As specified in Section 072100 "Thermal Insulation."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates including welded hollow-metal frames and support framing, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

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

3.2 INSTALLATION AND FINISHING OF PANELS, GENERAL

A. Comply with ASTM C840.

B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch (1.5 mm) of open space between panels. Do not force into place.

D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

E. Form control and expansion joints with space between edges of adjoining gypsum panels.

F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.

1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. (0.7 sq. m) in area.
2. Fit gypsum panels around ducts, pipes, and conduits.
3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- (6.4- to 9.5-mm-) wide joints to install sealant.

G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch- (6.4- to 12.7-mm-) wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

3.3 INSTALLATION OF INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:
   1. Ceiling Type: As indicated on Drawings.
   2. Mold-Resistant Type: Wet areas: restroom and shower room.

B. Single-Layer Application:

   1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
   2. On partitions/walls, apply gypsum panels vertically (parallel to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.

      a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
      b. At stairwells and other high walls, install panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.
   3. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

3.4 INSTALLATION OF TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints in accordance with ASTM C840 and in specific locations approved by Architect for visual effect.

C. Interior Trim: Install in the following locations:

   1. Cornerbead: Use at outside corners unless otherwise indicated.
   2. Bullnose Bead: Use at outside corners.
   3. LC-Bead: Use at exposed panel edges.
   4. L-Bead: Use where indicated on Drawings.
   5. U-Bead: Use at exposed panel edges.

D. Aluminum Trim: Install in locations indicated on Drawings.

3.5 FINISHING OF GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints, rounded or beveled edges, and damaged surface areas.

C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below and in accordance with ASTM C840:

1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.

3.6 PROTECTION

A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.

B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

C. Remove and replace panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092900

SECTION 096513 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Thermoset-rubber base.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Initial Selection: For each type of product indicated.

C. Samples for Verification: For each type of product indicated and for each color, texture, and pattern required in manufacturer's standard-size Samples, but not less than 12 inches (300 mm) long.

D. Product Schedule: For resilient base and accessory products. Use same designations indicated on Drawings.

1.3 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Furnish not less than 10 linear feet (3 linear m) for every 500 linear feet (150 linear m) or fraction thereof, of each type, color, pattern, and size of resilient product installed.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C).

1.5 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 95 deg F (35 deg C), in spaces to receive resilient products during the following periods:

1. 48 hours before installation.
2. During installation.

3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).

C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 THERMOSET-RUBBER BASE, RB

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Kentile Floors, Inc.
2. Burke Mercer Flooring Products; a division of Burke Industries, Inc.
3. Johnsonite; A Tarkett Company.
4. Roppe Corporation, USA.

B. Product Standard: ASTM F1861, Type TS (rubber, vulcanized thermoset), Group I (solid, homogeneous).

1. Style:
a. Cove

C. Thickness: 0.125 inch (3.2 mm).

D. Height: 4 inches (102 mm).

E. Lengths: Coils in manufacturer's standard length.

F. Outside Corners: Preformed.

G. Inside Corners: Job formed.

2.2 ACCESSORIES

A. Glue-Down Carpet Edging: 5/16 inch (7.94 mm) butting gauge undercut, long flange/smooth taper, 2-1/4 inch (57.2 mm) width.
1. Material: Thermal-Set, molded, vulcanized rubber, in manufacturer's longest lengths.

B. Reducer Strip: 1/8 inch (3.175 mm) butting gauge, 1-1/2 inch (38.1 mm) width.
1. Material: Thermal-Set, molded, vulcanized rubber, in manufacturer's longest lengths.

C. Tile/Carpet Joiner: 7/32 or 1/2 inch (5.55 or 12.7 mm) as required, 1 inch (25.4 mm) cover.

D. Adhesive: Water-resistant type recommended by manufacturer to suit floor tile and substrate conditions indicated.

1. Vinyl Composition Tile Flooring: Provide epoxy adhesive.

E. Chemical-Bonding Compound: Manufacturer's product for chemically bonding seams.

F. Trowelable Leveling and Patching Compounds: Latex-modified, Portland cement based or blended hydraulic cement based formulation provided or approved by resilient product manufacturer for applications indicated.

G. Floor Wax: One recommended by the floor covering manufacturer.
1. Vinyl Composition Tiles: Self-polishing, non-slip type.

H. Sealers: As recommended by the floor covering manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

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

1. Installation of resilient products indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

C. Do not install resilient products until materials are the same temperature as space where they are to be installed.

1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.

D. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

3.3 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch resilient base during installation.

F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.

G. Preformed Corners: Install preformed corners before installing straight pieces.

H. Job-Formed Corners:

1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches (76 mm) in length.

    a. Form without producing discoloration (whitening) at bends.

2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches (76 mm) in length.

3.4 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.

B. Perform the following operations immediately after completing resilient-product installation:

1. Remove adhesive and other blemishes from surfaces.
2. Sweep and vacuum horizontal surfaces thoroughly.
3. Damp-mop horizontal surfaces to remove marks and soil.

C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION 096513

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Vinyl composition floor tile.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Initial Selection: For each type of floor tile indicated.

C. Samples for Verification: Full-size units of each color and pattern of floor tile required.

   1. For heat-welding bead, manufacturer's standard-size Samples, but not less than 6 inches (230 mm) long, of each color required.

D. Product Schedule: For floor tile. Use same designations indicated on Drawings.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of floor tile to include in maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

Revise "Floor Tile" Subparagraph below to suit Project.

   1. Floor Tile: Furnish one box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are competent in techniques required by manufacturer for floor tile installation and seaming method indicated.

1. Engage an installer who employs workers for this Project who are trained or certified by floor tile manufacturer for installation techniques required.

B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. Coordinate mockups in this Section with mockups specified in other Sections.

a. Size: Minimum 100 sq. ft. (9.3 sq. m) for each type, color, and pattern [in locations indicated] [in locations directed by Architect] <Insert locations>.

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

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store floor tile and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C). Store floor tiles on flat surfaces.

1.8 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 95 deg F (35 deg C), in spaces to receive floor tile during the following periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).

C. Close spaces to traffic during floor tile installation.

D. Close spaces to traffic for 48 hours after floor tile installation.

E. Install floor tile after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

2.2 VINYL COMPOSITION FLOOR TILE, VCT

A. Products: Subject to compliance with requirements, provide one of the following:
   1. Armstrong Flooring
   2. J&J Flooring
   3. Shaw Cotnract Group; A Berkshire Hathaway Co.

B. Tile Standard: ASTM F1066.

C. Wearing Surface: Embossed.

D. Thickness: 0.125 inch (3.2 mm)

E. Size: 12 by 12 inches (305 by 305 mm).

F. Colors and Patterns: As indicated in the drawings.

2.3 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by floor tile manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by floor tile and adhesive manufacturers to suit floor tile and substrate conditions indicated.

C. Seamless-Installation Accessories:

   1. Heat-Welding Bead: Manufacturer's solid-strand product for heat welding seams.

      a. Colors: Match floor tile.

D. Floor Polish: Provide protective, liquid floor-polish products recommended by floor tile manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor tile.

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

3.2 PREPARATION

A. Prepare substrates according to floor tile manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates: Prepare according to ASTM F710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by floor tile manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by floor tile manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
4. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft. (18.6 sq. m) and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.

    a. Anhydrous Calcium Chloride Test: ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
    b. Relative Humidity Test: Using in-situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install floor tiles until materials are the same temperature as space where they are to be installed.

1. At least 48 hours in advance of installation, move resilient floor tile and installation materials into spaces where they will be installed.

E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.

3.3 FLOOR TILE INSTALLATION

A. Comply with manufacturer's written instructions for installing floor tile.

B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.

1. Lay tiles square with room axis.

C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.

1. Lay tiles with grain running in one direction.

D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.

E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent marking device.

G. Adhere floor tiles to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

H. Seamless Installation:

1. Heat-Welded Seams: Comply with ASTM F1516. Rout joints and heat weld with welding bead to fuse sections permanently into a seamless flooring installation. Prepare, weld, and finish seams to produce surfaces flush with adjoining flooring surfaces.
2. Chemically Bonded Seams: Bond seams with chemical-bonding compound to fuse sections permanently into a seamless flooring installation. Prepare seams and apply compound to produce tightly fitted seams without gaps, overlays, or excess bonding compound on flooring surfaces.

3.4 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting floor tile.

B. Perform the following operations immediately after completing floor tile installation:

1. Remove adhesive and other blemishes from surfaces.
2. Sweep and vacuum surfaces thoroughly.
3. Damp-mop surfaces to remove marks and soil.

C. Protect floor tile from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Floor Polish: Remove soil, adhesive, and blemishes from floor tile surfaces before applying liquid floor polish.

E. Cover floor tile until Substantial Completion.

END OF SECTION 096519

SECTION 096813 - TILE CARPETING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Carpet tile.

B. Related Requirements:
1. Section 096513 "Resilient Base and Accessories" for resilient wall base and accessories installed with carpet tile.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include manufacturer's written data on physical characteristics, durability, and fade resistance.
2. Include manufacturer's written installation recommendations for each type of substrate.

B. Shop Drawings: For carpet tile installation, showing the following:

1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet tiles.
2. Carpet tile type, color, and dye lot.
3. Type of subfloor.
4. Type of installation.
5. Type, color, and location of edge, transition, and other accessory strips.
6. Transition details to other flooring materials.

C. Samples for Initial Selection: Manufacturer's standard color sheets, showing full range of available colors for each type of carpet tile.

1. Include Samples of exposed edge, transition, and other accessory stripping involving color or finish selection.

D. Samples for Verification: Actual sample of finished products for each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.

1. Carpet Tile: Full-size Sample.
2. Exposed Edge, Transition, and Other Accessory Stripping: 12-inch long Samples.

E. Product Schedule: For carpet tile. Use same designations indicated on Drawings.

1.3 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For carpet tile, for tests performed by a qualified testing agency.

B. Qualification Statements: For Installer.

C. Sample Warranties: For carpet tile.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For carpet tiles. Include the following:

1. Methods for maintaining carpet tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
2. Precautions for cleaning materials and methods that could be detrimental to carpet tile.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Extra Stock Material: Furnish extra materials, from the same production run, to Owner that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Carpet Tile: Full-size units equal to 5 percent of amount installed for each type indicated, but no fewer than 10 full-size units.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is certified by the International Certified Floorcovering Installers Association at the Commercial II certification level.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Comply with CRI 104.

1.8 FIELD CONDITIONS

A. Comply with CRI 104 for temperature, humidity, and ventilation limitations.

B. Environmental Limitations: Do not deliver or install carpet tiles until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at levels planned for building occupants during the remainder of the construction period.

C. Do not install carpet tiles over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended in writing by carpet tile manufacturer.

D. Where demountable partitions or other items are indicated for installation on top of carpet tiles, install carpet tiles before installing these items.

1.9 WARRANTY

A. Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.

1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
2. Failures include, but are not limited to, the following:

    a. More than 10 percent loss of face fiber, edge raveling, snags, and runs.
    b. Loss of tuft-bind strength.
    c. Excess static discharge.
    d. Delamination.
    e. Dimensional instability.

3. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CARPET TILE

A. Manufacturers: Subject to compliance with requirements, provide products by the following, as indicated on Finish Legend Descriptions:
1. Stratton Landmark
2. Interface, Inc.
3. J&J Flooring Group
4. Shaw Contract

B. Color: As indicated in the drawings.

C. Fiber Type: Ecosolution Q100 Nylon.

D. Pile Characteristic: Multi-Level-Loop pile.

E. Stitches: 8.0-9.0 per inch.

F. Backing System: Synthetic.

G. Size: See Finish Legend Descriptions.

2.2 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended in writing by carpet tile manufacturer.

B. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive types to suit products and subfloor conditions indicated, that comply with flammability requirements for installed carpet tile, and that are recommended in writing by carpet tile manufacturer for releasable installation.

C. Metal Edge/Transition Strips: Extruded aluminum with mill finish of profile and width shown, of height required to protect exposed edge of carpet, and of maximum lengths to minimize running joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance.

B. Examine carpet tile for type, color, pattern, and potential defects.

C. Concrete Slabs: Verify that finishes comply with requirements specified in Section 033000 "Cast-in-Place Concrete" and that surfaces are free of cracks, ridges, depressions, scale, and foreign deposits.

1. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft. (20 sq. m) and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.

    a. Anhydrous Calcium Chloride Test: ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/100 sq. m) in 24 hours.
    b. Relative Humidity Test: Using in situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
    c. Perform additional moisture tests recommended in writing by adhesive and carpet tile manufacturers. Proceed with installation only after substrates pass testing.

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

3.2 PREPARATION

A. General: Comply with CRI 104 and with carpet tile manufacturer's written installation instructions for preparing substrates.

B. Use trowelable leveling and patching compounds, in accordance with manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch (3 mm) wide or wider, and protrusions more than 1/32 inch (0.8 mm) unless more stringent requirements are required by manufacturer's written instructions.

C. Concrete Substrates: Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by adhesive and carpet tile manufacturers.

D. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

3.3 INSTALLATION

A. General: Comply with CRI 104, Section 10, "Carpet Tile," and with carpet tile manufacturer's written installation instructions.

B. Installation Method: As recommended in writing by carpet tile manufacturer.

C. Maintain dye-lot integrity. Do not mix dye lots in same area.

D. Maintain pile-direction patterns as indicated in the drawings.

E. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended in writing by carpet tile manufacturer.

F. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

G. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on carpet tile as marked on subfloor. Use nonpermanent, nonstaining marking device.

H. Install pattern parallel to walls and borders.

3.4 CLEANING AND PROTECTION

A. Perform the following operations immediately after installing carpet tile:

1. Remove excess adhesive and other surface blemishes using cleaner recommended in writing by carpet tile manufacturer.
2. Remove yarns that protrude from carpet tile surface.
3. Vacuum carpet tile using commercial machine with face-beater element.

B. Protect installed carpet tile to comply with CRI 104, Section 13.7.

C. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION 096813

SECTION 099113 - EXTERIOR PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Primers.
2. Finish coatings.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include preparation requirements and application instructions.
2. Indicate VOC content.

B. Samples for Verification: For each type of paint system and each color and gloss of topcoat.

1. Submit Samples on rigid backing, 8 inches (200 mm) square.
2. Apply coats on Samples in steps to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.

1.4 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. (3.8 L) of each material and color applied.

1.5 QUALITY ASSURANCE

A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. Architect will select one surface to represent surfaces and conditions for application of each paint system.

    a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft. (9 sq. m).
    b. Other Items: Architect will designate items or areas required.

2. Final approval of color selections will be based on mockups.

    a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.

3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).

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

1.7 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).

B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

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:
1. Benjamin Moore & Co. (Moore)
2. PPG Paints. (PPG)
3. Sherwin-Williams Company. (S-W)

B. Source Limitations: Obtain each paint product from single source from single manufacturer.

2.2 PAINT PRODUCTS, GENERAL

A. Material Compatibility:

1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer based on testing and field experience.
2. For each coat in a paint system, provide products recommended in writing by topcoat manufacturer for use in paint system and on substrate indicated.

B. Colors: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Concrete: 12 percent.
2. Masonry (Clay and Concrete Masonry Units): 12 percent.

C. Verify suitability of substrates, including surface conditions and compatibility, with finishes and primers.

D. 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 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.

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 specified in this Section.

D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.

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 2.
2. 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. Aluminum Substrates: Remove loose surface oxidation.

J. Plastic Trim Fabrication Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.

3.3 INSTALLATION

A. Apply paints in accordance with manufacturer's written instructions.

1. Use applicators and techniques suited for paint and substrate indicated.
2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.
3. Paint both sides and edges of exterior doors and entire exposed surface of exterior door frames.

B. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

C. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

3.4 FIELD QUALITY CONTROL

A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.

1. Contractor shall touch up and restore painted surfaces damaged by testing.
2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written instructions, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written instructions.

3.5 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.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 EXTERIOR PAINTING SCHEDULE, MASONRY SUBSTRATES

A. Concrete Masonry Unit Substrates:

a. One coat of block filler:
   1) Moore: #V114 Corotech Acrylic Block Filler or #571 Ultra Spec Hi-Build Masonry Block Filler.
   2) PPG: Speedhide Interior/Exterior Masonry Block Filler Latex 6-7.
   3) S-W: Heavy-Duty Block Filler B42W46 or PrepRite Block Filler B25W25.
b. One coat of waterborne acrylic, gloss enamel:
   1) Moore: #HP28 Ultra Spec HP D.T.M. Gloss Enamel.
   2) PPG: 90-374 Pitt Tech Waterborne DTM Industrial Gloss Enamel.
   3) S-W: Pro Industrial Acrylic Gloss, B66 Series.

END OF SECTION 099113

SECTION 099123 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Concrete.
   2. Concrete masonry units (CMU).
   3. Steel.
   4. Galvanized metal.
   5. Gypsum board.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

B. Samples for Verification: For each type of paint system and each color and gloss of topcoat.

   1. Submit Samples on rigid backing, 8 inches (200 mm) square.
   2. Apply coats on Samples in steps to show each coat required for system.
   3. Label each coat of each Sample.
   4. Label each Sample for location and application area.

C. Product List: For each product indicated, include the following:
   1. Submit an inclusive list of required coating materials. Indicate each material and cross-reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.
   2. Manufacturer's Information: Submit manufacturer's technical information, including, but not limited to, label analysis and instructions for handling, storing, and applying each coating material proposed for use.
   3. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
   4. VOC content.

1.3 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish color formula cards that match products installed.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer shall be a firm engaged in the manufacture of paint of types required, and whose products have been in satisfactory use in similar service for a minimum of five years.

B. Applicator Qualifications: Applicator shall be a firm that shall have a minimum of five years of successful application experience with projects utilizing paint similar in type and scope to that required for this Project.

C. Preinstallation Conference: Conduct conference at the Project site to review the material selections, installation procedures, and coordination with other trades.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the Project Site in manufacturer’s original, unopened packages and containers bearing manufacturer's name and label, and the following information:
   1. Product name or title of material.
   2. Product description (generic classification or binder type).
   3. Manufacturer’s stock number and date of manufacture.
   4. Contents by volume, for pigment and vehicle constituents.
   5. Thinning instructions.
   6. Application instructions.
   7. Color name and number.
   8. VOC content.

B. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).

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

1.6 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).

B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures of less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.
   1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacturer during application and drying periods.

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:
   1. Benjamin Moore & Co. (Moore)
   2. PPG Paints. (PPG)
   3. Sherwin-Williams Company. (S-W)

2.2 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. VOC Content: Provide materials that comply with VOC limits of authorities having jurisdiction.

C. Colors: As indicated in a color schedule.

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. Notify the Architect, with a copy to the Owner, of any conditions detrimental to the proper and timely completion of the work.

C. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Concrete: 12 percent.
2. Fiber-Cement Board: 12 percent.
3. Masonry (Clay and CMUs): 12 percent.
4. Gypsum Board: 12 percent.

D. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.

E. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.

F. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations 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. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.

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 2.
2. 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. Previously Painted Surfaces: Prepare previously painted or coated surfaces before beginning coating application in accordance with manufacturer’s written recommendations. Preparation procedures shall include, but shall not be limited to, the following:
1. Remove flaking paint and other contaminants.
2. Clean chalking and dusting surfaces that interfere with coating adhesion.
3. Repair holes or cracks with an appropriate patching compound and spot prime.
4. Sand surfaces smooth.

3.3 INSTALLATION

A. Materials: Mix and prepare paint materials according to manufacturer’s written instructions. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using. Use only thinners approved by paint manufacturer and only within recommended limits.

B. Apply paints according to manufacturer's written instructions and recommendations in MPI Manual.

C. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators 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.

D. 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.

E. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

F. 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.

G. Painting Fire-Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:

1. Paint the following work where exposed in equipment rooms:

a. Equipment, including panelboards and switch gear.
b. Uninsulated metal piping.
c. Uninsulated plastic piping.
d. Pipe hangers and supports.
e. Metal conduit.
f. Plastic conduit.
g. Tanks that do not have factory-applied final finishes.
h. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.

2. 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.

3. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

3.4 FIELD QUALITY CONTROL

A. Dry-Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry-film thickness.

1. Contractor shall touch up and restore painted surfaces damaged by testing.
2. If test results show that dry-film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry-film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

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.

3.6 INTERIOR PAINTING SCHEDULE

A. Ferrous Metal:
1. One coat of primer. (250 g/L)
    a. Moore: #HP04 Ultra Spec HP Acrylic Metal Primer. (48 g/L)
    b. PPG: Pitt-Tech Primer/Finish DTM Acrylic Enamel 90-712 Series. (128 g/L)
    c. S-W: Pro Industrial ProCryl Universal Metal Primer, B66-310. (<100 g/L)
2. Two coats of semi-gloss enamel. (150 g/L)
    a. Moore: #HP29 Ultra Spec HP D.T.M. Acrylic Semi-Gloss Enamel. (147 g/L)
    b. PPG: 4216HP Pitt Tech Plus Waterborne Acrylic Semi-Gloss Enamel. (91 g/L)
    c. S-W: Pro Industrial Acrylic Semi-Gloss Enamel, B66-600 Series. (0 g/L)

B. Galvanized Metal:
   1. One coat of primer. (250 g/L)
      a. Moore: #HP04 Ultra Spec HP Acrylic Metal Primer. (48 g/L)
      b. PPG: Pitt-Tech Primer/Finish DTM Acrylic Enamel 90-712 Series. (128 g/L)
      c. S-W: Pro Industrial ProCryl Universal Metal Primer, B66-310. (<100 g/L)
   2. Two coats of semi-gloss enamel. (150 g/L)
      a. Moore: #HP29 Ultra Spec HP D.T.M. Acrylic Semi-Gloss Enamel. (147 g/L)
      b. PPG: 4216HP Pitt Tech Plus Waterborne Acrylic Semi-Gloss Enamel. (91 g/L)
      c. S-W: Pro Industrial Acrylic Semi-Gloss Enamel, B66-600 Series. (0 g/L)

C. Gypsum Board:
   1. Eggshell Enamel Finish:
      a. One coat of primer. (200 g/L)
         1) Moore: #534 Ultra Spec 500 Acrylic, Zero VOC, Primer. (0 g/L)
         2) PPG: Speedhide Zero Interior Zero VOC Latex Sealer 6-4900XI. (0 g/L)
         3) S-W: ProMar 200 Zero VOC Interior Latex Primer, B28W02600. (0 g/L)
      b. Two coats of semi-gloss enamel. (150 g/L)
         1) Moore: #538 Ultra Spec Acrylic, Zero VOC, Eggshell. (0 g/L)
         2) PPG: Speedhide Zero Interior Zero VOC Latex Eggshell, 6-4310XI. (0 g/L)
         3) S-W: ProMar 200 Acrylic Latex Egg-shell Enamel B20W200 Series. (<150 g/L)
   2. Semi-Gloss Enamel Finish:
      a. One coat of primer. (200 g/L)
         1) Moore: #534 Ultra Spec 500 Acrylic, Zero VOC, Primer. (0 g/L)
         2) PPG: Speedhide Zero Interior Zero VOC Latex Sealer 6-4900XI. (0 g/L)
         3) S-W: ProMar 200 Zero VOC Interior Latex Primer, B28W02600. (0 g/L)
      b. Two coats of semi-gloss enamel. (150 g/L)
         1) Moore: #539 Ultra Spec 500 Acrylic, Zero VOC, Semi-Gloss. (0 g/L)
         2) PPG: Speedhide Zero Interior Zero VOC Latex Semi-Gloss, 6-4510XI. (0 g/L)
         3) S-W: ProMar 200 Zero VOC Interior Latex Semi-Gloss B31-2600 Series. (0 g/L)
   3. Epoxy Finish in Standard Non-Wet Areas:
      a. One coat of primer. (200 g/L)
         1) Moore: #534 Ultra Spec 500 Acrylic, Zero VOC, Primer. (0 g/L)
         2) PPG: Speedhide Interior Latex Sealer Quick Drying 6-2. (0 g/L)
         3) S-W: ProMar 200 Zero VOC Interior Latex Primer, B28W02600. (0 g/L)
      b. Two coats of semi-gloss enamel. (150 g/L)
         1) Moore: #538 Ultra Spec Acrylic, Zero VOC, Eggshell. (0 g/L)
         2) PPG: Speedhide Zero Interior Zero VOC Latex Eggshell, 6-4310XI. (0 g/L)
         3) S-W: ProMar 200 Acrylic Latex Egg-shell Enamel B20W200 Series. (<150 g/L)
   4. Semi-Gloss Enamel Finish:
      a. One coat of primer. (200 g/L)
         1) Moore: #534 Ultra Spec 500 Acrylic, Zero VOC, Primer. (0 g/L)
         2) PPG: Seal Grip Interior Exterior Acrylic Universal Primer 17-921XI. (50 g/L)
         3) S-W: ProMar 200 Zero VOC Interior Latex Primer, B28W02600. (0 g/L)
      b. One coat of epoxy. (150 g/L)
         1) Moore: #V160 Corotech Surface Tolerant Epoxy Mastic Coating Semi-Gloss. (<184 g/L)

PPG: Amerlock 2 VOC Fast Drying Surface Tolerant Epoxy. (84 g/L)
S-W: Macropoxy 646-100 Epoxy, B58-600 Series, Gloss. (<100 g/L)

D. Concrete Block:
1. Semi-Gloss Enamel Finish:
a. One coat of primer. (200 g/L)
1) Moore: #V114 Corotech Acrylic Block Filler (43 g/L) / #571 Ultra Spec Hi-Build Masonry Block Filler. (45 g/L)
2) PPG: Speedhide Interior/Exterior Masonry Block Filler Latex 6-7. (18 g/L)
3) S-W: PreRite ProBlock Interior/Exterior Block Filler, B25W25. (<50 g/L)
b. Two coats of semi-gloss enamel. (150 g/L)
1) Moore: #N539 Ultra Spec 500 Acrylic, Zero VOC, Semi-Gloss Enamel. (0 g/L)
2) PPG: Speedhide Acrylic Latex Semi-Gloss Enamel 6-500 Series. (<50 g/L)
3) S-W: ProMar 200 Zero VOC Interior Latex Semi-Gloss B31-2600 Series (0 g/L)
2. Epoxy Finish in Standard, Non-Wet Areas:
a. One coat of block filler. (200 g/L)
1) Moore: #V114 Corotech Acrylic Block Filler (43 g/L) / #571 Ultra Spec Hi-Build Masonry Block Filler. (45 g/L)
2) PPG: Speedhide Interior/Exterior Masonry Block Filler Latex 6-7. (18 g/L)
3) S-W: PreRite ProBlock Interior/Exterior Block Filler, B25W25. (<50 g/L)
b. One coat of acrylic epoxy. (150 g/L)
Moore: #V341 Corotech Pre-Catalyzed Waterborne Epoxy Semi-Gloss Coating. (<7 g/L)
1) PPG: Pitt Glaze WB1 Pre-Catalyzed Waterborne Acrylic Epoxy 16-510. (<100 g/L)
2) S-W: Pro Industrial Pre-Catalyzed W/B Semi-Gloss Epoxy, K46W1151. (<50 g/L)
3. Epoxy Finish in High Moisture and Wet Areas:
a. One coat of primer. (200 g/L)
1) Moore: #571 Ultra Spec Hi-Build Masonry Block Filler. (45 g/L)
2) PPG: Speedhide Interior/Exterior Latex Masonry Block Filler 6-15XI. (<50 g/L)
3) S-W: B42W46 Heavy Duty Block Filler. (<100 g/L)
b. One coat of epoxy. (150 g/L)
1) Moore: #V160 Corotech Surface Tolerant Epoxy Mastic Coating Semi-Gloss. (<200 g/L)
2) PPG: Amerlock 2 VOC Fast Drying Surface Tolerant Epoxy. (84 g/L)
3) S-W: Pro Industrial Waterbased Catalyzed Epoxy, B73 Series. (0 g/L)

E. Concrete: Poured and Pre-Cast
1. Semi-Gloss Enamel Finish:
a. One coat of primer. (200 g/L)
1) Moore: #608 Ultra Spec Masonry Interior/Exterior 100% Acrylic Sealer. (46 g/L)
2) PPG: Speedhide Zero Interior Zero VOC Latex Sealer 6-4900XI. (0 g/L)
3) S-W: ProMar 200 Zero VOC Interior Latex Primer, B28W02600. (0 g/L)
b. Two coats of semi-gloss enamel. (150 g/L)
1) Moore: #N539 Ultra Spec 500 Acrylic, Zero VOC, Semi-Gloss Enamel. (0 g/L)

2) PPG: Speedhide Zero Interior Zero VOC Latex Semi-Gloss Enamel 6-4510XI. (0 g/L)
3) S-W: ProMar 200 Zero VOC Interior Latex Semi-Gloss B31-2600 Series. (0 g/L)

END OF SECTION 099123

SECTION 102800 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Public-use washroom accessories.
2. Public-use shower room accessories.
3. Custodial accessories.

1.2 COORDINATION

A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.

B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Public-use washroom accessories.
2. Public-use shower room accessories.
3. Custodial accessories.

B. Samples: For each exposed product and for each finish specified, full size.

1. Approved full-size Samples will be returned and may be used in the Work.

C. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.

1. Identify locations using room designations indicated.
2. Identify accessories using designations indicated.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For accessories to include in maintenance manuals.

PART 2 - PRODUCTS

2.1 PUBLIC-USE WASHROOM ACCESSORIES

A. Source Limitations: Obtain public-use washroom accessories from single source from single manufacturer.
   1. Material and Finish: Stainless steel

2.2 PUBLIC-USE SHOWER ROOM ACCESSORIES

A. Source Limitations: Obtain public-use shower room accessories from single source from single manufacturer.
   1. Material and Finish: Stainless steel

2.3 CUSTODIAL ACCESSORIES

A. Source Limitations: Obtain custodial accessories from single source from single manufacturer.

B. Custodial Mop and Broom Holder:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. AJW Architectural Products.
      b. ASI-American Specialties, Inc.
      c. Bobrick Washroom Equipment, Inc.
      d. Bradley Corporation.
   2. Description: Unit with shelf, hooks, holders, and rod suspended beneath shelf.
   3. Length: 36 inches (914 mm).
   4. Hooks: Four.
   5. Mop/Broom Holders: Three spring-loaded, rubber hat, cam type.
   6. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

      a. Shelf: Not less than nominal 0.05-inch- (1.3-mm-) thick stainless steel.
      b. Rod: Approximately 1/4-inch- (6-mm-) diameter stainless steel.

2.4 MATERIALS

A. Stainless Steel: ASTM A240/A240M or ASTM A666, Type 304, 0.031-inch- (0.8-mm-) minimum nominal thickness unless otherwise indicated.

B. Steel Sheet: ASTM A1008/A1008M, Designation CS (cold rolled, commercial steel), 0.036-inch- (0.9-mm-) minimum nominal thickness.

C. Galvanized-Steel Sheet: ASTM A653/A653M, with G60 (Z180) hot-dip zinc coating.

D. Galvanized-Steel Mounting Devices: ASTM A153/A153M, hot-dip galvanized after fabrication.

E. Fasteners: Screws, bolts, and other devices of same material as accessory unit, unless otherwise recommended by manufacturer or specified in this Section, and tamper and theft resistant where exposed, and of stainless or galvanized steel where concealed.

2.5 FABRICATION

A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.

B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install accessories in accordance with manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

1. Remove temporary labels and protective coatings.

3.2 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.

B. Clean and polish exposed surfaces in accordance with manufacturer's written instructions.

END OF SECTION 102800

SECTION 104413 - FIRE PROTECTION CABINETS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fire-protection cabinets for the following:

a. Portable fire extinguisher.

B. Related Requirements:

1. Section 104416 "Fire Extinguishers" for portable, hand-carried fire extinguishers accommodated by fire-protection cabinets.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Show door hardware, cabinet type, trim style, and panel style. Include roughing-in dimensions and details showing semirecessed method and relationships of box and trim to surrounding construction.

B. Shop Drawings: For fire-protection cabinets.

1. Include plans, elevations, sections, details, and attachments to other work.

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

D. Product Schedule: For fire-protection cabinets. Indicate semirecessed. Coordinate final fire-protection cabinet schedule with fire-extinguisher schedule to ensure proper fit and function. Use same designations indicated on Drawings.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: For fire-protection cabinets to include in maintenance manuals.

1.4 COORDINATION

A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

B. Coordinate sizes and locations of fire-protection cabinets with wall depths.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain fire-protection cabinets, accessories, and fire extinguishers from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Rated Fire-Protection Cabinets: Listed and labeled to comply with requirements in ASTM E814 for fire-resistance rating of walls where they are installed.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.3 FIRE-PROTECTION CABINET

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Babcock-Davis.
   2. Guardian Fire Equipment, Inc.
   3. Potter Roemer LLC; a Division of Morris Group International.

B. Fire-Protection Cabinet Type: Suitable for fire extinguisher.

C. Cabinet Construction: Nonrated.

D. Cabinet Material: Cold-rolled steel sheet.

E. Semirecessed Cabinet: One-piece combination trim and perimeter door frame overlapping surrounding wall surface, with exposed trim face and wall return at outer edge (backbend).

   1. Square-Edge Trim: 1-1/4- to 1-1/2-inch (32- to 38-mm) backbend depth.
   2. Rolled-Edge Trim: [2-1/2-inch (64-mm)] [4-inch (102-mm)] [4-1/2-inch (114-mm)] <Insert dimension> backbend depth.

F. Cabinet Trim Material: Same material and finish as door.

G. Door Material: Steel sheet.

H. Door Style: Full acrylic bubble with frame.

I. Door Glazing: Break acrylic bubble] [Molded acrylic bubble].

   1. Acrylic Bubble Color: Clear, transparent.

J. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.

1. Provide projecting lever handle with cam-action latch.

K. Accessories:
1. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as directed by Architect.

a. Identify fire extinguisher in fire-protection cabinet with the words "FIRE EXTINGUISHER."

1) Location: Applied to cabinet glazing.
2) Application Process: Decals.
3) Lettering Color: Red.
4) Orientation: Vertical.

L. Materials:

1. Cold-Rolled Steel: ASTM A1008/A1008M, Commercial Steel (CS), Type B.

a. Finish: Baked enamel, TGIC polyester powder coat, HAA polyester powder coat, epoxy powder coat, or polyester/epoxy hybrid powder coat, complying with AAMA 2603.
b. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
c. Color: As selected by Architect from manufacturer's full range.

2.4 FABRICATION

A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.

1. Weld joints and grind smooth.
2. Miter corners and grind smooth.
3. Provide factory-drilled mounting holes.
4. Prepare doors and frames to receive locks.
5. Install door locks at factory.

B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles.

1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch (13 mm) thick.
2. Fabricate door frames of one-piece construction with edges flanged.
3. Miter and weld perimeter door frames and grind smooth.

C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.5 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's AMP 500, "Metal Finishes Manual for Architectural and Metal Products," for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces of fire-protection cabinets from damage by applying a strippable, temporary protective covering before shipping.

C. Finish fire-protection cabinets after assembly.

D. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for cabinets to verify actual locations of piping connections before cabinet installation.

B. Examine walls and partitions for suitable framing depth and blocking where recessed cabinets will be installed.

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

3.2 PREPARATION

A. Prepare recesses for semirecessed fire-protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION OF FIRE-PROTECTION CABINETS

A. General: Install fire-protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.

1. Fire-Protection Cabinet Mounting Height: 42 inches (1067 mm) above finished floor to top of fire extinguisher.

B. Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb.

1. Unless otherwise indicated, provide semirecessed fire-protection cabinets.
2. Provide inside latch and lock for break-glass panels.
3. Fasten mounting brackets to inside surface of fire-protection cabinets, square and plumb.
4. Fire-Rated Cabinets:

    a. Install cabinet with not more than 1/16-inch (1.6-mm) tolerance between pipe OD and knockout OD. Center pipe within knockout.

b. Seal through penetrations with firestopping sealant as specified in Section 078413 "Penetration Firestopping."

C. Identification:

1. Apply decals at locations indicated.
2. Apply decals on field-painted fire-protection cabinets after painting is complete.

3.4 ADJUSTING AND CLEANING

A. Remove temporary protective coverings and strippable films, if any, as fire-protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.

B. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.

C. On completion of fire-protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.

D. Touch up marred finishes, or replace fire-protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire-protection cabinet and mounting bracket manufacturers.

E. Replace fire-protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 104413

SECTION 104416 - FIRE EXTINGUISHERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes portable, hand-carried fire extinguishers.

B. Related Requirements:

1. Section 104413 "Fire Protection Cabinets."

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.

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 indicated.
1. Manufacturers: Subject to compliance with requirements, provide by one of the following:
   a. Activar Construction Products Group, Inc. – JL Industries.
   b. Amerex Corporation.
   c. Guardian Fire Equipment, Inc.
   d. Kidde; Carrier Global Corporation.
   e. Potter Roemer LLC; a Division of Morris Group International.
2. Source Limitations: Obtain fire extinguishers, fire-protection cabinets, and accessories, from single source from single manufacturer.
3. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B, and bar coding for documenting fire-extinguisher location, inspections, maintenance, and recharging.

B. Pressurized, FFFP-Foam Type Unheated locations: UL-rated 3-A:20-B, 2.5-gal. (9.5-L) nominal capacity, with FFFP foam in stainless steel container; with pressure-indicating gage.

C. Regular Dry-Chemical Type Unheated locations: UL-rated 2.5-gal. nominal capacity, with sodium bicarbonate-based dry chemical in manufacturer's standard enameled container.

D. Multipurpose Dry-Chemical Type in Steel Container <Type FEC>: UL-rated 4-A:60-B:C, 10-lb (4.5-kg) nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.

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 in locations indicated and in compliance with requirements of authorities having jurisdiction.

END OF SECTION 104416

SECTION 111900 - DETENTION EQUIPMENT GENERAL PROVISIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Single pre-qualified Detention Equipment Contractor (DEC) shall provide the entire scope of work specified below. None of the materials, equipment, systems or labor specified or required for the complete installation of the scope of work below shall be provided or bid as separate packages outside of the Detention Equipment Contractor's subcontract.

B. DEC shall furnish all labor, equipment, appliances, services and materials, perform work, and otherwise assume all responsibility related to procurement and installation of equipment, products and materials as indicated in the scope of work below. DEC shall self-perform installation of materials required in this scope of work. Installation subcontractors will not be allowed.

C. DEC shall coordinate and interface with Security Electronics Contractor (SEC) as required for a complete, operational system.

D. DEC must base its bid on the products by the manufacturers that are specified in this scope of work.

1.2 SECTION INCLUDES

A. The scope of work for the DEC includes the following specification sections:
   1. Section 08 34 63 – Detention Doors and Frames
   2. Section 08 66 00 – Series Hot Rolled Steel Detention Windows
   3. Section 08 88 53 – Security Glass and Glazing
   4. Section 11 19 00 – Basic Requirements for Detention Systems
   5. Section 11 19 30 – Security Hardware

B. Products furnished and installed under this scope of work:
   1. Security hollow metal doors per the door schedule
   2. Manufactured Steel Detention Cells
   3. Security hardware per the security hardware schedule
   4. Security glass and glazing per the glazing schedule and as indicated on the drawings
   5. Security furnishings and accessories as indicated on the drawings
   6. Detention metal fabrications as indicated on the drawings
   7. Security mesh partitions and gates

C. Products furnished, but not installed under this scope of work:
   1. Security hollow metal doorframes, windows and control room frames.
   2. Steel embeds required to anchor detention equipment furnished under this scope of work to concrete or masonry.
   3. Security access panels in this scope of work to be built into concrete or masonry.
   4. Pass-throughs, package passes, or hopper passes to be built into concrete or masonry.

D. Related work to be performed by others:
   1. Installation of embeds.
   2. Installation of security hollow metal doorframes, windows, and control room frames.
   3. Grouting of security hollow metal frames.
   4. Caulking and sealants, including detention caulking and sealants.
   5. Casework and millwork.
   6. Final cleaning.
   7. Touch-up of primer paint.
   8. Finish painting.
   9. Access panels not specified in this scope of work.
   10. Miscellaneous steel embedded anchoring plates, angles, channels, etc.
   11. Security barriers at mechanical openings.
   12. Fire safeing.
   13. Flashing and counter flashing.
   14. Plumbing fixtures and piping.
   15. Electrical work, except as specified herein.
   16. Electrical items or fixtures, including light fixtures.
   17. Provision of electrical power.
   18. Electronic security system installation.
   19. Security fencing and gates.

1.3 SYSTEM DESCRIPTION

A. Design requirements:
   1. Detention equipment shall be designed specifically for detention use, simple in construction and operation, and free from parts susceptible to unusual wear or maintenance requirements.

B. Performance requirements:
   1. Detention equipment shall be use-proven through satisfactory performance under actual jail or prison conditions.

1.4 DEFINITIONS

A. DEC: Detention Equipment Construction Professional

B. CP: Construction Professional

1.5 SUBMITTALS

A. Shop drawings of all materials and equipment provided in this scope of work shall be submitted for approval. They shall indicate item location, size, type of materials, construction, finishes, spacing of anchors and joinery details with adjacent work. The DEC shall extensively check each of the submittals under its scope of work, ensuring their correctness and compatibility not only with each other, but also with the contract documents. It shall be the Construction Professional's responsibility to coordinate the DEC's work with other trades.

B. The hollow metal manufacturer shall indicate any specified fire rated openings that cannot be fire labeled and reasons why they cannot. If the designer furnishes the name of an approved manufacturer who can supply the fire labeled openings in question, the manufacturer shall be required to furnish the openings with fire labels at no additional cost. However, if label openings are not available as designed, the designer shall either authorize the necessary changes in opening design, hardware, glass and/or other features, which will bring the openings into compliance or drop the fire-labeling requirement on openings in question. Manufacturing the openings "Label Construction" without factory applied fire labels shall be unacceptable.

C. Upon receipt of the approved security hardware schedule, the DEC shall promptly provide the hardware manufacturer's templates to all manufacturers requiring the information prior to commencement of fabrication.

D. Unless required otherwise in Division 1, the DEC shall submit six (6) complete sets of documentation for approval.

E. Quality control submittals (for information only):
   1. Certification that fire rated door assemblies bear UL or Warnock Hersey Label for scheduled fire rating.
   2. Certified test reports from an independent testing laboratory verifying that security hollow metal doors meet or exceed specified design criteria and that security glazing meets specification requirements.
   3. Label Construction Certification: Manufacturer’s certification for oversize doors or doors not otherwise suitable for fire rating. Certify that door and frame assembly has been constructed with materials and methods equivalent to requirements for labeled openings per ASTM E152.
   4. Manufacturer’s installation instructions.

F. Contract closeout submittals:
   1. Operating/Maintenance manuals:
      a. Include the following, as applicable, for each type of detention door hardware and operating and locking device provided under this scope of work:
         1) Operating instructions.
         2) Wiring diagrams for locking device wiring.
         3) Lubrication and maintenance requirements.
         4) Spare parts list.
   2. Owner instruction reports.
   3. Warranty.
   4. Letter verifying that spare parts have been delivered.
   5. Key release form.

G. Substitutions: No substitutions of materials or equipment will be permitted where specific trade names or manufacturers are listed unless the Design Professional adds the proposed substitution by addendum.
   1. Materials and products specified by name of manufacturer or brand trade name shall be the basis of the bids received, unless changed by addendum prior to the bid dates.
   2. In the event a construction professional wishes to use any materials or products other than those specified, a written request shall be made to the Design Professional within the required time frame identifying the proposed substitution and providing sufficient data for the Design Professional to make a determination.

3. All additional costs resulting from the use of an approved substitution by the DEC shall be borne by the DEC without additional expense to the Owner. Such additional costs shall include necessary modifications and alterations to structures, equipment, raceways and furnishing of all additional materials required to affect the substitution.

1.6 QUALITY ASSURANCE

A. In order to establish and maintain the standard of quality required for this project, only the pre-qualified DEC's listed below, or DEC's subsequently pre-qualified by addendum will be allowed to perform the work under this section of the specifications.

B. The following DEC's are pre-qualified to perform the work of this section:
   1. U.S. Security Systems, Inc. – Auburn, AL
   2. Crowder Detention – Westfield, IN
   3. Jailcraft, Inc. – Stevensville, MD

C. Any DEC not listed above that intends to submit a bid to perform the work under this section of the specifications must submit the following pre-qualification data to the Design Professional in accordance with the requirements in division 1 for Prior Approvals. If approved, acknowledgement shall be by addendum prior to bid date. Verbal approval will not satisfy this requirement. All DEC's except those listed above shall submit all information exactly as indicated below, or they will not be pre-qualified to perform this portion of the Work. Grounds for disqualification shall exist if any of the information submitted is inaccurate, or if in the opinion of the Design Professional, does not satisfy the pre-qualification requirements.
   1. Evidence that the DEC has a minimum of ten (10) years experience in successfully completing projects of equal scope and magnitude with products as herein specified. This evidence shall consist of a list of ten (10) projects that have been complete and operational for a minimum of five (5) years. Provide the following information for each facility:
      a. Name and location of the facility.
      b. Value of the contract and scope of work performed.
      c. Date of occupancy by the Owner.
      d. Names and phone numbers of the representatives to contact for the Owner, the Construction Professional or General Construction Professional and the Design Professional.
   2. Notarized statement indicating that employees of the firm seeking pre-qualification will install all equipment provided under this scope of work in lieu of DEC utilizing an installation subcontractor.
   3. Sample CPM schedules for each of at least two (2) previously completed projects commensurate in size and scope to this project, graphically indicating both initially projected and actual durations required for all major activities in the respective scopes of work.
   4. Independently audited financial statements for the previous three (3) years.
   5. Notarized statement indicating that firm seeking pre-qualification has not filed for bankruptcy protection within the past ten (10) years.
   6. Current letter from a surety company that has an AM Best “A15” rating stating that a 100% payment and performance bond can be supplied if firm seeking pre-qualification is the successful Detention Equipment Contractor (DEC) on this project. Letters from bonding agents will not be acceptable.

7. Current letter from the security lock manufacturer to be utilized on this project stating that DEC seeking pre-qualification is a factory trained, fully authorized installer of the manufacturer's complete line of products.
8. Complete list of key employees (both office and field personnel) indicating areas of responsibility and years of experience.
9. Failure to provide any of above information or to comply with any of above requirements will result in disqualification of firm seeking pre-qualification.
10. Pre-qualification of a DEC does not relieve that DEC from the requirement to furnish all materials from the manufacturers specified herein.

D. The Design Professional will promptly review pre-qualification requests to determine the acceptability of each prospective DEC. Those found acceptable will be named subsequently by addendum as pre-qualified to bid and perform the scope of work under this section. Verbal approval will not satisfy this requirement.

E. Owner and Design Professional reserve the right to disqualify manufacturers, equipment suppliers and construction professionals who do not strictly comply with requirements of this section or product substitution procedures called for in this section and Division 1. Grounds for disqualification shall exist if it is determined that the information submitted is inaccurate, or in the opinion of the Design Professional, does not satisfy the pre-qualification requirements.

1.7 DELIVERY, STORAGE AND HANDLING

A. The Construction Professional (CP) shall be responsible for the following:
1. Receive from carrier, unload, and store all products and materials that are furnished-only by the DEC for installation by others.
2. Provide temporary access openings required through walls to permit the placing of the detention equipment in the areas of the building where it is to be installed and provide use of hoist, cranes, elevators, and lifts and/or cranes on regular time with qualified operators.
3. Protect all materials during storage on the job and after installation. All protection required while working and/or cleaning adjacent materials should be the responsibility of the Construction Professional.
4. Provide an adequate, secure, dry, lockable storage area or room in each building and floor (if high rise) for all materials specified in this section.
5. Ensure that all embedded items are installed plumb and true.
6. Complete all floor finish, concrete curbs, waterproofing, and other concrete work where shown or specified in connection with the detention equipment.
7. Promptly clean and touch up any scratches or disfigurement caused by shipping or handling with a compatible rust inhibitive primer, or the shipment must be rejected at time of receiving.
8. Remove protective materials and clean all finished surfaces using clear water and non-abrasive detergent. Any protection required to clean adjacent materials shall be the responsibility of the Construction Professional.
9. Provide an environmentally controlled room in each building and floor for the on-site storage of all hardware and electronic devices and equipment, or the hardware and electronic devices shall be shipped to the DEC's home office where it shall be inventoried and securely stored until required at the facility for installation. In this case, the DEC shall submit a notarized list indicating exactly what has been received and stored each month and its value with the current Constructions Professional's Monthly Pay Request.

Prompt payments will be made for equipment and materials properly stored at the DEC's home office.

B. The DEC shall be responsible for receiving, unloading and distribution of all products furnished and installed under this scope of work.

1.8 REGULATORY REQUIREMENTS

A. All work is to be performed in compliance with latest editions of:
1. Federal, state, and local codes and ordinances.
2. National Electric Code, NFPA 70.
3. Standard for Fire Doors and Windows, NFPA 80.
4. Life Safety Code, NFPA 101.

B. In cases where Specifications call for materials or construction of better quality or larger size than codes require, Specifications shall take preference. Codes shall govern in cases of direct conflict with Specifications or Contract Drawings.

1.9 WARRANTY

A. Provide Owner with written warranty covering products provided under this section for period of one (1) year from date of Owner acceptance. During this period, make necessary repairs and corrections to defects in the Work and replace defective parts at no cost to Owner.

B. Warranty does not cover consequential or incidental damages. Work made necessary by abuse, misuse, accidents, or negligence of using personnel is excluded from this agreement.

C. Provide emergency service during warranty period, including maximum twenty-four (24) hour response time for emergency calls requiring visits to facility.

1.10 MAINTENANCE MANUALS/SPARE PARTS

A. Provide Owner with three (3) copies of operating and maintenance manuals for products furnished and installed under this scope of work. Clearly identify all parts and include manufacturer's standard part number for each component of various mechanisms.

B. Provide spare parts per requirements of individual specification sections.

1.11 KEYS FOR LOCKS

A. Provide safekeeping of keys for locks provided under this section. Ensure that building security is not breached through job site loss or theft of keys being used for hardware installation or "fit-up" purposes.

B. Die-stamp each key with identification code designated on approved keying schedule.

C. Upon completion of work and prior to final acceptance, present one (1) complete set of keys to Owner's designated representative and obtain a signed receipt. Send all keys subsequently ordered to same individual via registered mail, return receipt requested.

PART 2 - PRODUCTS

2.1 The DEC shall utilize only listed approved manufacturers, component fabricators and suppliers. Any other manufacturers, component fabricators or suppliers must be approved by addendum no later than fourteen (14) days prior to bid date.

2.2 The DEC shall be responsible for the integration, interfacing and coordination of all products and systems with other related parties as hereinafter defined and specified.

PART 3 - EXECUTION

3.1 PREPARATION

A. DEC responsibilities:
1. Examine the areas and conditions under which installation is to occur and document conditions detrimental to the proper and timely completion of the work. Report unsatisfactory conditions to Design Professional in writing. Do not proceed with installation until unsatisfactory conditions have been corrected.
2. Prior to installation, meet at project site for purpose of reviewing products and installation methods selected, procedures to be followed in performing the work and coordination with other trades.
3. Protect adjacent surfaces from damage and stains during installation of materials provided in this scope of work.
4. Ascertain location and arrangement of anchorage required for equipment supplied under this scope of work; coordinate with other trades where necessary to make provisions for installation.
5. Furnish setting drawings, diagrams, templates, instructions and directions for installation of all products. Coordinate delivery of such products to project site.
6. Distribute all items to installation locations immediately prior to installation, complying with all applicable product handling requirements. Coordinate timing of distribution.
7. Coordinate with other trades for proper location of rough-in services and service connections specified elsewhere.

B. CP responsibilities:
1. Provide openings through exterior and interior building walls to accommodate ingress of detention equipment. Coordinate sizes and locations of openings with DEC.
2. Ensure accuracy of building construction, including sizes and locations of beams and columns, concrete and masonry walls, evenness of concrete and dimensional consistency.
    a. Concrete floors and ceilings should be level and true.
    b. At locations where concrete is uneven, chip or grout as required for proper fit between detention equipment and concrete.

3. Broom clean, properly light and heat areas of building where detention equipment is to be installed.
4. Prior to installation of electrical and mechanical hardware or locking and operating devices, exterior-closing walls should be in place, exterior windows glazed and roof completely installed to prevent weather damage to components. Provide DEC with written notification to proceed with installation once these conditions have been met. Installation will not commence until DEC receives written notification.
5. Provide 24-volt single phase power for use by DEC in connection with installation of detention equipment.
    a. If permanent power service is not available within reasonable access to detention areas when installation of detention equipment begins, provide temporary power (50 amps per welding machine) and bear expense.
    b. If sufficient temporary power is not available, reimburse DEC for extra labor and fuel required for use of gasoline welding machines.

3.2 INSTALLATION

A. General:
1. Install fixtures, materials, assemblies, and equipment in strict compliance with Specifications, Contract Drawings and manufacturers' recommendations and instructions.
2. Provide necessary drawings, setting diagrams or other information required to construction professional responsible for installation of DEC-furnished items to be installed by others.

B. Attachment of detention equipment:
1. Secure detention equipment permanently in place with minimum of exposed fasteners and free from warp, twists, bends, rough edges, cracks, or open joints. Exposed fasteners shall be uniform in size, spacing, and appearance and shall be tamper-resistant.
2. Punch bolt holes not more than l/l6 inch larger in diameter than bolts to be used. Accurately space and align holes to permit insertion of bolts. When bolts are used, nuts shall be tightly drawn, and bolt threads battered to prevent removal.
3. Remove loose scale, rust, oil, or other foreign matter from surfaces to be welded. Welds shall show uniform cross-sections, good penetration of base metals and smoothness of weld metal with a minimum of craters, porosity, and clinkers.
4. Thoroughly clean burns, welds, and welding spatter on detention equipment resulting from fabrication and installation.
5. Welds that are neat in appearance and evenly spaced shall not require grinding.

C. Supervision:
1. Work shall be performed under direct supervision of a competent, experienced, factory-trained project superintendent who shall be a full-time employee of the DEC.
2. DEC's superintendent shall be present at job site during all phases of installation of the equipment furnished and installed under this section.
3. DEC shall be responsible for conduct and performance of job site personnel and shall ensure that this scope of work progresses without serious conflict with related work being performed simultaneously by other trades.

3.3 PROTECTION AND CLEANING

A. During installation, protect adjacent surfaces and detention equipment from damage. Work shall be free from scratches, dents, permanent discolorations, and other defects.

B. During installation, keep storage and work areas neat, orderly and in a broom clean condition.

C. Whenever hardware is located in areas where it may be subject to damage during construction by other trades, CP shall ensure that hardware is adequately protected or schedule the installation to occur after the hazardous condition is eliminated.

D. Hardware shall be cleaned as necessary to restore correct operation, function and finish.

E. All final cleaning shall be the responsibility of the Construction Professional.

3.4 ADJUSTMENTS

A. Prior to final inspection, test all electric locks, door locking devices and door position sensors and adjust as required to provide proper functions.

B. Check all mechanical hardware items to ensure correct operation and function. Adjust and lubricate moving parts as required to operate smoothly and quietly without binding. Replace any items that cannot be adjusted to operate as intended for its application.

3.5 DEMONSTRATION, OPERATING INSTRUCTIONS AND TRAINING

A. The object of the operating/maintenance manuals, training materials and instruction period shall be to communicate a total understanding of operations and maintenance of all detention equipment included in this scope of work. Submit proposed operating/maintenance materials and training materials for review, comment and approval by the Design Professional and Owner. Coordinate with Owner to review materials and instruction periods to assure Owner instruction and information requirements will be met. Obtain approval prior to scheduling training session.

B. Provide representative(s) with thorough knowledge of products provided under this scope of work to the Owner for an on-site instruction and training period involving Owner’s designated personnel. Representative(s) must be capable of training personnel in the adjustment and operation of detention equipment, including pertinent safety requirements, as well as instructing maintenance personnel in operation, repair, and upkeep. Instruction shall be given during the first week after material completion unless additional adjustments or repairs are required prior to training. In such case, training sessions are not to occur until such adjustments or repairs have been satisfactorily completed. On-site instruction and training period will not exceed five (2) consecutive eight (8) hour days.

3.6 FIELD QUALITY CONTROL

A. Upon completion of installation of detention equipment and electronic security systems, perform and document detailed quality assurance inspection confirming proper installation and

operation of equipment and systems, and provide confirmation in writing to Design Professional. Include written request to Design Professional to inspect Work.

B. Design Professional shall respond within five (5) working days after receipt of request for inspection. Upon completion of inspection, Design Professional shall provide DEC with written acceptance of Work, noting any exceptions discovered during inspection.

C. Within one (1) week of inspection, Design Professional shall furnish DEC with final punch list of all exceptions noted.

D. Address items noted on final punch list and return to Design Professional with written request for punch list completion verification.

E. Within two (2) weeks after receipt of written request, Design Professional shall perform punch list completion verification. Only items noted on final punch list shall be addressed.

F. Within five (5) working days of punch list completion verification, Design Professional shall provide DEC with written final acceptance.

END OF SECTION 111900

SECTION 111930 – SECURITY HARDWARE

PART 1 - GENERAL

1.1 SUMMARY

A. The work under this section shall consist of furnishing all labor, materials, equipment, and appliances necessary or required to perform and complete all Security Door Hardware work as shown on the drawings, as specified herein, or required by conditions at the site. Security Hardware shall be furnished to complete the building project and shall meet all requirements of building, fire, safety, and all other codes as applicable.

B. The hardware supplier shall coordinate hardware with related trades such as metal doors, frames, etc.

C. Refer to the Door/Openings Schedule for door schedule relating to this Work.

1.2 QUALITY ASSURANCE

A. The security hardware supplier shall have past experience in security hardware and have in their employ, a specialist in detailing security hardware for detention doors and frames.

B. Immediately after award of the security hardware contract, it shall be the responsibility of the security hardware supplier to request approved shop drawings from such trades with which hardware must be coordinated.

C. All items of hardware shall be delivered to the job site in manufacturer's original package. Each item shall be clearly marked with the proper opening number so that installer can clearly identify the proper location.

1.3 SUBMITTALS

A. Security hardware supplier shall prepare and submit to the Design Professional for approval four (4) copies of the complete detailed hardware schedule, plus three (3) additional copies for his use. Schedule and detail project as required by Design Professional. Submit a cut sheet for each type of hardware.

B. If requested by Design Professional, a sample of each hardware item will be supplied as required, to be retained by Design Professional for comparison with hardware as furnished. Any deviation from hardware schedule shall be replaced with the proper hardware at hardware supplier's expense.

C. All blueprint templates and/or template information shall be sent to each manufacturer who requires such information (Example: Security hollow metal door and frame manufacturers, etc.) Approved hardware schedule shall be sent to each manufacturer who requires template information.

D. A schedule of mounting heights for all items of hardware shall be established in consultation with the Design Professional and shall be included in hardware schedule for approval.

E. Degree of openings for doors with overhead holder, closers, etc. shall be established by hardware supplier and include in hardware schedule for Design Professionals approval.

1.4 PRODUCT HANDLING

A. Hardware shall be ordered in sufficient time so that it will be available for job requirements. A locked storage space will be provided for unpacking crates and sorting out hardware Design Professional. Products of other manufacturers of builder's hardware only may be substituted, providing they are equal in quality and design to the items specified and receive the express approval of the Design Professional. The Design Professional will permit no substitutions after final approval of the hardware schedule.

B. Any products to be substituted for items of hardware other than those specified must be

1.5 APPROVED DESIGN AND MANUFACTURER

A. Items of security hardware specified in the hardware sets of this division have been selected for the purpose of establishing a quality and design standard acceptable to the submitted in writing to the Design Professional for prior approval at least ten (10) days before bid date. Include the name of manufacturer, catalog number of series, design, and other pertinent data. No substitutions shall be permitted after the start of the ten day period prior to bid date.

B. Security equipment items specified in the security hardware sets have been selected from the various manufacturers' catalogs. Identifying numbers of the manufacturer, where listed herein, are given for purposes of establishing a quality and design standard acceptable to the Design Professional. The manufacturers listed are:
   1. Hinges:
      a. Northwest Specialty Hardware
      b. Stanley Security Solutions
      c. Hager Companies
   2. Locks - Security:
      a. R.R. Brink Locking Systems, Inc. (Basis of Design)
      b. Willoughby
      c. Southern Steel
   3. Closers:
      a. LCN
      b. Sargent & Co.
      c. Norton
   4. Stops:
      a. H.B. Ives
      b. Northwest Specialty Hardware
      c. Rockwood
   5. Trim:
      a. Rockwood
      b. RR Brink
      c. Northwest Specialty Hardware

6. Threshold/Weatherstripping:
    a. National Guard Products
    b. Pemko
    c. Hager

C. FASTENINGS
1. All bolts, screws and other fastenings required for the application of the hardware shall be of the size and type to fit requirements and shall be of the same material and finish as the hardware to which they connect.
2. Screws for products used in secured areas will have torx security screws. Screws for products in other areas such as offices, kitchen and maintenance shall have fasteners normally furnished by the manufacturer.
3. The hardware supplier shall furnish four (4) of each size torx driver required for installation of hardware. At completion of job, torx drivers shall be turned over to the Owner.
4. All kick plates are to be mounted with stainless steel pop rivets.

1.6 INSTALLATION

A. All security hardware and other items shall be received, stored and distributed and the responsibility for its safety assumed by the Construction Professional. The protection wrapped around pieces of hardware shall be securely attached to the hardware as it is installed and properly maintained until the final completion of the building.

B. Installation and hook-up of electric-operated locks shall be the responsibility for the security hardware supplier. Balance of surface-applied hardware such as closers, trim items, stops, frame portion of hinge, position switches, etc., and the alignment of doors shall be the responsibility of this Construction Professional.

C. Security hardware shall be installed by Union Ironworker Mechanics, skilled in the application of hardware and in accordance with the recommendations of the appropriate manufacturer. All instruction sheets and installation details, which are packed with hardware, shall be read and understood before any attempt is made to install the hardware.

D. Hardware and all other items shall be accurately fitted and secured in place, adjusted to operate perfectly and be free from scratches or other defacements.

E. The Construction Professional shall be responsible for the condition and operation of all items installed hereunder until the issuance of the Certificate of Final Acceptance or until the building is occupied, whichever is sooner.

F. After installation, all templates, instruction sheets, and installation details, shall be placed in a black, 3-ring binder, clearly labeled to be turned over to the Owner when the building is accepted.

G. After the building is occupied, the security hardware supplier shall contact the Owner and arrange an appointment with the custodian or maintenance engineer. The security hardware supplier will then instruct this person in the proper use, servicing, adjusting and maintenance of hardware.

PART 2 - PRODUCTS

2.1 HINGES

A. Security Hardware Hinges:
   1. Each security door shall be hung with three (3) knuckle institutional, stainless-steel hinge. Hinge shall be full mortise on all doors.
   2. Hinge shall be 4-1/2" x 4-1/2" with 3/16" leaf thickness, made of investment cast 304 stainless steel with integral security stud.
   3. Each hinge shall have bearing material that is a self-lubricating, engineered thermo-plastic, flange type design to support thrust and radial loads.
   4. Entire construction shall be cross-pinned after assembly to make disassembly impossible.
   5. Furnish three hinges for single openings up to and including 7'-4" height. Furnish one additional hinge for openings over 7'-4" high and for each additional 2'-6" of opening height and for openings over 3'-0" wide.

2.2 LOCKS AND KEYING

A. Electric locks (2" Jamb) – RR Brink 3020.
   1. Lock case to be 1/8" thick steel plate approximately 4-5/8" x 3-1/4" x 9-3/4". Latchbolt to be 3/4" x 1-1/2" with minimum 3/4" throw and shall be monitored by a limit switch within the lock. Strike keeper to be stainless steel.
   2. Locks to operate electrically through either constant duty motors (24V DC) or constant duty solenoids (115V AC). Locks to be remotely unlocked electrically by momentary contact push button, or mechanically operated by key at the lock.
   3. Standard latchbolt function is to be held in retracted position on unlocking until door is opened. On opening of door, latchbolt extends and snap locks on closing of door. Trigger bolt deadlocks latchbolt in extended position on closing of door. For variations, see specific locks in security hardware schedule.
   4. Locks shall have key cylinders on one or both sides as specified using mogul cylinder. See security hardware schedule.
   5. All exterior door locks to be galvanized or stainless steel and have solenoid operation.

B. Heavy-Duty Pin Tumbler Mortise Lock with Mogul Cylinder, Brink 1020, series.
   1. Provide a 1" throw stainless steel deadbolt with two hardened SS inserts, operated by mogul pin tumbler cylinder or thumb turn.
   2. Provide a 5/8" throw SS latch operated by knobs or levers with escorts and deadlocked by a SS trigger bolt.
   3. Lock base plate to be of Y2" thick investment cast stainless steel with SS case and cover.
   4. Lock must have Underwriters Laboratories 3 hour fire rating and ASTM grade 2 rating.

C. Mechanical Deadbolt, Paracentric Key Operated - Brink 1040 series.
   1. Lock size to be approximately 4-1/4" x 3" x 1-1/4". Deadbolt is 3/4" x 1-1/2" stainless steel, with 5/8" throw.
   2. Investment cast steel case – Zinc Plated.
   3. Investment cast bronze alloy, one-piece key cylinder.

D. Keying and Keys

1. The DEC will meet with the Design Professional and Owner upon their request to review the keying schedule and systems layout. All locks are to be keyed as directed as a result of this meeting.
2. Mogul type cylinder shall be keyed in sets and master keyed to level as directed. Provide five (5) keys per key alike set and five (5) keys per master level.
3. Paracentric prison locks shall be keyed in sets and provided with three (3) keys for each set. Each key to be not less than 4 1/2" in length. Blade to be 7/8" wide by /32" thick. Key to have overlapping Paracentric grooves to match similar grooves in cylinder. Handle to be of oval shape to properly fit hand, about 2-1/4" x 1-3/8" in size and separated from the key blade by 1/2" x 1-1/2" shank to provide clearance for officer's hand. Entire key to be made of polished silicone bronze/copper alloy having tensile strength of not less than 60,000 psi and have a hardness of B73-75 on the Rockwell scale.
4. All keys shall be stamped with number or letter combination as directed.
5. Keys shall be notched and color coded

E. KEY CONTROL SYSTEM
1. Key Cabinets and components as manufactured by Telkee, out of 18-guage steel (minimum).
2. System shall include completely set up three way cross index system, installation of keys and tag system, and instructions to the owner on proper use of the system. Cabinet to be size to accommodate one complete set of all security building keys.

2.3 DOOR CLOSERS

A. Door closers shall be Concealed LCN 2210/2210-DPS series. Closers shall be handed and sized for exact condition required. Closers shall be fully hydraulic, full rack and pinion with cast iron cylinder. Separate adjustments for latch speed general speed, and back-check shall have tamper-proof regulating screws. 2210-DPS should be used on openings that require self-closing and door position monitoring.

2.4 DOOR POSITION SWITCHES

A. Furnish R.R. Brink Locking Systems, Inc. 201020 Magnetic concealed door position switches where specified. Switch is single pole double throw type with rating of .5 amps at 24V maximum.

2.5 MISCELLANEOUS HARDWARE

A. Door Stops: Furnish doorstops for all doors. All stops and bumpers shall be cast bronze and shall be furnished with machine screws and expansion shields or toggle bolts to use the material it is to be fastened upon. Stops shall be equal to Northwest Specialty Hardware NW 606.

B. Push Plates, Pull Plates, and Protection Plates: Furnish push and pull plates as specified in the hardware sets. Finish to be satin stainless steel, US32D. Plates to be cut for cylinder or turn pieces as required.

C. Protection plates (kick and armor) shall be .050 thick type 304 stainless steel. Kickplates shall be 8" high. Plates shall be 2" less than door width. All protection plates are to be mounted with stainless steel pop rivets.

D. Provide silencers in metal door frames, unless not permitted for fire rating, or unless bumper-type weatherstripping is provided; three per single door frame, two per double door frame. All exterior doors to have bumper type weatherstripping.

2.6 HARDWARE SCHEDULE

A. General: Provide hardware for each door to comply with requirements of Section Builders and Security Hardware, hardware set numbers indicated in door schedule, and in the following schedule of hardware sets.

On following pages.

DH-1

3	HINGES	NORTHWEST SPECIALTY NW#645FMST x US32D x 1/4-20 TORX SECURITY SCREWS
1	ELECTRIC LOCK	RR BRINK #3026-FSE x KCE x 24VDC x LESS MEDCO CYLINDER
2	GRIP PULL	NORTHWEST SPECIALTY NW#601 x US32D x TORX SECURITY SCREWS
1	CLOSER	LCN #2215 w/ DPS x AL x TORX SECURITY SCREWS
1	WEATHERSTRIP	NATIONAL GUARD #5050 ADHESIVE BACKED x BLACK x SIZE AS REQUIRED
1	THRESHOLD	NATIONAL GUARD #425E x AL x TORX SECURITY SCREWS x SIZE AS REQUIRED

DH-2

3	HINGES	NORTHWEST SPECIALTY NW#645FMST x US32D x 1/4-20 TORX SECURITY SCREWS
1	MECHANICAL LOCK	RR BRINK #1042-401 MORTISE
1	CLOSER	LCN #2215 x AL x TORX SECURITY SCREWS LESS DOOR POSITION SWITCH
3	SILENCERS	IVES #SR64

DH-3

3	HINGES	NORTHWEST SPECIALTY NW#645FMST x US32D x 1/4-20 TORX SECURITY SCREWS
1	MECHANICAL LOCK	RR BRINK #1042-401 MORTISE
1	CLOSER	LCN #2215 x AL x TORX SECURITY SCREWS LESS DOOR POSITION SWITCH
1	WEATHERSTRIP	NATIONAL GUARD #5050 ADHESIVE BACKED x BLACK x SIZE AS REQUIRED
1	THRESHOLD	NATIONAL GUARD #425E x AL x TORX SECURITY SCREWS x SIZE AS REQUIRED

DH-4

3	HINGES	NORTHWEST SPECIALTY NW#645FMST x US32D x 1/4-20 TORX SECURITY SCREWS
1	ELECTRIC LOCK	RR BRINK #1040-403 MORTISE PASSAGE
1	CLOSER	LCN #2215 x AL x TORX SECURITY SCREWS LESS DOOR POSITION SWITCH
3	SILENCERS	IVES #SR64

Mark	Type	Thickness	Spec Sec	Glass Type	Qty.	HW Set	Description
001A	SHM Door - NL	2"	Detention Hollow Metal	SG-1 (1/2" MPC500)	1	DH-1	2" Jamb, Electric, Keyed 2 Sides
001B	SHM Door - NL	2"	Detention Hollow Metal	SG-1 (1/2" MPC500)	1	DH-1	2" Jamb, Electric, Keyed 2 Sides
002	SHM Door - HG	2"	Detention Hollow Metal	SG-1 (1/2" MPC500)	1	DH-2	Mortise Detention - Office
003A	SHM Door - HG	2"	Detention Hollow Metal	SG-1 (1/2" MPC500)	1	DH-4	Mortise Detention - Passage
003B	SHM Door - NL	2"	Detention Hollow Metal	SG-1 (1/2" MPC500)	1	DH-1	2" Jamb, Electric, Keyed 2 Sides
006	SHM Door - F	2"	Detention Hollow Metal	-	1	DH-3	Mortise Detention - Store Room
007	HM Door - F	1-3/4"	Commercial Hollow Metal	-	1	BH-1	-
008	SHM Door - F	2"	Detention Hollow Metal	-	1	DH-3	Mortise Detention - Store Room
010	SHM Door - NL	2"	Detention Hollow Metal	SG-1 (1/2" MPC500)	1	DH-1	2" Jamb, Electric, Keyed 2 Sides
011	SHM Door - NL	2"	Detention Hollow Metal	SG-1 (1/2" MPC500)	1	DH-1	2" Jamb, Electric, Keyed 2 Sides
012	SHM Door - NL	2"	Detention Hollow Metal	SG-1 (1/2" MPC500)	1	DH-1	2" Jamb, Electric, Keyed 2 Sides

Mark	Type	Spec Sec	Glass Type	Qty.	Description
SF01	Exterior Operable	Security Windows	SG-1 (1/2" MPC500)	26	Thermally Broken / Operable
SF02	SHM - Interior	Detention Hollow Metal	SG-1 (1/2" MPC500)	8	

SECTION 210110 – FIRE PROTECTION GENERAL PROVISIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

B. It is recognized that separate sub-contracts may be instituted by THIS CONTRACT'S GENERAL CONTRACTOR with others. It is the responsibility of THIS CONTRACT'S GENERAL CONTRACTOR to completely inform, coordinate, and advise those sub-contractors all the requirements, conditions, and information associated with providing and installing their portion of the total job.

1.2 IMPOSED REGULATIONS:

A. Applicable provisions of the State and Local Codes and of the following codes and standards in addition to those listed elsewhere in the specifications are hereby imposed on a general basis for plumbing work. In each case, the prevailing edition shall be the current adopted edition of the state where the project is located.

1. International Fire Code.
2. NFPA Documents.

1.3 SCOPE OF WORK:

A. Provide all permits, labor, materials, equipment, tests, and supervision to construct complete and operable fire protection systems as indicated on the drawings and specified herein. All materials and equipment used shall be new, undamaged, and free from any defects.

1.4 EXISTING SERVICES AND FACILITIES:

A. Damage to Existing Services: Existing services and facilities damaged by the Contractor through negligence or through use of faulty materials or workmanship shall be promptly repaired, replaced, or otherwise restored to previous conditions by the Contractor without additional cost to the Owner.

B. Interruption of Services: Interruptions of services necessary for connection to or modification of existing systems or facilities shall occur only at prearranged times approved by the Owner. Interruptions shall only occur after the provision of all temporary work and the availability of adequate labor and materials will assure that the duration of the interruption will not exceed the time agreed upon.

C. Removed Materials: Existing materials made unnecessary by the new installation shall be removed, shall remain the property of the Owner and shall be stored at a location and in a manner as directed, or, if classified by the Owner's authorized representative as unsuitable for

further use, shall become the property of the Contractor and shall be removed from the site.

1.5 PRODUCT WARRANTIES:

A. Provide manufacturer's standard printed commitment in reference to a specific product and normal application, stating that certain acts of restitution will be performed for the Purchaser or Owner by the manufacturer, when and if the product fails within certain operational conditions and time limits. Where the warranty requirements of a specific specification section exceed the manufacturer's standard warranty, the more stringent requirements will apply, and modified manufacturer's warranty shall be provided. In no case shall the manufacturer's warranty be less than one (1) year.

1.6 PRODUCT SUBSTITUTIONS:

A. General: Materials specified by manufacturer's name shall be used unless prior approval of an alternate is given by addenda. Requests for substitutions must be received in the office of the Design Professional at least 10 days prior to opening of bids.

PART 2 - PRODUCTS

2.1 GENERAL PRODUCT REQUIREMENTS:

A. Standard Products: Provide not less (quality) than manufacturer's standard products, as specified by their published product data. In addition to the indication that a particular product/model number is acceptable, comply with the specified requirements. Do not assume that the available off-the-shelf condition of a product complies with the requirements; as an example, a specific finish or color may be required.

B. Uniformity: Where multiple units of a general product are required for the work, provide identical products by the same manufacturer, without variations except for sizes and similar variations as indicated.

C. Product Compatibility, Options: Where more than one product selection is specified, either generically or proprietarily, selection is Purchaser's or Installer's option. Provide adaptations as needed for interfacing of selected products in the work.

D. Equipment Nameplates: Provide a permanent operational data nameplate on each item of power operated equipment, indicating the manufacturer, product name, model number, serial number, speed, capacity, power characteristics, labels of tested compliance, and similar essential operating data.

E. Locate nameplates in easy-to-read locations. When product is visually exposed in an occupied area of the building, locate nameplate in a concealed position (where possible) which is accessible for reading by service personnel.

PART 3 - EXECUTION

3.1 PRODUCT INSTALLATION, GENERAL:

A. Except where more stringent requirements are indicated, comply with the product manufacturer's installation instructions and recommendations, including handling, anchorage, assembly, connections, cleaning and testing, charging, lubrication, startup, test operation and shutdown of operating equipment. Consult with manufacturer's technical experts, for specific instructions on unique product conditions and unforeseen problems.

B. Protection and Identification: Deliver products to project properly identified with names, models numbers, types, grades, compliance labels and similar information needed for distinct identifications; adequately packaged or protected to prevent deterioration during shipment, storage, and handling. Store in a dry, well ventilated, indoor space, except where prepared and protected by the manufacturer specifically for exterior storage.

END OF SECTION 210110

SECTION 210120 – FIRE PROTECTION STANDARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

1.2 QUALITY ASSURANCE:

A. Industry Standards: It is a general requirement that fire protection work comply with applicable requirements and recommendations of standards published by listed agencies and trade associations, except to the extent more detailed and stringent requirements are indicated or required by governing regulations. Listing of Associations, Standards, and Abbreviations:

1.	AWS	American Welding Society, Inc. 2501 NW 7th St., Miami, FL 33125
2.	CISPI	Cast Iron Soil Pipe Institute 2020 K. St., NW, Washington, DC
3.	NEC	National Electrical Code by NFPA
4.	NEMA	National Electrical Manufacturers Association 1300 N 17th Street, Suite 1847 Rosslyn, VA 22209
5.	NFPA	National Fire Protection Association 407 Atlantic Ave., Boston, MA 02210
6.	UL	Underwriters' Laboratories, Inc. 207 East Ohio St., Chicago, IL 60611

PARTS 2 AND 3 - PRODUCTS AND EXECUTION (Not applicable)

END OF SECTION 210120

SECTION 210210 – FIRE PROTECTION COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

1.2 QUALITY ASSURANCE:

A. Coordinate the actual location of all fire protection work visible in finished spaces with the Design Professional.

PART 2 - PRODUCTS

2.1 PRODUCT COORDINATION:

A. Power Characteristics: Refer to the electrical sections of the specifications and the electrical drawings for the power characteristics available for the operation of each power-driven item of equipment. The electrical design was based on the typical power requirements of the equipment manufacturers scheduled or specified. Any modifications to the electrical system which are required due to the use of an approved equivalent manufacturer shall be made at no additional cost to the owner. All changes must be clearly documented and submitted for review by the Design Professional prior to purchasing equipment. Coordinate purchases to ensure uniform interface with electrical work. The fire protection contractor shall furnish a detailed list of equipment electrical characteristics to the electrical contractor for the purpose of preparing the coordination affidavit required by Division 26.

B. Coordination of Options and Substitutions: Where the contract documents permit the selection from several product options, and where it becomes necessary to authorize a substitution, do not proceed with purchasing until coordination of interface of equipment has been checked and satisfactorily established.

C. Firestopping: Refer to architectural drawings for the locations of all fire rated ceilings, floors, and walls. The contractor shall furnish detailed shop drawings of all firestopping details to be used for both piping and ductwork. All firestopping details shall be *UL listed* and subject to approval by the State Fire Marshal.

PART 3 - EXECUTION

3.1 INSPECTION AND PREPARATION:

A. Substrate Examination: The Installer of each element of the work must examine the

condition of the substrate to receive the work, and the conditions under which the work will be performed and must notify the Contractor in writing of conditions detrimental to the proper completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

B. Do not proceed with the installation of sleeves, anchors, hangers, roof penetrations and similar work until coordination drawings have been processed and released for construction. Where work must be installed prior to that time to avoid a project delay, review proposed installation in a project coordination meeting including all parties involved with the interfacing of the work.

3.2 CUTTING AND PATCHING:

A. Structural Limitations: Do not cut structural framing, walls, floors, decks, and other members intended to withstand stress, except with the Design Professional's written authorization. Authorization will be granted only where there is not another reasonable method for completing the work, and where the proposed cutting clearly does not materially weaken the structure.

B. Where authorized, cut opening through concrete (for pipe penetrations and similar services) by core drilling or sawing. Do not cut by hammer-driven chisel or drill.

C. Other work: Do not endanger or damage other work through the procedures and processes of cutting to accommodate mechanical work. Review the proposed cutting with the Installer of the work to be cut and comply with recommendations to minimize damage. Where necessary, engage the original Installer or other specialists to execute the cutting in the recommended manner.

D. Where patching is required to restore other work, because of either cutting or other damage inflicted during the installation of fire protection work, execute the patching in the manner recommended by the original Installer. Restore the other work in every respect, including the elimination of visual defects in exposed finishes, as judged by the Design Professional. Engage the original Installer to complete patching of the following categories of work:

1. Exposed concrete finishes.
2. Exposed masonry.
3. Waterproofing and vapor barriers.
4. Roofing, flashing and accessories.
5. Interior exposed finishes and casework, where judged by the Design Professional to be difficult to achieve an acceptable match by other means.

3.3 COORDINATION OF FIRE PROTECTION INSTALLATION:

A. General: Sequence, coordinate and integrate the various elements of fire protection work so that building systems will perform as indicated and be in harmony with other work of the building. The Design Professional will not supervise the coordination, which is the exclusive responsibility of the Contractor. Comply with the following requirements:

1. Install piping and similar services straight and true, aligned with other work and with

overhead structures and allowing for insulation where applicable. Conceal where possible.

2. Arrange work to facilitate maintenance and repair or replacement of equipment. Locate services requiring maintenance on valves and similar units in front of services requiring less maintenance. Connect equipment for ease of disconnecting, with minimum of interference with other work.
3. Give the right-of way to piping systems required to slope for drainage (over other service lines). Piping shall be located to avoid interference with ductwork and light fixtures.
4. Piping shall not be routed above the outline of any electrical equipment. Contractor shall coordinate locations of electrical equipment with installation of piping.
5. Store materials off the ground and protected from standing water and weather.

B. Drawings: Conform with the arrangement indicated by the contract documents to the greatest extent possible, recognizing that portions of the work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, comply with the Design Professional's decision on resolution of the conflict.

C. Electrical Work: Coordinate the fire protection work with electrical work, and properly interface with the electrical service. In general, and except as otherwise indicated, install fire protection equipment ready for electrical connection. Refer to electrical sections of the specifications for electrical connection of fire protection equipment.

D. Utility Connections: Coordinate the connection of fire protection systems with exterior underground utilities and services. Comply with the requirements of governing regulations, franchised service companies and controlling agencies. Provide a single connection for each service except where multiple connections are indicated.

END OF SECTION 210210

SECTION 210220 – FIRE PROTECTION SUBMITTALS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

1.2 SUBMITTAL FORMS AND PROCEDURES:

A. The purpose of submittals is to demonstrate to the Design Professional that the Contractor understands the design concept. The Design Professional's review of such drawings, schedules, or cuts shall not relieve the Contractor from responsibility for deviation from drawings or specifications unless he has, in writing, called the Design Professional's attention to such deviations at the time of submission, and has received from the Design Professional, in writing, permission for such deviations. All submittals must be completely checked by the Contractor prior to submission for review.

B. Hard Copy Submittals: Submittal data shall be placed in one or more hard-back 3-ring binders, arranged, and labeled according to specification section. Each binder shall contain a title page and table of contents. Provide separator tabs, and label by specification section. Make note in the table of contents, any drawings that accompany the submittal. Title page shall contain Project Name, Contractor’s Name, Division 21 Superintendent’s name, Suppliers and point of contact for each, and date. Except as otherwise indicated in other sections, submit 5 complete copies. Quantity indicated does not include copies required for regulatory agencies.

C. Electronic Submittals: All electronic submittal files shall be organized to match the bid documents for specification section and name. Each submittal file shall be complete for each specification section. Multiple partial submittals per specification section will be rejected. Make note in the table of contents, any drawings that accompany the submittal. Title page shall contain Project Name, Contractor’s Name, Division 21 Superintendent’s name, Suppliers and point of contact for each, and date.

D. Submittals shall be made for all items contained in the following specification sections:

1. Fire Protection Coordination
2. Fire Protection Identification
3. Fire Protection Pipe, Tube, and Fittings
4. Fire Protection Hangers and Supports
5. Fire Protection Seismic Control
6. Fire Protection Sprinkler System
7. Hydraulic Calculations

E. Response to Submittals: A Submittal Review Report shall be issued by the Design Professional with the following classifications for each item:

1. **"No Exceptions Taken"**: No corrections, no marks. Contractor shall submit copies for distribution.
2. **"Make Corrections Noted"**: A few minor corrections. Items may be ordered as marked up without further resubmission. Submit copies for distribution.
3. **"Revise and Resubmit"**: Minor corrections. Item may be ordered at the Contractor's option. Contractor shall resubmit drawings with corrections noted.
4. **"Rejected"**: Major corrections or not in accordance with the contract documents. No items shall be ordered. Contractor shall correct and resubmit drawings.

PART 2 - PRODUCTS

2.1 SUBMITTAL REQUIREMENTS:

A. General: Each specification section shall list the required submittal items. All submittal items shall conform to the requirements listed below. For each major section of submittal data, include a summary page which lists items and model numbers for each piece of equipment.

B. Shop Drawings: Prepare shop drawings to accurate scale except where diagrammatic representations are specifically indicated. Show clearance dimensions of critical locations and show dimensions of spaces required for operation and maintenance of equipment. Show piping connections and other service connections and show interface with other work including structural support. Indicate by note, the portions of fire protection work shown on the shop drawings which deviated from the indication of work in the contract documents and explain the reasons for the deviations. Show how such deviations coordinate with interfacing deviations on shop drawings for other portions of the work, currently or previously submitted.

C. Manufacturer's Data: Where pre-printed data is submitted for more than one distinct product, size, type, material, trim, accessory group or other variation, mark submitted copy with black pen to indicate which of the variations is to be provided. Delete or mark-out significant portions of preprinted data which are not applicable. Where operating ranges are shown, mark data to show portion of range required for project application. Expansion or elaboration of standard data to describe a non-standard product must be processed as a shop drawing submittal. For each product include the manufacturer's production specifications, installation or fabrication instructions, nearest source of supply (including telephone number), sizes, weights, speeds, operating capacities, piping and service line connection sizes and locations, statements of compliance with required standards and governing regulation (include manufacturer's signed statements if not covered in printed data), performance data (where applicable) and similar information needed to confirm compliance with the requirements.

D. Certifications: Where specifically indicated, submit with notarized execution.

E. Test Reports: Submit test reports which have been signed and dated by the firm performing the test and prepared in the manner specified in the standard or regulation governing the test procedures as indicated.

F. Manufacturer's Product Warranties: Where pre-printed and published warranty includes substantial deviation from required warranty (as judged by the Design Professional), product is automatically disqualified from use on the project, except where manufacturer prepares and

issues a specific product warranty on the product, stating that it is in lieu of the published warranty, and is executed by an authorized officer, and complies with the requirements. Warranties shall comply with the requirements of individual specification section where those requirements exceed the manufacturer's standard warranty.

PART 3 - EXECUTION

3.1 CLOSEOUT REQUIREMENTS:

A. Operating Instructions: Submit manufacturer's operating instructions for each item of fire protection equipment and supplement with additional project application instructions where necessary. Prepare and submit specific operating instructions for charging, start-up, control or sequencing of operation, phase, or seasonal variations, shut-down, safety and similar operational instructions. Prepare in typewritten form in completely explained and easily understood English language.

B. Maintenance Manuals: Organize each copy of the required system maintenance manuals to include an index followed by thumb-tab marked sections for each of the following:

1. System operating instructions.
2. Emergency instructions including addresses and telephone numbers of service sources.
3. Regular system maintenance procedures including lubrication.
4. Spare parts listing and stocking recommendations.
5. Inspection, adjusting, rebalancing, cleaning, parts replacement, and similar maintenance instructions and recommendations, including the proper use of tools and accessories.
6. Valve schedule and control diagram for each system.
7. Manufacturer's data for each operating item in each system.
8. Manufacturer's product warranties and guarantees relating to the system and equipment items in the system.
9. Corrected or approved issues of submittal items relating to the system.
10. Bind each maintenance manual in one or more vinyl-covered, 2", 3-ring binder, plus pocket-folder type binders for folded drawings, and mark the back spine of each binder with system identification and volume number.

C. Maintenance Materials: Deliver to Owner’s representative at the location as directed, in containers or packages suitable for storage and fully identified.

D. Guarantees: Where indicated as "Certified", provide guarantee which, in addition to execution by an authorized officer of each guarantor, is attested to by the Secretary of each guarantor and bears the corporate seal.

END OF SECTION 210220

SECTION 210230– FIRE PROTECTION IDENTIFICATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

1.2 QUALITY ASSURANCE:

A. Manufacturers: Firms regularly engaged in the manufacture of identification systems required for this product.

B. Submittals: Submit manufacturer's data on materials and submit a sample of each type required.

PART 2 - PRODUCTS

2.1 FIRE PROTECTION IDENTIFICATION MATERIALS:

A. Plastic Pipe Markers:

1. General: Product manufacturer's standard pre-printed, flexible or semi-rigid, permanent, color-coded, plastic-sheet pipe markers, complying with ANSI A13.1.
2. Small Pipe: For external diameters less than 6", provide full band pipe markers, extending 360 degrees around pipe at each location, fastened by one of the following methods:
   a. Snap-on application of pre-tensioned semi-rigid plastic pipe marker.
   b. Adhesive lap joint in pipe marker overlap.
   c. Laminated or bonded application of pipe marker to pipe.
   d. Taped to pipe with color-coded plastic adhesive tape, not less than 3/4" wide; full circle at both ends of pipe marker, tape lapped 1-1/2".
3. Large Pipes: For external diameters of 6 inches and larger, provide either full-band or strip-type pipe markers, but not narrower than 3 x letter height (and of required length), fastened by one of the following methods:
   a. Laminated or bonded application of pipe marker to pipe.
   b. Taped to pipe with color-coded plastic adhesive tape, not less than 1-1/2" wide: full circle at both ends of pipe marker, tape lapped 3".
4. Lettering: Comply with piping system names as specified, scheduled, or shown, and abbreviate only as necessary for each application length.
5. Arrows: Print each pipe marker with arrow indicating direction of flow, either integrally with piping system service lettering or as separate unit of plastic (to accommodate both directions).
6. Install pipe markers on piping of the following piping systems:
   a. Automatic Wet Pipe Sprinkler System Water

B. Plastic Tape: Manufacturer's standard color-coded pressure-sensitive (self-adhesive) vinyl tape, not less than 3 mils thick.

1. Width: Provide 1-1/2" wide tape markers on pipes with outside diameters of less than 6", 2-1/2" wide tape on larger pipes.
2. Color: Comply with ANSI A13.1.

C. Engraved Plastic-Laminate Signs:

1. General: Provide engraving stock melamine plastic laminated, 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.
2. Thickness: 1/16", except as otherwise indicated.
3. Fasteners: Self-tapping stainless-steel screws, except contact type permanent adhesive where screws cannot or should not penetrate the substrate.

D. Valve Tags:

1. Valve signs shall be in accordance with NFPA 13.
2. The identification sign shall be secured with corrosion-resistant wire, chain, or other approved means.
3. Valve tags shall be installed at all shut-off, balancing, metering, and drain valves. Valve tag shape and designations shall with NFPA and UL.

E. Valve Charts:

1. Valve charts shall be provided for fire protection systems. Charts shall be located at the riser.
2. Valve charts shall be typed listing all valve tags. List shall include identification number, valve location in system (e.g., Corridor 123, etc.) and its function (e.g., shut-off, balancing, drain, etc.). Charts shall be mounted in a wooden frame with glass cover.

2.2 LETTERING AND GRAPHICS:

A. General: Coordinate names, abbreviations and other designations used in the identification work, with the corresponding designations shown, specified, or scheduled. Provide numbers and lettering recommended by manufacturers or as required for proper identifications and operation/maintenance of the systems and equipment.

B. Multiple Systems: Where multiple systems of the same generic name are shown and specified, provide identification which indicates the individual system number as well as the service.

PART 3 - EXECUTION

3.1 APPLICATION AND INSTALLATION:

A. Coordination: Where identification is to be applied to surfaces which require painting and other covering or finish, including valve tags in finished spaces, install identification after completion of covering or painting.

B. Piping System Identification: Install pipe markers on each system indicated to receive identification and include arrows to show normal direction of flow.

C. Locate pipe markers as follows wherever piping is exposed to view in mechanical rooms, accessible maintenance spaces (including accessible areas above ceilings) and exterior non-concealed locations:

1. Near each valve and control device.
2. Near each branch, excluding short take-offs for fixtures. Mark each pipe at branch, where there could be a question of flow pattern.
3. Near locations where pipes pass through walls or ceilings or enter non-accessible enclosures.
4. Near major equipment items and other points of origination and termination.
5. Spaced intermediately at maximum spacing of 50’ along each piping run, except reduce spacing to 25’ in congested areas of piping and equipment.

D. Do not mark piping exposed in finished occupied spaces.

E. Fire protection Equipment Identification: Install an engraved plastic laminate sign on or near each major item of fire protection equipment and each operational device, as specified herein if not otherwise specified for each item or device. Provide signs for all major items of fire protection equipment.

F. Valve tags shall be attached to the valve handwheel with cable ties.

END OF SECTION 210230

SECTION 210240 – FIRE PROTECTION WORK CLOSEOUT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

1.2 DOCUMENTATION PROCEDURES:

A. Signed Commitments: Do not proceed with transfer of fire protection systems to the Owner for operation until warranties, performance certifications and similar commitments to be signed by Contractor and other entities have been executed and transmitted to Design Professional (for Owner's records).

1.3 RECORD DRAWINGS:

A. Explanation: Except where otherwise indicated, fire protection drawings (contract drawings) prepared by Design Professional are diagrammatic in nature and may not show locations accurately for various components of fire protection systems. Shop drawings, including coordination drawings, prepared by Contractor shall show certain portions of work more accurately to scale and location, and in greater detail.

B. General Recording Procedure: Maintain a white-print set, blue-line or black-line, of fire protection contract drawings and shop drawings in clean, undamaged condition, for mark-up of actual installations which vary substantially from the work as shown. Mark-up whatever drawings are most capable of showing the installed conditions accurately; however, where shop drawings are marked, record a reference note on appropriate contract drawing. Mark with erasable pencil and use multiple colors to aid in the distinction between work of separate systems. In general, record every substantive installation of fire protection work which previously is either not shown or shown inaccurately, but in any case, record the following:

1. Underground and aboveground piping, both exterior and interior, drawn to scale and fully dimensioned.
2. Fire Protection "Project Record" shall be maintained as part of the "Project Record" specified in Division 1.

PART 2 - PRODUCTS

2.1 NOT APPLICABLE:

PART 3 - EXECUTION

3.1 CLOSEOUT PROCEDURES:

A. General Coordination: Sequence closeout procedures properly, so that work will not be endangered or damaged, and so that every required performance will be fully tested and demonstrated.

B. System Performance Test Run: At the time of fire protection work closeout, check each item in each system to determine that it is set for proper operation. With Owner's representative and Design Professional present, operate each system in a test run of appropriate duration to demonstrate compliance with performance requirements. During or following test runs, make final corrections or adjustments of system to refine and improve performances wherever possible, including noise and vibration reductions, elimination of hazards, better response of controls, signals and alarms, and similar system performance improvements. Provide testing or inspection devices as may be requested for Design Professional's observation of actual system performances. Demonstrate that controls and items requiring service or maintenance are accessible. Test run shall be scheduled to coincide with Design Professional's final inspection of the fire protection work.

C. Cleaning and Lubrication: After final performance test run of each fire protection system, clean system. Lubricate both power and hand operated equipment and remove excess lubrication. Touch-up minor damage to factory painted finishes and other painting specified as fire protection work; refinish work where damage is extensive.

D. General Operating Instructions: In addition to specified training of Owner's operating personnel specified in individual fire protection sections, and in addition to preparation of written operating instructions and compiled maintenance manuals specified, provide general operating instructions for the fire protection systems. Conduct a walk-through explanation and demonstration for orientation and education of Owner's personnel to be involved in continued operation of building.

1. Describe each basic system and how its control system functions.
2. Explain and point out identification system, displayed diagrams, signals, alarms and similar provisions of the work.
3. Describe basic sequencing requirements and interlock provisions for system start-up, phasing and shutdown.
4. Emphasize emergency procedures and safety provisions for protection of equipment and safety of occupants during equipment malfunction, disasters, power failures and similar unusual circumstances.
5. Outline basic maintenance procedures.

E. Demonstrate what adjustments have been made and can continue to be made to reduce noise and vibration, improve system output, decrease energy consumption and similar performance improvements.

F. Point out operational security provisions, safety, unavoidable hazards, and similar operator limitations. Display and conduct a "thumb-through" explanation of maintenance manuals, record drawings, meter readings and similar service items.

G. Construction Equipment: After completion of performance testing and Owner's operating instructions and demonstrations, remove installers tools, test facilities, construction

equipment and similar devices and materials used in execution of the work but not incorporated in the work.

3.2 CONTINUED SYSTEM OPERATIONS:

A. Final Acceptance: At time of substantial completion of fire protection work, Owner's operating personnel will take over operation of fire protection systems. However, until time of final acceptance, respond promptly with consultation and services on whatever operation or maintenance problems may remain or arise.

END OF SECTION 210240

SECTION 210310 – FIRE PROTECTION EXCAVATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

1.2 QUALITY ASSURANCE:

A. Coordination: Where excavation and backfill for fire protection work passes through or occurs in the same areas as work specified in the Division 02 sections, comply with both the requirements of the Division 02 sections and the requirements of this section, whichever is the more stringent (as determined by the Design Professional in cases of conflicting requirements).

1.3 JOB CONDITIONS:

A. Existing Utilities: Locate and protect existing utilities and other underground work in a manner which will ensure that no damage or service interruption will result from excavating and backfilling.

PART 2 - PRODUCTS

2.1 BACKFILL MATERIALS:

A. Subbase Material: A graded mixture of gravel, sand, crushed stone, or crushed slag.

PART 3 - EXECUTION

3.1 EXCAVATING:

A. Inspection: The excavator must examine the areas to be excavated, and the conditions under which the work is to be performed and notify the Contractor in writing of conditions detrimental to the proper completion of the work. Do not proceed with excavating until unsatisfactory conditions have been corrected in a manner acceptable to the excavator.

B. General:

1. Do not excavate until the work is ready to proceed without delay, so that the total time lapse from excavation to completion of backfilling will be minimum.
2. Provide signs, illuminations, and barricades as necessary to prevent accidents at

excavations.

3. Excavate with vertical sided excavations to the 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 the work or other property. Where not removed, cut sheeting off at a sufficient distance below finished grade to not interfere with other work.
4. Excavate for piping with 6" to 9" clearance both sides of pipe, except where otherwise shown or required for proper installation of pipe joints, fittings, valves, and other work. Provide a minimum of 12" clearance around underground tanks.
5. For work to be supported directly on undisturbed soil, do not excavate beyond required depths, and hand excavate the bottom cut to accurate elevations. Except as otherwise indicated, support the following work on undisturbed soil at the bottom of the excavations:
   a. Piping of 5" and less pipe/tube size.
   b. Cast-in-place concrete.
6. Where directed, excavate additional depth to reach satisfactory soil-bearing conditions. Backfill with subbase material, compacted as directed, to indicated excavation depth.
7. Except as otherwise indicated, excavate for exterior water-bearing piping so that the top of piping will not be less than 2'- 0" vertical distance below finished grade.
8. Store excavated material (temporarily) near the excavation, in a manner which will not interfere with or damage the excavation or other work.
   a. Retain excavated material which complies with the requirements for backfill material.
   b. Dispose of excavated material which is either in excess of quantity needed for backfilling or does not comply with requirement for backfill material.

3.2 DEWATERING:

A. Maintain dry excavations by removing 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 from being damaged by water, sediment, or erosion from or through excavations.

3.3 BASE PREPARATION:

A. Install subbase material to receive fire protection work and compact by tamping to form a firm base for the work. For piping, shape the subbase to fit the shape of the bottom 90 degrees of the cylinder, for uniform continuous support.

B. Shape subbases and bottoms of excavations with recesses to receive pipe bells, flanges connections, valves, and similar enlargements in the piping systems.

3.4 BACKFILLING:

A. Do not backfill until installed work has been tested and accepted, wherever testing is indicated.

B. Condition backfill material by either drying or adding water uniformly, to whatever extent

may be necessary to facilitate compaction to the required densities. Do not backfill with frozen soil materials.

C. Backfill simultaneously on opposite sides of work and compact simultaneously; do not dislocate the work from installed positions.

D. Backfill excavations in 8" high courses of backfill material, uniformly compacted to the following densities (percent of maximum density, ASTM Standard Proctor), using power-driven hand-operated compaction equipment.

1. Lawn/Landscaped Areas: 90%
2. Roadways: 95%
3. Paved Area, Other than Roadways: 95%

E. Backfill to elevations matching adjacent grades, at the time of backfilling excavations for mechanical work.

F. 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 Design Professional.

3.5 PERFORMANCE AND MAINTENANCE:

A. Where subsidence is measurable or observable at fire protection work excavations during the guarantee period, remove the surface (pavement, lawn or other finish), add backfill material, compact and replace the surface treatment. Restore the appearance, quality and condition of the surface or finish to match adjacent work and eliminate evidence of the restoration to the greatest extent possible.

END OF SECTION 210310

SECTION 212010 - FIRE PROTECTION SPRINKLER SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

1.2 SCOPE:

A. Fire Protection Supply Pipe: Route the building fire main to the municipal water main and connect to the supply line at the appropriate time and location. Contractor shall field verify exact location of water main prior to start of construction.

B. Work Includes but is not limited to:

1. Installing a complete "Wet Pipe" Automatic Sprinkler system throughout the building.

C. Related Work Specified Elsewhere: Wiring of flow alarm switches and tamper switches and connection of switches to building alarm system are specified in Section 271010.

D. Sprinkler Design Requirements: (for Light Hazard)

1. The sprinkler system shall be a wet pipe type. The design area shall be the most remote 1500 square feet. The design density shall be .10 gpm/ft^2. Hose requirement shall be 100 gpm.
2. The contractor shall submit 4 complete sets of sprinkler shop drawings and hydraulic calculations to the Design Professional for review, prior to ordering material and/or cutting pipe. Contractor shall not cut any piping until shop drawings have been reviewed and accepted. The contractor shall show in dashed lines the location of all ductwork, lights, and diffusers.
3. The contractor shall be responsible for coordinating sprinkler piping and head locations with other trades. Contractor shall relocate sprinkler piping and heads as necessary to avoid conflict with ductwork, lights, and structure.
4. Provide auxiliary drains at low points in system and for trapped sections as required by NFPA-13. Locate auxiliary drains in mechanical closets or other locations out of sight.
5. The contractor shall include a (10 psi) buffer in the hydraulic calculations, i.e. the pressure required for the sprinkler system (including hose stream) shall be a minimum of 10 psi less than the available pressure at the required flow.
6. The contractor shall perform a flow test prior to commencing design and shall provide test information to the Design Professional for approval. Sprinkler system design shall be based upon the contractor’s flow test.

1.3 QUALITY CRITERIA:

A. Permits, Licenses, Inspection Fees:

1. Obtain and pay for permits, licenses and inspection fees as may be required for performance and approval of the work performed under this section of the specifications.
2. Comply with all requirements of NFPA 13, NFPA 24 and the State Fire Marshall and local codes.

B. Materials: Materials specified by manufacturer's name shall be used unless prior approval of a substitute is given by addenda.

1.4 SUBMITTALS:

A. Before materials and equipment are purchased, submit for Design Professional's approval, a complete schedule of materials and equipment to be incorporated in the work. Submittals shall include the following:

1. Complete Shop Drawings with hydraulic calculations
2. All Valves
3. Fire Department Connections
4. Sprinkler Heads
5. Tamper Switches
6. Pipe Hangers and Supports
7. Pipe and Fittings
8. Cabinets
9. Access Panels
10. Alarm Valve

B. Grooved joint couplings and fittings shall be shown on drawings and product submittals and be specifically identified with the applicable style number.

C. Sprinkler heads shall be referred to on drawings, submittals, and other documentation, by the sprinkler identification or model number as specifically published in the appropriate agency listing or approval. Trade names or other abbreviated designations shall not be allowed.

1.5 TESTING PIPE SYSTEMS:

A. Tests shall be conducted in the presence of the Design Professional or his designated representative. Equipment, materials, and instruments for testing shall be furnished by the Contractor without additional cost to the Owner.

B. Automatic Sprinkler Piping: The automatic sprinkler systems shall be hydrostatically tested in their entirety or in zones defined by shutoff valves. The piping shall be tested at a pressure of 200 psig, measured at the low point in the system or zone, and shall be proved tight at this pressure for a period of not less than (2) hours. Leaks detected shall be repaired by tightening, rewelding joints, or replacing damaged pipe or fittings. Caulking of joints will not be permitted.

1.6 OPERATION AND MAINTENANCE INSTRUCTIONS:

A. Operating and Maintenance Instructions, printed and bound in hard cover three ring loose leaf

notebooks, shall be provided for each item of equipment listed below; 5 separate copies shall be provided. Each notebook shall be provided within an identifying label under a clear plastic cover shield on the front cover which shall identify the Project, Design Professional, Contractor, and Date.

1. National Fire Protection Association Pamphlet No. 25.
2. Copies of All Approved Submittal Data (listed above under submittals).
3. As-Built copies of Design Drawings and Hydraulic Calculations.

1.7 SEISMIC REQUIREMENTS:

A. Provide seismic protection for the sprinkler system. Design and install seismic protection in accordance with the requirements of NFPA 13 section titled "Protection of Piping Against Damage Where Subject to Earthquakes." Seismic requirements may be waived by the Authority Having Jurisdiction. Provide written documentation of waiver.

1.8 GUARANTEE:

A. All equipment shall be guaranteed as specified under the General and Special Conditions. Guarantee on all equipment shall start and coincide with the Contractor's guarantee obligations.

PART 2 - PRODUCTS AND INSTALLATION

2.1 PIPE AND FITTINGS:

A. Pipe and fittings listed herein shall be for the services indicated.

2.2 SPRINKLER AND STANDPIPE:

A. Piping Options:

1. Schedule 40 black steel pipe: ASTM A-795, A-53, or A-135 with class 150- or 300-pound malleable iron threaded fittings, welded steel fittings, or with mechanical grooved joint couplings. Mechanical couplings for main sprinkler and standpipe risers shall be rigid type coupling.
2. Schedule 10 black steel pipe: ASTM A-135 pipe, UL listed for sprinkler systems. Fittings for thin wall pipe shall be same type specified for Schedule 40 pipe.

2.3 JOINTS:

A. Mechanical grooved joint couplings shall be listed for use in fire protection systems.

1. Grooved End Fittings: Fittings shall be ductile iron (ASTM A536); forged steel (ASTM A234); or fabricated from carbon steel pipe (ASTM A53); with pre-grooved ends for use

with mechanical couplings of the same manufacturer.

2. Mechanical Couplings: Coupling housings shall be ductile iron (ASTM A536). Bolts and nuts shall be carbon steel track-type (ASTM A183), minimum tensile 110,000 psi. Gaskets shall be Grade "E" EPDM, for water services from -30 to +230 F. At joints allowing controlled movement, expansion, contraction of deflection, flexible couplings with shall be used. At all joints not requiring flexibility, a rigid coupling shall be used.
   a. Rigid Type: Coupling housings cast with offsetting, angle-pattern bolt pads shall be used to provide system rigidity and support and hanging in accordance with NFPA 13.
   b. Flexible Type: Use in locations where vibration attenuation and stress relief are required.
3. Flange Adapter: Flat face, for direct connection to ANSI Class 125 or 150 flanged components.

B. Welded flanged joints shall be faced true, provided with 1/16" ring type gasket, and made square and tight. Flanges shall have raised or flat faces to mate with adjacent flanges or valves. Welding shall comply with ANSI B31.1.

C. Welded joints shall be butt welded in accordance with ANSI B31.1.

D. Qualification of Welders:

1. All welders employed for the work shall be qualified under the requirements of ANSI B31.1.0, Section 127.5.
2. Evidence of the welder's qualifications shall be submitted to the Design Professional before any welds are made.
3. Coupling for sprinkler piping shall be Victaulic Model 75.

E. Underground Pipe:

1. Standard weight ductile iron pipe with mechanical "bolted type" joints.
2. Provide tie rods and thrust blocks at each change of direction of the underground fire service piping. Install tie rods and thrust blocks in accordance with NFPA 24 requirements.

2.4 VALVES, EQUIPMENT AND ACCESSORIES FOR FIRE PROTECTION SYSTEM:

A. Gate Valves 2-1/2" and Larger: Valves shall be O.S. and Y type with iron body, bronze trim, solid wedge, and flanged ends for 175-pound W.W.P. Valves shall be UL listed with identification mark for such stamped or cast on valve body. Valve shall be Crane, Stockham, Nibco/Scott, or Kennedy.

B. Gate Valves 2" and Smaller: Valves shall be O.S. and Y type with bronze body, solid wedge, and threaded ends for 175-pound W.W.P. Valves shall be UL listed with identification mark for such stamped or cast on valve body. Valves shall be Crane, Stockham, Nibco/Scott, or Kennedy.

C. Check Valves 2" in Size and Smaller: Check valves shall be horizontal swing type with bronze body, composition disc, threaded ends for 200-pound W.O.G. and shall be Crane, Stockham, Nibco/Scott, or Kennedy.

D. Swing Check Valves 2-1/2" and Larger: Check valves shall be horizontal swing type with iron body, bronze trim, and flanged ends for 175-pound W.W.P. Valves shall be UL listed with identification mark for such stamped or cast on the valve body. Valves shall be Crane, Stockham, Nibco/Scott, or Kennedy.

E. Wafer Check Valves 4" and Larger: Valves shall be iron body with bronze trim, EPDM O-ring seals and stainless steel Hinge pins. Valve shall be UL listed and FM approved. Wafer check valves shall be Grinnell, Victaulic, or Gruvlock.

F. Spring-Assisted Check Valves 2-1/2" and Larger: Valve shall be UL listed and FM approved. Valves shall have a ductile iron body with aluminum bronze or elastomer encapsulated ductile iron disc, stainless steel spring and shaft and grooved ends. Spring-assisted check valves shall be Victaulic, or Gruvlock.

G. Butterfly Valves 2-1/2" and Larger: Valve shall be UL listed and FM approved. Valves shall have a ductile iron body, elastomer encapsulated ductile iron disc with integrally cast stem and grooved ends. Butterfly valves shall be Victaulic, Gruvlock, or Kennedy.

H. Globe Valves: Valves shall have bronze body, rising stem, composition disc, threaded ends for 200-pound W.O.G. and shall be Crane, Stockham, Nibco/Scott, or Kennedy.

I. Angle Valves: Valves shall have bronze body, rising stem, composition disc, threaded ends for 200-pound W.O.G. and shall be Crane, Stockham, Nibco/Scott, or Kennedy.

J. Sprinkler Wet Pipe Alarm Valves: Valves shall be UL listed and shall be furnished with all standard trim including pressure gauges, by-pass, test valves, electric alarm pressure switch and main drain. Valve shall be cast iron or ductile iron, and all parts in contact with water shall be non-ferrous. Internal parts shall be replaceable without removal of valve from installed position. Valve shall be Victaulic, Central Sprinkler, Viking, Grinnell, Automatic Sprinkler, or Reliant.

K. Electric alarm pressure switches shall be dual switch closer or opener type, and shall be System Sensor, United Electrics, Potter, or Viking.

L. Supervisory Switches: The valve for each sprinkler system shall be provided with a valve mounted switch capable of detecting motion of the valve from a full open position. Switches shall be UL listed and FM approved. Switch shall be System Sensor, United Electrics, Potter, or Viking.

M. Water Flow Switches: water flow switches shall be line mounted vane type with retard. Switch shall consist of two single pole, double throw, snap action switches and an adjustable, recycling pneumatic retard, contained inside a general-purpose die-cast housing. Switches shall be capable of either horizontal or vertical mounting and shall be UL listed and FM approved. Switch shall be System Sensor, United Electrics, Potter, or Viking.

N. Electric Bell: Bell shall be 10" round red enameled steel bell 120-Volt A.C. electric motor. Bell shall be Potter, Viking, System Sensor, or United Electrics.

O. In-Building Riser: In-Building Riser shall be installed as indicated on the plans. Riser shall be composed of a single extended 90-degree fitting of fabricated 304 stainless steel tubing,

maximum working pressure 200 psi. The fitting shall have a flanged-end or grooved-end connection on the outlet (building) side and a CIPS coupler on the inlet (underground) side. In-Building Riser shall be Ames Fire & Waterworks, Zurn, or Viking.

P. Riser Manifold Assembly: shall be UL listed for horizontal or vertical installation as a one-piece, fabricated assembled unit. The riser manifold assembly shall consist of a cast, non-welded, ductile iron body with grooved end connections having all brass and galvanized trim. The manifold piping shall clearly identify manifold pipe size, flow direction, test, drain, and gauge outlets. A built-in drain port shall be available to permit hydrostatic testing without draining the system. Assembly shall have a working pressure rating of 300 psi.

2.5 SPRINKLER HEADS:

A. Sprinkler heads shall be glass-bulb type. Body shall be die cast brass, with hex-shaped wrench boss cast into the body to facilitate installation and reduce the risk of damage during installation.

B. Sprinkler head types shall be coordinated with the Design Professional.

C. Upright sprinkler heads shall be ½ inch spray type with bronze finish. Sprinklers shall be Viking, Reliable, Tyco, or Automatic Sprinkler.

D. Institutional sprinklers shall be quick response, small, flush, solder link and lever sprinklers made with tamper-resistant construction. The sprinkler assembly consists of the sprinkler body and a 3 or 4 inch escutcheon plate. Provide in [chrome, white, grey] finish with matching escutcheon. Sprinklers shall be by Viking, Reliable, or Tyco.

2.6 FLEXIBLE SPRINKLER CONNECTIONS:

A. Flexible sprinkler connections may be used to locate sprinklers as required by final finished ceiling tiles and walls. The flexible sprinkler connection system shall consist of a braided type 304 stainless steel flexible hose, zinc plated steel male threaded nipple or groove style coupling for connection to branch-line piping, and a zinc plated steel reducer with a female thread for connection to the sprinkler head. System shall be FM 1637 and UL 2443 approved and designed for use in hydraulically calculated wet, preaction, deluge or dry sprinkler systems per NFPA 13 and UL2443 requirements. Hose assembly shall be UL listed for a maximum working pressure of 175 psi or FM approved for a maximum working pressure of 200 psi, maximum working temperature of 300°F, and minimum allowable bending radius of 3” per UL guidelines and 7” per FM guidelines. Flexible sprinkler connection systems shall be by Anvil, Viking, Reliable, or Victaulic.

B. Provide with the flexible sprinkler connection system manufacturer’s reducer and bracket accessories as required for a complete installation.

2.7 HANGERS FOR FIRE PROTECTION PIPING:

A. Hanger for 4" and larger horizontal lines shall be Clevis type hangers, B-Line, Anvil, or Erico.

B. Hanger for horizontal lines up to 3½" shall be band type hangers, B-Line, Anvil, or Erico.

C. Supports for vertical lines passing through floor shall be riser clamp type, Fee & Mason, Carpenter and Patterson, B-Line, Anvil, or Erico.

PART 3 - EXECUTION

3.1 GENERAL:

A. Unless specifically stated otherwise, the fire protection system shall conform to all other sections of this specification which apply to pipe installation, accessories, and controls.

B. All threaded hose outlets shall comply with the local fire department requirements.

C. All shop drawings submitted on items requiring UL listing shall bear evidence of UL approval.

D. All exposed fire system piping including valve room piping shall be cleaned of rust, grease and scaled and shall be provided with a field applied prime coat and two coats of an oil-based enamel paint. Color shall be red or as directed by Design Professional.

E. The contractor shall perform all tests of Fire Protection Systems as required by governing codes and local authorities at no additional cost to the Owner. Tests shall be performed in the presence of the Owners representative.

3.2 INSTALLATION:

A. Install sprinkler piping with a slope to valve room and to auxiliary low point drains as required by NFPA 13.

B. Coordinate sprinkler installation with building structure and other trades.

C. Route drains to outside building and terminate 9" AFG.

D. Verify locations of lights and diffusers prior to installing sprinkler heads and piping.

E. Sprinkler heads shall be installed on centerline with lights, diffusers, and doors, in living units. In lay-in tile ceiling the sprinkler heads shall be installed in the center of 2'x2' tiles and in the center of the half-tile in 2'x4' tiles.

F. Contractor shall purge air from all wet pipe sprinkler system piping prior to final system completion.

G. Provide return bends or flexible sprinkler head connectors in heated areas in order to allow for adjusting heads to centerline.

H. Install a spare sprinkler cabinet near the sprinkler riser. Provide number of spare sprinklers

as required by NFPA 13, with at least one spare for each type of head installed.

END OF SECTION 212010

SECTION 220110 – PLUMBING GENERAL PROVISIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

B. It is recognized that separate sub-contracts may be instituted by THIS CONTRACT'S GENERAL CONTRACTOR with others. It is the responsibility of THIS CONTRACT'S GENERAL CONTRACTOR to completely inform, coordinate and advise those sub-contractors of the requirements, conditions, and information associated with providing and installing their portion of the total job.

1.2 IMPOSED REGULATIONS:

A. Applicable provisions of the State and Local Codes and of the following codes and standards in addition to those listed elsewhere in the specifications are hereby imposed on a general basis for plumbing work. In each case, the prevailing edition shall be the current adopted edition of the state where the project is located.

1. International Plumbing Code.
2. International Gas Code.
3. International Energy Conservation Code.
4. International Fire Code.
5. NFPA 54

1.3 SCOPE OF WORK:

A. Provide all permits, labor, materials, equipment, tests, and supervision to construct complete and operable plumbing systems as indicated on the drawings and specified herein. All materials and equipment used shall be new, undamaged, and free from any defects.

1.4 EXISTING SERVICES AND FACILITIES:

A. Damage to Existing Services: Existing services and facilities damaged by the Contractor through negligence or through use of faulty materials or workmanship shall be promptly repaired, replaced, or otherwise restored to previous conditions by the Contractor without additional cost to the Owner.

B. Interruption of Services: Interruptions of services necessary for connection to or modification of existing systems or facilities shall occur only at prearranged times approved by the Owner. Interruptions shall only occur after the provision of all temporary work and the availability of adequate labor and materials will assure that the duration of the interruption will not exceed the time agreed upon.

C. Removed Materials: Existing materials made unnecessary by the new installation shall be removed, shall remain the property of the Owner and shall be stored at a location and in a manner as directed, or, if classified by the Owner's authorized representative as unsuitable for further use, shall become the property of the Contractor and shall be removed from the site.

1.5 PRODUCT WARRANTIES:

A. Provide manufacturer's standard printed commitment in reference to a specific product and normal application, stating that certain acts of restitution will be performed for the Purchaser or Owner by the manufacturer, when and if the product fails within certain operational conditions and time limits. Where the warranty requirements of a specific specification section exceed the manufacturer's standard warranty, the more stringent requirements will apply and modified manufacturer's warranty shall be provided. In no case shall the manufacturer's warranty be less than one (1) year.

1.6 PRODUCT SUBSTITUTIONS:

A. General: Materials specified by manufacturer's name shall be used unless prior approval of an alternate is given by addenda. Requests for substitutions must be received in the office of the Design Professional at least (10) days prior to opening of bids.

PART 2 - PRODUCTS

2.1 GENERAL PRODUCT REQUIREMENTS:

A. Standard Products: Provide not less (quality) than manufacturer's standard products, as specified by their published product data. In addition to the indication that a particular product/model number is acceptable, comply with the specified requirements. Do not assume that the available off-the-shelf condition of a product complies with the requirements; as an example, a specific finish or color may be required.

B. Uniformity: Where multiple units of a general product are required for the work, provide identical products by the same manufacturer, without variations except for sizes and similar variations as indicated.

C. Product Compatibility, Options: Where more than one product selection is specified, either generically or proprietarily, selection is Purchaser's or Installer's option. Provide adaptations as needed for interfacing of selected products in the work.

D. Equipment Nameplates: Provide a permanent operational data nameplate on each item of power operated equipment, indicating the manufacturer, product name, model number, serial number, speed, capacity, power characteristics, labels of tested compliance, and similar essential operating data.

E. Locate nameplates in easy-to-read locations. When product is visually exposed in an occupied area of the building, locate nameplate in a concealed position (where possible)

which is accessible for reading by service personnel.

PART 3 - EXECUTION

3.1 PRODUCT INSTALLATION, GENERAL:

A. Except where more stringent requirements are indicated, comply with the product manufacturer's installation instructions and recommendations, including handling, anchorage, assembly, connections, cleaning and testing, charging, lubrication, startup, test operation and shutdown of operating equipment. Consult with manufacturer's technical experts, for specific instructions on unique product conditions and unforeseen problems.

B. Protection and Identification: Deliver products to project properly identified with names, models numbers, types, grades, compliance labels and similar information needed for distinct identifications; adequately packaged or protected to prevent deterioration during shipment, storage, and handling. Store in a dry, well ventilated, indoor space, except where prepared and protected by the manufacturer specifically for exterior storage.

END OF SECTION 220110

SECTION 220120 - PLUMBING STANDARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

1.2 QUALITY ASSURANCE:

A. Industry Standards: It is a general requirement that plumbing work comply with applicable requirements and recommendations of standards published by listed agencies and trade associations, except to the extent more detailed and stringent requirements are indicated or required by governing regulations. Listing of Associations, Standards, and Abbreviations:

1.	AGA	American Gas Association 1515 Wilson Blvd. Arlington, VA 22209
2.	ASHRAE	American Society of Heating, Refrigerating & Air Conditioning Engineers, Inc. 1791 Tullie Circle, NE, Atlanta, GA. 30329
3.	AWS	American Welding Society, Inc. 2501 NW 7th St., Miami, FL 33125
4.	CISPI	Cast Iron Soil Pipe Institute 2020 K. St., NW, Washington, DC
5.	NEC	National Electrical Code by NFPA
6.	NEMA	National Electrical Manufacturers Association 1300 N 17th Street, Suite 1847 Rosslyn, VA 22209
7.	NFPA	National Fire Protection Association 407 Atlantic Ave., Boston, MA 02210
8.	UL	Underwriters' Laboratories, Inc. 207 st Ohio St., Chicago, IL 60611

PART 2 AND 3 - PRODUCTS AND EXECUTION (Not applicable)

END OF SECTION 220120

SECTION 220210 - PLUMBING COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

1.2 QUALITY ASSURANCE:

A. Plumbing Coordination Drawings: Prepare a set of coordination drawings showing the coordination of the major elements, components, and systems of the plumbing work, and showing the coordination of plumbing work with other work. Prepare drawings at accurate scale and sufficiently large to show locations of every item, including clearances for installing, maintaining, insulating, breaking down equipment, replacing motors and similar requirements. Prepare drawings to include plans, elevations, sections, and details as needed to conclusively show successful coordination and integration of the work. Submit drawings for review by the Design Professional.

B. Coordinate the actual location of all plumbing work visible in finished spaces with the Design Professional.

C. Plumbing Coordination Affidavit: Prior to ordering materials, provide the Coordination Affidavit required by Section 220220.

PART 2 - PRODUCTS

2.1 PRODUCT COORDINATION:

A. Power Characteristics: Refer to the electrical sections of the specifications and the electrical drawings for the power characteristics available for the operation of each power-driven item of equipment. The electrical design was based on the typical power requirements of the equipment manufacturers scheduled or specified. Any modifications to the electrical system which are required due to the use of an approved equivalent manufacturer shall be made at no additional cost to the owner. All changes must be clearly documented and submitted for review by the Design Professional prior to purchasing equipment. Coordinate purchases to ensure uniform interface with electrical work. The plumbing contractor shall furnish a detailed list of equipment electrical characteristics to the electrical contractor for the purpose of preparing the coordination affidavit required by Division 26.

B. Coordination of Options and Substitutions: Where the contract documents permit the selection from several product options, and where it becomes necessary to authorize a substitution, do not proceed with purchasing until coordination of interface of equipment has been checked and satisfactorily established.

C. Firestopping: Refer to architectural drawings for the locations of all fire rated ceilings, floors, and walls. The contractor shall furnish detailed shop drawings of all firestopping details to be used for both piping and ductwork. All firestopping details shall be U.L. listed and subject to approval by the Authority having jurisdiction.

PART 3 - EXECUTION

3.1 INSPECTION AND PREPARATION:

A. Substrate Examination: The Installer of each element of the work must examine the condition of the substrate to receive the work, and the conditions under which the work will be performed and must notify the Contractor in writing of conditions detrimental to the proper completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

B. Do not proceed with the installation of sleeves, anchors, hangers, roof penetrations and similar work until coordination drawings have been processed and released for construction. Where work must be installed prior to that time, in order to avoid a project delay, review proposed installation in a project coordination meeting including all parties involved with the interfacing of the work.

3.2 CUTTING AND PATCHING:

A. Structural Limitations: Do not cut structural framing, walls, floors, decks, and other members intended to withstand stress, except with the Design Professional's written authorization. Authorization will be granted only where there is not other reasonable method for completing the work, and where the proposed cutting clearly does not materially weaken the structure.

B. Where authorized, cut opening through concrete (for pipe penetrations and similar services) by core drilling or sawing. Do not cut by hammer-driven chisel or drill.

C. Other work: Do not endanger or damage other work through the procedures and processes of cutting to accommodate mechanical work. Review the proposed cutting with the Installer of the work to be cut and comply with recommendations to minimize damage. Where necessary, engage the original Installer or other specialists to execute the cutting in the recommended manner.

D. Where patching is required to restore other work, because of either cutting or other damage inflicted during the installation of plumbing work, execute the patching in the manner recommended by the original Installer. Restore the other work in every respect, including the elimination of visual defects in exposed finishes, as judged by the Design Professional. Engage the original Installer to complete patching of the following categories of work:

1. Exposed concrete finishes.
2. Exposed masonry.
3. Waterproofing and vapor barriers.
4. Roofing, flashing and accessories.
5. Interior exposed finishes and casework, where judged by the Design Professional to be

difficult to achieve an acceptable match by other means.

3.3 COORDINATION OF PLUMBING INSTALLATION:

A. General: Sequence, coordinate and integrate the various elements of plumbing work so that building systems will perform as indicated and be in harmony with other work of the building. The Design Professional will not supervise the coordination, which is the exclusive responsibility of the Contractor. Comply with the following requirements:

1. Install piping and similar services straight and true, aligned with other work and with overhead structures and allowing for insulation where applicable. Conceal where possible.
2. Arrange work to facilitate maintenance and repair or replacement of equipment. Locate services requiring maintenance on valves and similar units in front of services requiring less maintenance. Connect equipment for ease of disconnecting, with minimum of interference with other work.
3. Give the right-of way to piping systems required to slope for drainage (over other service lines). Piping shall be located to avoid interference with ductwork and light fixtures.
4. Piping shall not be routed above the outline of any electrical equipment. Contractor shall coordinate locations of electrical equipment with installation of piping.
5. Store materials off the ground and protected from standing water and weather.

B. Drawings: Conform with the arrangement indicated by the contract documents to the greatest extent possible, recognizing that portions of the work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, comply with the Design Professional's decision on resolution of the conflict.

C. Electrical Work: Coordinate the plumbing work with electrical work, and properly interface with the electrical service. In general, and except as otherwise indicated, install plumbing equipment ready for electrical connection. Refer to electrical sections of the specifications for electrical connection of plumbing equipment.

D. Utility Connections: Coordinate the connection of plumbing systems with exterior underground utilities and services. Comply with the requirements of governing regulations, franchised service companies and controlling agencies. Provide a single connection for each service except where multiple connections are indicated.

END OF SECTION 220210

SECTION 220220 - PLUMBING SUBMITTALS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

1.2 SUBMITTAL FORMS AND PROCEDURES:

A. The purpose of submittals is to demonstrate to the Design Professional that the Contractor understands the design concept. The Design Professional's review of such drawings, schedules, or cuts shall not relieve the Contractor from responsibility for deviation from drawings or specifications unless he has, in writing, called the Design Professional's attention to such deviations at the time of submission, and has received from the Design Professional, in writing, permission for such deviations. All submittals must be completely checked by the Contractor prior to submission for review.

B. Hard Copy Submittals: Submittal data shall be placed in one or more hard-back 3-ring binders, arranged and labeled according to specification section. Each binder shall contain a title page and table of contents. Provide separator tabs, and label by specification section. Make note in the table of contents, any drawings that accompany the submittal. Title page shall contain Project Name, Contractor's Name, Division 22 Superintendent's name, Suppliers, and point of contact for each, and date. Except as otherwise indicated in other sections, submit 5 complete copies. Quantity indicated does not include copies required for regulatory agencies.

C. Electronic Submittals: All electronic submittal files shall be organized to match the bid documents for specification section and name. Each submittal file shall be complete for each specification section. Multiple partial submittals per specification section will be rejected. Make note in the table of contents, any drawings that accompany the submittal. Title page shall contain Project Name, Contractor's Name, Division 22 Superintendent's name, Suppliers, and point of contact for each, and date.

D. Submittals shall be made for all items contained in the following specification sections:

1. Plumbing Coordination
2. Plumbing Identification
3. Plumbing Pipe, Tube, and Fittings
4. Plumbing Hangers and Supports
5. Domestic Water Piping System
6. Soil, Waste and Vent Piping System
7. Gas Piping System
8. Plumbing Piping Systems Insulation
9. Water Heaters
10. Plumbing Fixtures
11. Electric Water Coolers

12. Plumbing Coordination Affidavit (see Attachment No. 1 below)

E. Response to Submittals: A Submittal Review Report shall be issued by the Design Professional with the following classifications for each item:

1. **"No Exceptions Taken"**: No corrections, no marks. Contractor shall submit copies for distribution.
2. **"Make Corrections Noted"**: A few minor corrections. Items may be ordered as marked up without further resubmission. Submit copies for distribution.
3. **"Revise and Resubmit"**: Minor corrections. Item may be ordered at the Contractor's option. Contractor shall resubmit drawings with corrections noted.
4. **"Rejected"**: Major corrections or not in accordance with the contract documents. No items shall be ordered. Contractor shall correct and resubmit drawings.

PART 2 - PRODUCTS

2.1 SUBMITTAL REQUIREMENTS:

A. General: Each specification section shall list the required submittal items. All submittal items shall conform to the requirements listed below. For each major section of submittal data, include a summary page which lists items and model numbers for each piece of equipment.

B. Shop Drawings: Prepare shop drawings to accurate scale except where diagrammatic representations are specifically indicated. Show clearance dimensions of critical locations and show dimensions of spaces required for operation and maintenance of equipment. Show piping connections and other service connections and show interface with other work including structural support. Indicate by note, the portions of plumbing work shown on the shop drawings which deviated from the indication of work in the contract documents and explain the reasons for the deviations. Show how such deviations coordinate with interfacing deviations on shop drawings for other portions of the work, currently or previously submitted.

C. Manufacturer's Data: Where pre-printed data is submitted for more than one distinct product, size, type, material, trim, accessory group or other variation, mark submitted copy with black pen to indicate which of the variations is to be provided. Delete or mark-out significant portions of preprinted data which are not applicable. Where operating ranges are shown, mark data to show portion of range required for project application. Expansion or elaboration of standard data to describe a non-standard product must be processed as a shop drawing submittal. For each product include the manufacturer's production specifications, installation or fabrication instructions, nearest source of supply (including telephone number), sizes, weights, speeds, operating capacities, piping and service line connection sizes and locations, statements of compliance with required standards and governing regulation (include manufacturer's signed statements if not covered in printed data), performance data (where applicable) and similar information needed to confirm compliance with the requirements.

D. Certifications: Where specifically indicated, submit with notarized execution.

E. Test Reports: Submit test reports which have been signed and dated by the firm performing the test and prepared in the manner specified in the standard or regulation governing the test

procedures as indicated.

F. Manufacturer's Product Warranties: Where pre-printed and published warranty includes substantial deviation from required warranty (as judged by the Design Professional or Engineer), product is automatically disqualified from use on the project, except where manufacturer prepares and issues a specific product warranty on the product, stating that it is in lieu of the published warranty, and is executed by an authorized officer, and complies with the requirements. Warranties shall comply with the requirements of individual specification section where those requirements exceed the manufacturer's standard warranty.

PART 3 - EXECUTION

3.1 CLOSEOUT REQUIREMENTS:

A. Operating Instructions: Submit manufacturer's operating instructions for each item of plumbing equipment and supplement with additional project application instructions where necessary. Prepare and submit specific operating instructions for charging, start-up, control or sequencing of operation, phase, or seasonal variations, shut-down, safety and similar operational instructions. Prepare in typewritten form in completely explained and easily understood English language.

B. Maintenance Manuals: Organize each copy of the required system maintenance manuals to include an index followed by thumb-tab marked sections for each of the following:

1. System operating instructions.
2. Emergency instructions including addresses and telephone numbers of service sources.
3. Regular system maintenance procedures including lubrication.
4. Spare parts listing and stocking recommendations.
5. Inspection, adjusting, rebalancing, cleaning, parts replacement, and similar maintenance instructions and recommendations, including the proper use of tools and accessories.
6. Valve schedule and control diagram for each system.
7. Manufacturer's data for each operating item in each system.
8. Manufacturer's product warranties and guarantees relating to the system and equipment items in the system.
9. Corrected or approved issues of submittal items relating to the system.
10. Bind each maintenance manual in one or more vinyl-covered, 2", 3-ring binder, plus pocket-folder type binders for folded drawings, and mark the back spine of each binder with system identification and volume number.

C. Maintenance Materials: Deliver to Owner’s representative at the location as directed, in containers or packages suitable for storage and fully identified.

D. Guarantees: Where indicated as "Certified", provide guarantee which, in addition to execution by an authorized officer of each guarantor, is attested to by the Secretary of each guarantor and bears the corporate seal.

3.2 ATTACHMENT NO. 1 (Plumbing Coordination Affidavit):

A. The intent of Attachment Number 1 is to ensure that the electrical requirements for plumbing equipment have been reviewed and coordinated by the Contractor. No plumbing equipment shall be ordered, nor shall rough-in begin, before this coordination has taken place. This document shall be returned appropriately marked whether or not any changes are deemed to be necessary by the contractor.

END OF SECTION 220220

ATTACHMENT NO. 1

SHOP DRAWING COORDINATION AFFIDAVIT

I, the Division 22 Superintendent, certify that I have reviewed the plumbing shop drawings for electrically driven equipment and that the accompanying plumbing shop drawings reflect the requirements of the actual equipment to be furnished for use on this project. In addition, the electrical requirements of said equipment have been coordinated with the Division 26 contractor.

NOTE: If no deviations are required please indicate by circling the appropriate answer above your signature.

PROJECT: _____DEVIATIONS: Yes / No

COMPANY:_____

TITLE:_____SIGNATURE:_____

TELEPHONE:_____DATE:_____

FAILURE TO PERFORM THE WORK REQUIRED BY THIS AFFIDAVIT, PRIOR TO ORDERING MATERIALS OR ROUGHING-IN, MAY RESULT IN IMPROPER CONNECTIONS BEING PROVIDED. THE EXPENSE OF CORRECTIVE MEASURES, IF REQUIRED, SHALL BE BORNE BY THE CONTRACTOR.

SECTION 220230 - PLUMBING IDENTIFICATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

1.2 QUALITY ASSURANCE:

A. Manufacturers: Firms regularly engaged in the manufacture of identification systems required for this product.

B. Submittals: Submit manufacturer's data on materials and submit a sample of each type required.

PART 2 - PRODUCTS

2.1 PLUMBING IDENTIFICATION MATERIALS:

A. Plastic Pipe Markers:

1. General: Product manufacturer's standard pre-printed, flexible, or semi-rigid, permanent, color-coded, plastic-sheet pipe markers, complying with ANSI A13.1.
2. Small Pipe: For external diameters less than 6” (including insulation, if any), provide full band pipe markers, extending 360 degrees around pipe at each location, fastened by one of the following methods:
   a. Snap-on application of pre-tensioned semi-rigid plastic pipe marker.
   b. Adhesive lap joint in pipe marker overlap.
   c. Laminated or bonded application of pipe marker to pipe (or insulation).
   d. Taped to pipe (or insulation) with color-coded plastic adhesive tape, not less than 3/4” wide; full circle at both ends of pipe marker, tape lapped 1-1/2”.
3. Large Pipes: For external diameters of 6” and larger (including insulation, if any), provide either full-band or strip-type pipe markers, but not narrower than 3 x letter height (and of required length), fastened by one of the following methods:
   a. Laminated or bonded application of pipe marker to pipe (insulation).
   b. Taped to pipe (or insulation) with color-coded plastic adhesive tape, not less than 1-1/2” wide: full circle at both ends of pipe marker, tape lapped 3”.
4. Lettering: Comply with piping system names as specified, scheduled, or shown, and abbreviate only as necessary for each application length.
5. Arrows: Print each pipe marker with arrow indicating direction of flow, either integrally with piping system service lettering or as separate unit of plastic (to accommodate both directions).
6. Install pipe markers on piping of the following piping systems:
   a. Domestic Cold Water

b. Domestic Hot Water
c. Dom. Hot Water Return
d. Natural Gas

B. Plastic Tape: Manufacturer's standard color-coded pressure-sensitive (self-adhesive) vinyl tape, not less than 3 mils thick:

1. Width: Provide 1-1/2” wide tape markers on pipes with outside diameters including insulation of less than 6”, and 2-1/2” wide tape on larger pipes.
2. Color: Comply with ANSI A13.1.

C. Engraved Plastic-Laminate Signs:

1. General: Provide engraving stock melamine plastic laminated, 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.
2. Thickness: 1/16”, except as otherwise indicated.
3. Fasteners: Self-tapping stainless-steel screws, except contact type permanent adhesive where screws cannot or should not penetrate the substrate.

D. Valve Tags:

1. Valve tags shall be 18-gauge (minimum) brass with 1-1/4" (minimum) height and width. Identification letters and numbers shall be stamped in tag and shall be filled with black paint
2. Valve tags shall be attached to valve using cable ties. Cable ties shall be self-locking nylon ties.
3. Valve tags shall be installed at all shut-off, balancing, metering, and drain valves. Valve tag shape and designations shall be as follows:

Identification System	Shape	Numbers
Domestic Cold Water	Square	CW-1, 2, 3, ...
Domestic Hot Water	Square	HW-1, 2, 3, ...
Dom. Hot Water Return	Square	HWR-1, 2, 3, ...
Natural Gas	Octagonal	NG-1, 2, 3, ...

E. Valve Charts:

1. Valve charts shall be provided for plumbing systems. Charts shall be located in the main mechanical room.
2. Valve charts shall be typed listing all valve tags. List shall include identification number, valve location in system (e.g., Corridor 123, Water Heater WH-1, etc.) and its function (e.g., shut-off, balancing, drain, etc.). Charts shall be mounted in a wooden frame with glass cover.

2.2 LETTERING AND GRAPHICS:

A. General: Coordinate names, abbreviations and other designations used in the identification

work, with the corresponding designations shown, specified, or scheduled. Provide numbers, lettering recommended by manufacturers or as required for proper identifications and operation/maintenance of the systems and equipment.

B. Multiple Systems: Where multiple systems of the same generic name are shown and specified, provide identification which indicates the individual system number as well as the service.

PART 3 - EXECUTION

3.1 APPLICATION AND INSTALLATION:

A. Coordination: Where identification is to be applied to surfaces which require insulation, painting and other covering or finish, including valve tags in finished spaces, install identification after completion of covering or painting.

B. All equipment, valves, etc. located above ceiling grids shall be located with an engraved marker permanently attached to the ceiling grid. The marker shall describe the item located above the ceiling.

C. Piping System Identification: Install pipe markers on each system indicated to receive identification and include arrows to show normal direction of flow.

D. Locate pipe markers as follows wherever piping is exposed to view in mechanical rooms, accessible maintenance spaces (including accessible areas above ceilings) and exterior non-concealed locations:

1. Near each valve and control device.
2. Near each branch, excluding short take-offs for fixtures. Mark each pipe at branch, where there could be a question of flow pattern.
3. Near locations where pipes pass through walls, ceilings, or enter non-accessible enclosures.
4. Near major equipment items and other points of origination and termination.
5. Spaced intermediately at maximum spacing of 50’ along each piping run, except reduce spacing to 25’ in congested areas of piping and equipment.

E. Do not mark piping exposed in finished occupied spaces.

F. Plumbing Equipment Identification: Install an engraved plastic laminate sign on or near each major item of plumbing equipment and each operational device, as specified herein if not otherwise specified for each item or device. Provide signs for all major items of plumbing equipment.

G. Valve tags shall be attached to the valve handwheel with cable ties.

END OF SECTION 220230

SECTION 220240 - PLUMBING WORK CLOSEOUT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

1.2 DOCUMENTATION PROCEDURES:

A. Signed Commitments: Do not proceed with transfer of plumbing systems to the Owner for operation until warranties, performance certifications and similar commitments to be signed by Contractor and other entities have been executed and transmitted to Design Professional (for Owner's records).

1.3 RECORD DRAWINGS:

A. Explanation: Except where otherwise indicated, plumbing drawings (contract drawings) prepared by Design Professional, contract/drawings, are diagrammatic in nature and may not show locations accurately for various components of plumbing systems. Shop drawings, including coordination drawings, prepared by Contractor shall show certain portions of work more accurately to scale and location, and in greater detail.

B. General Recording Procedure: Maintain a white-print set, blue-line or black-line, of plumbing contract drawings and shop drawings in clean, undamaged condition, for mark-up of actual installations which vary substantially from the work as shown. Mark-up whatever drawings are most capable of showing the installed conditions accurately; however, where shop drawings are marked, record a reference note on appropriate contract drawing. Mark with erasable pencil and use multiple colors to aid in the distinction between work of separate systems. In general, record every substantive installation of plumbing work which previously is either not shown or shown inaccurately, but in any case, record the following:

1. Underground and aboveground piping, both exterior and interior, drawn to scale and fully dimensioned.
2. Plumbing "Project Record" shall be maintained as part of the "Project Record" specified in Division 1.

PART 2 – PRODUCTS

2.1 NOT APPLICABLE:

PART 3 - EXECUTION

3.1 CLOSEOUT PROCEDURES:

A. General Coordination: Sequence closeout procedures properly, so that work will not be endangered or damaged, and so that every required performance will be fully tested and demonstrated.

B. System Performance Test Run: At the time of plumbing work closeout, check each item in each system to determine that it is set for proper operation. With Owner's representative and Design Professional present, operate each system in a test run of appropriate duration to demonstrate compliance with performance requirements. During or following test runs, make final corrections or adjustments of system to refine and improve performances wherever possible, including noise and vibration reductions, elimination of hazards, better response of controls, signals and alarms, and similar system performance improvements. Provide testing or inspection devices as may be requested for Design Professional's observation of actual system performances. Demonstrate that controls and items requiring service or maintenance are accessible. Test run shall be scheduled to coincide with Design Professional's final inspection of the plumbing work.

C. Cleaning and Lubrication: After final performance test run of each plumbing system, clean system both externally and internally. Flush piping system by operating drains and similar means, and clean strainers and traps. Lubricate both power and hand operated equipment and remove excess lubrication. Touch-up minor damage to factory painted finishes and other painting specified as plumbing work; refinish work where damage is extensive.

D. General Operating Instructions: In addition to specified training of Owner's operating personnel specified in individual plumbing sections, and in addition to preparation of written operating instructions and compiled maintenance manuals specified, provide general operating instructions for the plumbing systems. Conduct a walk-through explanation and demonstration for orientation and education of Owner's personnel to be involved in continued operation of building.

1. Describe each basic system and how its control system functions, including flow adjustments, temperature control and similar operations.
2. Explain and point out identification system, displayed diagrams, signals, alarms and similar provisions of the work.
3. Describe basic sequencing requirements and interlock provisions for system start-up, phasing and shutdown.
4. Emphasize emergency procedures and safety provisions for protection of equipment and safety of occupants during equipment malfunction, disasters, power failures and similar unusual circumstances.
5. Outline basic maintenance procedures.

E. Demonstrate what adjustments have been made and can continue to be made to reduce noise and vibration, improve system output, decrease energy consumption and similar performance improvements.

F. Point out operational security provisions, safety, unavoidable hazards, and similar operator limitations. Display and conduct a "thumb-through" explanation of maintenance manuals, record drawings, meter readings and similar service items.

G. Construction Equipment: After completion of performance testing and Owner's operating instructions and demonstrations, remove installers tools, test facilities, construction equipment and similar devices and materials used in execution of the work but not incorporated in the work.

3.2 CONTINUED SYSTEM OPERATIONS:

A. Final Acceptance: At time of substantial completion of plumbing work, Owner's operating personnel will take over operation of plumbing systems. However, until time of final acceptance, respond promptly with consultation and services on whatever operation or maintenance problems may remain or arise.

END OF SECTION 220240

SECTION 220310 – PLUMBING PIPE, TUBE AND FITTINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

1.2 QUALITY ASSURANCE:

A. Industry Standards:

1. Qualify welding procedures, welders, and operators in accordance with ASME B31.1 for shop and project site welding of piping work.
2. Certify welding of piping work using the standard procedure specifications by, and welders tested under supervision of, the National Certified Pipe Welding Bureau.
3. Where plastic piping is indicated to transport potable water, provide pipe and fittings bearing approval label by the National Sanitation Foundation (NSF).
4. Press joint fittings shall be installed using the proper tool, actuator, jaws, and rings as instructed by the press fitting manufacturer. Installing contractor shall be familiar with the installation of press joint systems and qualified through training provided directly by the fitting manufacturer.

B. Submittals:

1. Submit manufacturer's data, welding certifications, press to connect fitting training certifications, test reports, and product warranties as applicable for all piping materials.
2. Grooved joint couplings and fittings and press joint fittings shall be shown on drawings and product submittals and be specifically identified with the applicable style number.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS:

A. General: Provide pipe and tube of the 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. Black Steel Pipe: ASTM A 53, Schedule 40.

C. Galvanized Steel Pipe: ASTM A 53, Schedule 40.

D. Copper Tube: ASTM B88-89 Type (wall thickness) as indicated for each service; hard-drawn temper, except as otherwise indicated. Solder for use on domestic water piping shall

be lead free type.

E. Copper Tube DWV: ASTM B 306-88 type.

F. Hubless Cast-Iron Soil Pipe: CISPI 301 or ASTM A 888 including standards for heavy duty coupling assembly ASTM C 564 and ASTM C 1540. Pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute and be listed by NSF.

G. Cast-Iron Hub-and-Spigot Soil Pipe: ASTM A 74 including ASTM C 564 and ASTM C1563 for compression gaskets. Pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute and be listed by NSF International.

H. Plastic Pipe:

1. PVC-WATER: ASTM D 1784; ASTM D 1785; ASTM D 2466.
2. PVC-DWV: ASTM D 1784; ASTM D 1785; ASTM D 2665.
3. CPVC-WATER: ASTM D 1784, ASTM D 2846, ASTM F 441 and ASTM F 442 with socket type solvent cement or threaded fittings and joints complying with ASTM F 437, ASTM F 438 and ASTM F 439.

I. Plastic Pipe - Natural Gas Service: Polyethylene: ASTM D2513.

2.2 PIPE/TUBE FITTINGS:

A. General: Provide factory-fabricated fittings of the type, materials, grade, class and pressure rating indicated for each service and pipe size. Provide sizes and types matching pipe, tube valve or equipment connections in each case. Where not otherwise indicated, comply with governing regulations and industry standards for selections, and with pipe manufacturer's recommendations where applicable.

B. Cast-Iron Threaded Fittings for Steel Pipe: ASTM A 126-84 Class 125, plain or galvanized to match pipe.

C. Welded Fittings for Steel Pipe: ASTM A 234.

D. Gaskets for Hub and Spigot Pipe and Hubless Couplings: ASTM C 564, and ASTM C 1540 for heavy duty couplings, ASTM C 1563 for compression gaskets, and CISPI 310 or ASTM C 1277 for standard duty couplings.

E. Soldering Materials: Except as otherwise indicated, provide soldering materials as determined by the Installer to comply with installation requirements.

1. Tin-Antimony Solder: ASTM B 32, Grade 95TA.

F. Copper Press Joint Fittings: Fittings 2” and smaller size shall be wrought-copper or cast copper alloy with EPDM-rubber, O-ring seal and inboard bead design in each end. Fittings 2-1/2”-4" size shall be wrought-copper fitting with EPDM-rubber, O-ring seal and inboard bead design in each end. Fittings shall be compatible with seamless K, L, or M copper tube made to ASTM B 88 and have a maximum non-shock working pressure of 200 PSI between the temperatures of -20 F and +250 F. Copper and copper alloy press fittings shall conform to

material requirements of ASME B16.18, ASME B16.22, or ASME B16.26 and performance criteria of ASME B16.51 and IAPMO PS 117.

G. Steel Press Joint Fittings: Fittings 2” and smaller shall be carbon steel with HNBR sealing element, 420 stainless steel grip ring and 304 stainless steel separator ring. Fittings 2-1/2”-4” size shall be carbon steel with HNBR sealing element and graphite separator ring. Fittings shall be designed specifically for gas and fuel oil applications with Schedule 5 to Schedule 40 carbon steel pipe and have a corrosion-resistant zinc nickel coating. Fittings shall have CSA LC-4, 125-psig pressure rating.

H. Primer for PVC and CPVC Joints: ASTM F 656.

I. Solvent Cement for PVC Joints: ASTM D 2564.

J. Solvent Cement for CPVC Joints: ASTM F 493.

K. Pipe Sleeves:

1. Iron Pipe Sleeves: Fabricate from Schedule 40 galvanized steel pipe; remove burrs.
2. Sheet Metal Pipe Sleeves: Fabricate from galvanized sheet metal closed with lock-seam joints. For following pipe sizes provide gauge indicated: 3” pipe and smaller, 20-gauge; 4” - 6” pipe, 16-gauge; over 6” pipe, 14-gauge.
3. Pipe Sleeve Caulking: 3M, except where another caulking system or material is specified or approved by Jaco or Flamestopper.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. General: Install pipe, tube, and 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 a minimum of 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" misalignment tolerance.
1. Comply with ASME B31.1 Code for Pressure Piping.
2. Comply with ASME B31.9 Code for Building Services Piping.

B. Locate piping runs as indicated on the drawings. Route vertically and horizontally (pitched to drain) and avoid diagonal runs wherever possible. 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 the shortest route which does not obstruct usable space or block access for servicing the building and its equipment. Where possible, locate insulated piping for 1" clearance outside insulation. Changes in direction shall be made with fittings.

C. Piping System Joints: Provide joints of the type indicated in each piping system.

D. Threaded Joints: Thread pipe in accordance with ANSI B2.12; 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.

E. Welded Joints: Weld pipe joints in accordance with recognized industry practice and as follows: Weld pipe joints only when ambient temperature is above 0 F. where possible. Bevel pipe ends at a 37.5-degree angle where possible, smooth rough cuts and clean to remove slag, metal particles and dirt. Install welding rings for butt welded joints. Use pipe clamps or tack-weld joints with 1" long welds; (4) welds for pipe sizes to 10". Build up welds with a stringer-bead pass, followed by a hot pass, followed by a cover or filler pass. Eliminate valleys at center and edges of each weld. Weld by procedures which will ensure elimination of unsound or unfused metal, cracks, oxidation, blow holes and non-metallic inclusions. Do not weld-out piping system imperfections by tack-welding procedures; refabricate to comply with requirements. Install forged branch-connection fittings wherever branch pipe is indicated or install regular "T" fitting (at Contractor's option).

F. Soldered Joints: Solder copper tube and fitting joints where required, 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 with steel wool. 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. Use a non-corrosive paste flux and wire solder composed of 95% tin and 5% antimony.

G. Press Joints: Press tube and fitting joints where required, in accordance with the manufacturer’s installation instructions. Cut tube ends squarely, ream to full inside diameter, and clean outside of tube ends and inside of fittings before assembly. The tubing end shall be clean and dry before being inserted into the fitting and the tubing marked at the shoulder of the fitting. The fitting alignment shall be checked against the mark on the tubing to assure the tubing is fully engaged (inserted) in the fitting. The joints shall be pressed using the tool(s) approved by the manufacturer.

H. Hubless Cast-Iron Joints: Comply with the manufacturer’s installation instructions, CISPI 310 and local code requirements.

I. Plastic Pipe/Tube Joints: Comply with manufacturer’s instructions and recommendations and with applicable industry standards. Install all storm, soil, waste, and vent plastic pipe underground in compliance with ASTM D 2321.

J. Insulating (Dielectric) Nipples: Comply with manufacturer's instructions for installing nipples in a manner which will prevent galvanic action and stop corrosion where the joining of ferrous and non-ferrous piping occurs.

K. Pipe Sleeves: Install pipe sleeves of the types specified wherever piping passes through the walls, floors, or structural members of the work. Provide sleeves of adequate size, accurately centered in pipe runs. Size sleeves so that piping and insulation will have free movement in the sleeve, including allowance for thermal expansion. Where insulation includes a vapor barrier covering provide sleeve with sufficient clearance for installation of vapor barrier. Install length of sleeve equal to thickness of construction penetrated, except extend floor sleeves 1/4” above floor finish. Provide temporary support of sleeves during placement of

concrete and other work around sleeves and provide temporary closure to prevent concrete and other materials from entering pipe sleeves.

1. Sleeve Type: At interior partitions and ceilings, install sheet metal sleeves.
2. Sleeve Type: At exterior penetrations both above and below grade, install iron pipe sleeves.
3. Sleeve Type: Except as otherwise specified, install steel pipe sleeves.
4. Caulk pipe sleeves at exterior penetrations and at other locations where indicated. Provide sufficient quantities of oakum and lead to make permanent weather-tight closure between sleeve and piping, slightly recessed at exposed surface.

L. PVC piping exposed to sunlight shall be coated with water-based latex white paint to prevent UV light degradation.

3.2 CLEANING, FLUSHING, AND INSPECTING:

A. General: Clean exterior surfaces of installed piping systems of superfluous materials and prepare for application of specified coatings.

B. Flush out piping system with clean water before proceeding with required tests. Inspect each run of each system for completion of joints, supports and accessory items.

3.3 PIPING TESTS:

A. General: Provide temporary equipment for testing, including pump and gages. Test piping systems 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. Required test period is (2) hours.

B. Unless otherwise specified for specific systems, hydraulically test each pressurized piping system at 150% of operating pressure indicated, but not less than 100-psig test pressure.

C. Observe each test section for leakage at end of test period. Test fails if leakage is observed or if pressure drop exceeds 5% of test pressure.

D. Repair piping systems sections which fail the required piping test, by disassembly and re-installation, using new materials to the extent required to overcome leakage. Do not use chemicals, stop-leak compound, mastics, or other temporary repair methods. Drain test water from piping systems after repair work and retesting has been completed.

END OF SECTION 220310

SECTION 220320 – PLUMBING HANGERS AND SUPPORTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

1.2 SUBMITTALS:

A. Provide manufacturer's data, test reports, and product warranties on all items.

PART 2 - PRODUCTS

2.1 HANGERS AND SUPPORTS:

A. General: Except as otherwise indicated, provide factory-fabricated piping hangers and supports of the type specified complete with bolts and washers. Comply with the manufacturer's published product information. Size hangers and supports properly for piping and weight of the medium being transported. Provide insulation shields for all insulated piping.

B. Hangers for domestic hot and cold water piping shall be copper plated band type with adjusting nut; Anvil, B-Line, Erico Caddy, PHD Manufacturing or Hubbard Enterprises/Holdrite.

C. Hangers for cast iron or plastic drain and vent piping, and natural gas piping shall be Clevis type, B-Line, Anvil, Erico Caddy, PHD Manufacturing or Hubbard Enterprises/Holdrite.

D. Piping installed above a roof shall be supported on prefabricated, non-penetrating supports by Pipe Pier, B-Line or Cooper. Provide matching adjustable elevation kits and method for positive attachment to roof.

PART 3 - EXECUTION

3.1 HORIZONTAL PIPING SUPPORT:

A. Maximum spacing of hangers and supports for above-ground horizontal pipe and tubing shall be in accordance with the applicable International Plumbing Code.

B. Prevent electrolysis in the support of copper tubing by the use of hangers and supports which are copper plated, or by other recognized industry methods.

C. Branch piping located in walls, partitions or pipe chases shall be rigidly supported inside the wall or chase.

D. Piping installed above a roof shall be supported on prefabricated, non-penetrating supports by Pipe Pier or approved equal. Provide matching adjustable elevation kits.

3.2 VERTICAL PIPING SUPPORT:

A. Maximum spacing of vertical supports for pipe and tubing shall be in accordance with the applicable International Plumbing Code.

B. Fixture Supports: See Fixture Schedule. Provide concealed supports and carriers recommended by the manufacturer of the fixtures and equipment to suit the structural and finish conditions.

3.3 ADJUSTMENT OF HANGERS AND SUPPORTS:

A. Adjust hangers and supports to bring piping to proper level, elevations, and slopes.

END OF SECTION 220320

SECTION 220330 – PLUMBING EXCAVATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

1.2 QUALITY ASSURANCE:

A. Coordination: Where excavation and backfill for plumbing work passes through or occurs in the same areas as work specified in the Division 02 sections, comply with both the requirements of the Division 02 sections and the requirements of this section, whichever is the more stringent (as determined by the Design Professional in cases of conflicting requirements).

1.3 JOB CONDITIONS:

A. Existing Utilities: Locate and protect existing utilities and other underground work in a manner which will ensure that no damage or service interruption will result from excavating and backfilling.

PART 2 - PRODUCTS

2.1 BACKFILL MATERIALS:

A. Subbase Material: A graded mixture of gravel, sand, crushed stone, or crushed slag.

PART 3 - EXECUTION

3.1 EXCAVATING:

A. Inspection: The excavator must examine the areas to be excavated, and the conditions under which the work is to be performed and notify the Contractor in writing of conditions detrimental to the proper completion of the work. Do not proceed with excavating until unsatisfactory conditions have been corrected in a manner acceptable to the excavator.

B. General:

1. Do not excavate until the work is ready to proceed without delay, so that the total time lapse from excavation to completion of backfilling will be minimum.
2. Provide signs, illuminations, and barricades as necessary to prevent accidents at

excavations.

3. Excavate with vertical sided excavations to the 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 the work or other property. Where not removed, cut sheeting off at a sufficient distance below finished grade to not interfere with other work.
4. Excavate for piping with 6" to 9" clearance both sides of pipe, except where otherwise shown or required for proper installation of pipe joints, fittings, valves, and other work. Provide a minimum of 12" clearance around underground tanks.
5. For work to be supported directly on undisturbed soil, do not excavate beyond required depths, and hand excavate the bottom cut to accurate elevations. Except as otherwise indicated, support the following work on undisturbed soil at the bottom of the excavations:
   a. Piping of 5" and less pipe/tube size.
   b. Cast-in-place concrete.
6. Where directed, excavate additional depth to reach satisfactory soil-bearing conditions. Backfill with subbase material, compacted as directed, to indicated excavation depth.
7. Except as otherwise indicated, excavate for exterior water-bearing piping so that the top of piping will not be less than 2'- 0" vertical distance below finished grade.
8. Store excavated material (temporarily) near the excavation, in a manner which will not interfere with or damage the excavation or other work.
   a. Retain excavated material which complies with the requirements for backfill material.
   b. Dispose of excavated material which is either in excess of quantity needed for backfilling or does not comply with requirement for backfill material.

3.2 DEWATERING:

A. Maintain dry excavations by removing 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 from being damaged by water, sediment, or erosion from or through excavations.

3.3 BASE PREPARATION:

A. Install subbase material to receive plumbing work and compact by tamping to form a firm base for the work. For piping, shape the subbase to fit the shape of the bottom 90 degrees of the cylinder, for uniform continuous support.

B. Shape subbases and bottoms of excavations with recesses to receive pipe bells, flanges connections, valves, and similar enlargements in the piping systems.

3.4 BACKFILLING:

A. Do not backfill until installed work has been tested and accepted, wherever testing is indicated.

B. Condition backfill material by either drying or adding water uniformly, to whatever extent

may be necessary to facilitate compaction to the required densities. Do not backfill with frozen soil materials.

C. Backfill simultaneously on opposite sides of work and compact simultaneously; do not dislocate the work from installed positions.

D. Backfill excavations in 8" high courses of backfill material, uniformly compacted to the following densities (percent of maximum density, ASTM Standard Proctor), using power-driven hand-operated compaction equipment.

1.	Lawn/Landscaped Areas:	90%
2.	Roadways:	95%
3.	Paved Area, Other than Roadways:	95%

E. Backfill to elevations matching adjacent grades, at the time of backfilling excavations for mechanical work.

F. 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 Design Professional.

3.5 PERFORMANCE AND MAINTENANCE:

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

END OF SECTION 220330

SECTION 221110 - DOMESTIC WATER PIPING SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

1.2 QUALITY ASSURANCE:

A. Code Compliance: Comply with governing regulations which require the products used for domestic water piping work to be selected from lists in certain published standards or codes as indicated therein.

1.3 SUBMITTALS:

A. Provide manufacturer's data, test reports, and product warranties as applicable for all items.

B. Provide certified copy of contractor’s sterilization test.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS:

A. General: Comply with section 220310 for product requirements of piping materials. For each service, provide the piping materials indicated including, pipe, fitting, hangers, supports, anchors, valves, and accessories. Where more than one type is indicated, selection is Installer's option. Where type is not otherwise indicated, provide materials complying with governing regulations.

B. Service Water Piping:

1. Pipe Sizes 4" and Smaller:	Copper tube or CPVC of the size indicated.
2. Wall Thickness:	Type K or Schedule 80 CPVC
3. Fittings:	Wrought copper-solder joint (with lead free solder). Schedule 80 CPVC joint (with solvent cement).

C. Water Distribution Piping:

1. Pipe Sizes 4" and Smaller:	Copper tube of the size indicated or CPVC.
2. Wall Thickness:	Type K (belowground) or Schedule 80 CPVC. Type L (above ground) or Schedule 80 CPVC. CTS CPVC is allowed for piping 2” and smaller.
3. Fittings:	Wrought copper-solder joint (with lead free solder).

Schedule 80 CPVC joint (with solvent cement).

2.2 ACCESSORIES:

A. General: Provide factory-fabricated piping products of the size, type, rating, and capacity indicated. Where not indicated, provide proper selection as determined by the Installer to comply with installation requirements. Provide sizes and types matching piping and equipment connections.

B. Watts is an approved manufacturer for water supply products.

C. Water Hammer Arrestors: Bellows type; precharged compressor chamber; stainless steel casing and bellows. Provide sizes complying with PDI Standard WH-201. Josam, Jay R. Smith, Watts, or Zurn.

D. Exterior Wall Hydrant HB/E: All brass freezeproof automatic draining type with stainless steel mounting wall box, adjustable packing nut, teflon impregnated packing, vacuum breaker with hose thread and loose key operated. Hydrants shall be Woodford, Jay R. Smith, Josam, Watts, Prier, or Zurn.

E. Roof Hydrant HB/R: Exposed, non-freeze roof hydrant, with coated cast iron head and lift handle with lock option, bronze interior parts, galvanized steel casing, and bronze valve housing. Roof hydrant shall be drainless type. Complete with coated cast iron roof support sleeve with wide anchoring flange and clamp collar. Hydrants shall be Zurn, Watts, Woodford, Prier, Jay R. Smith or Josam.

F. Domestic Water Piping Strainers: Strainers shall be a "Y" bronze body type with 20 mesh stainless steel screen, and threaded ends, rated for 250 psig wwp at 210 F. Strainers shall be Watts, Wilkins, Keckley, or Mueller.

G. Flow Control Valves: Valves for domestic hot water return shall have brass and stainless steel bodies, with integral ball valve, ground joint union, and solder ends. Valve shall be rated for 600 psig and flow rate, as shown on drawings. Flow control valves shall be Autoflow, Hays, or Griswold.

H. Thermostatic Balancing Valves: Valves for domestic hot water return shall be a self-acting thermostatic recirculation valve that automatically and continuously maintains the end of each domestic hot water supply line at the specified water temperature. Valve shall be stainless steel in construction and include set or adjustable temperature setpoints. Valve assembly shall include strainer and ball valves at each end. Valve temperature shall be set to match recirculating pump activation temperature. Thermostatic balancing valves shall be CircuitSolver, Caleffi, Jomar, Leonard, or Xylem.

I. Pressure Reducing Valves: Valves shall be bronze body construction with renewable seats and integral check valve and strainer. Pressure reducing valves shall be Caleffi, Watts, Wilkins, Zurn, or Conbraco.

J. Pressure Relief Valves: Valves shall be bronze construction engineered in accordance with the requirements of Section IV of the ASME Boiler and Pressure Vessel Code for Heating Boilers. Capacities shall be certified by the National Board of Boiler and Pressure Vessel Inspectors. Valves shall be Bell & Gossett, Taco, Watts, or Armstrong.

K. Check Valves: Valves 2” and smaller shall be bronze body with bronze seat and disc and shall be rated at 125 SWP, 200 W0G. Valves shall be Milwaukee, Nibco, Watts, Jomar, or Red-White.

L. Ball Valves: Ball valves shall have two-piece bronze or brass body, meeting MSS-SP110, full or standard port, blowout-proof stem and adjustable packing nut independent of handle. Valves shall be rated for 150 SWP, 600 WOG or 300 CWP. Valves shall be Apollo, Milwaukee, Nibco, Victaulic, Watts Smith-Cooper, Jomar, or Red-White.

M. Thermometers: Piping systems thermometers shall be the red-reading mercury filled adjustable angle type. Thermometers shall be adjustable to any angle through a 180-degree arc and shall be provided with a locking device. Where possible, thermometers shall be installed not higher than 8’ above finished floor. Final positioning of each thermometer shall be such that it is readable from the floor, and it shall be locked in that position. Thermometers shall have V-cast aluminum case with baked enamel finish and 9” scale. Thermometers shall be provided with separable sockets, and where installed on insulated pipes, sockets shall be extension neck type. Thermometer scale range shall be 30 to 300 F for hot water systems. Thermometers shall be Omega, Wika, Trerice, Winters or Weiss.

N. Pressure Gauges: Gauges shall be connected to the piping system with threaded brass pipe and fittings. Gauges shall be the flangeless type and shall have 4-1/2” dials, cast aluminum cases, stainless-steel, heavy-duty rotary gear movements, phosphor bronze bourdon tubes, forged brass rod sockets and tips, 1/2 % accuracy of scale range, plexiglass dial covers, and1/4” lower connections. Each gauge shall be provided with brass lever handle cock and a stainless-steel pulsation dampener. Provide compound gauges for locations which under negative pressure. Range for pressure gauges shall be selected so that the normal operating point for each application falls in the approximate midpoint of the gauge range. Gauges shall be Omega, Wika, Trerice, Winters or Weiss.

O. Access Panel: Access panels shall be 16-gauge steel door and frame with concealed hinge and vandal resistant latch. Panels shall be flush type. Access panel shall be Jay R. Smith, Watts, Zurn, Josam or Mifab.

P. Escutcheon Plates: Metal split-ring type units, with nickel or chrome plated finish. Provide units sized to fit closely outside of pipe insulation or bare pipe where no covering is required.

Q. Automatic Air Vents: Provide automatic float type air vents in locations indicated on the drawings. Units shall be suitable for a maximum working pressure of 75 psig and a maximum operating temperature of 240 F. Automatic air vents shall be Taco, Bell & Gossett, Amtrol, Wheatley or Armstrong.

R. Manual Air Vents: Vents shall consist of a1/4” gauge cock with soft drawn copper discharge tube.

S. Sheet-Metal Pipe Sleeves: Fabricate from galvanized sheet metal closed with lock-seam joints. For following pipe sizes provide gauge indicated: 3” pipe and smaller, 20-gauge; 4” – 6” pipe, 16-gauge; over 6” pipe, 14-gauge.

T. Pipe Sleeve Caulking: 3M Fire Barrier Caulk, CP25N/S, except where another caulking system or material is specified, or equivalent by Hilti or Tremco.

PART 3 - EXECUTION

3.1 INSTALLATION OF PIPING:

A. General: Comply with the requirements of section 220310 for installation of basic piping materials.

B. Expansion Compensation: Except as otherwise indicated, install piping, including mains, branches, and runouts with offsets to allow for free expansion and contraction sufficient to prevent leaks and over-stressing of the piping system.

C. Sterilization: The entire water distribution system shall be thoroughly sterilized with a solution containing not less than 50 parts per million of available chlorine. The chlorinating material shall be liquid chlorine conforming to Federal Specification BB-C-120. The sterilization solution shall be allowed to remain in the system for a period of 24 hours, during which time all valves and faucets shall be opened and closed several times. After sterilization, the solution shall be flushed from the system with clean water until the residual chlorine content is not greater than 0.2 parts per million. After completion of sterilization water samples shall be sent to the Local Health Department or Local Department of Public Health (LDH) for testing. Approval must be received from LDH before the system is put into service.

3.2 INSTALLATION OF ACCESSORIES:

A. Install premanufactured accessories in accordance with the manufacturer's instructions and recommendations.

B. Access Panel: Install access panels as shown on drawings. Paint access panels to match walls or ceilings.

C. Escutcheon Plates: Install escutcheon plates at pipe sleeves where piping is exposed to view in occupied spaces of the building, on the exterior and elsewhere as indicated.

D. Water Hammer Arrestors: Install units at the top of each riser or as otherwise indicated to comply with PDI Standard WH-201.

E. Air Vents: Install manual air vents at high points in the system and as shown on the drawings.

END OF SECTION 221110

SECTION 221210 - SOIL, WASTE, VENT AND STORM PIPING SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

1.2 SUBMITTALS:

A. Provide manufacturer's data, test reports, and product warranties as applicable for all items.

1.3 QUALITY ASSURANCE:

A. Industry Standards: Comply with local regulations, the International Plumbing Code and standards established by the Plumbing and Drainage Institute (PDI) pertaining to floor drains.

B. General: Provide factory-fabricated drainage piping products of the size and type indicated. Where not indicated, provide proper selection as determined by the Installer to comply with the installation requirements and governing regulations. Contractor shall coordinate drainage products selected with finish conditions encountered.

C. Cast Iron Pipe: All cast iron soil pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute (CISPI) and be listed by NSF International.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS:

A. General: Comply with section 220310 for product requirements of piping materials. For each service, provide the piping materials indicated, including pipe, fittings, joints, hangers, supports, anchors, and accessories. Where type is not otherwise indicated, provide materials complying with governing regulations.

B. Watts, Mifab, and Wade are approved manufacturers for drainage products.

C. Soil, Waste and Vent Piping (Belowground):

1. Schedule 40 PVC or PVC-DWV solid core pipe and fittings. Joints shall be solvent cement socket type.
2. Service weight cast iron hub and spigot pipe and fittings, ASTM A74. Joints in underground cast iron piping shall be made using an ASTM-C564 neoprene elastomeric compression gasket conforming to the requirements of ASTM C 1563.

D. Soil, Waste Drain and Vent Piping (Above Ground):

1. Schedule 40 PVC or PVC-DWV solid core pipe and fittings. Joints shall be solvent cement socket type above ground. If PVC or PVC-DWV pipe and fittings are used aboveground all penetrations of rated walls, floors, and assemblies shall be protected in an approved manner, including penetrations of one side of an assembly.
2. Hub less cast iron pipe and fittings conforming to CISPI 301 or ASTM A888. Joints in above ground cast iron shall be made using heavy-duty ASTM C 1540 and ASTM C 564 stainless steel no-hub couplings or cast iron no-hub couplings.
3. Galvanized steel pipe with threaded cast iron fittings or DWV Type copper pipe with solder joint fittings may be used for waste and vent piping 1-1/2” and 1-1/4” in size.

2.2 FLOOR DRAINS:

A. Drains installed in waterproofed floors shall be provided with flashing clamps.

B. Floor Drain FD-A: shall be a ligature resistant floor drain designed with an internal gusset system. Floor drain shall have 6” round top strainer head with ligature resistant 304 stainless steel strainer with 6 strainer slots, adjustable height nickel bronze strainer head, reversible flashing, vandal resistant screws, and ligature resistant baffle. Drains shall be Whitehall, Cape Cod, or Willoughby.

C. Floor Drain FD-B: shall have a coated cast iron body with integral pipe stops, flashing collar, seepage flange, sediment bucket, vandal-proof screws and 9” diameter round Nikaloy strainer with raised flange. Where indicated on the drawings, drain shall have a trap primer connection. Drains shall be Jay R. Smith, Josam, Watts, or Zurn.

2.3 CLEANOUTS:

A. Cleanout plugs shall be cast bronze or brass countersunk type with taper threads complying with ANSI B2.

B. Cleanouts on underground drainage shall have piping extended to the floor and finished with cleanout plug and removable floor plate.

C. Cleanouts shall be the same size as the pipe on which installed, except cleanouts on underground piping shall be a maximum of 4".

D. Cleanouts in waterproofed floors shall have flashing clamp.

E. Cleanouts in carpeted floors shall be provided with a carpet marker.

F. Concrete Floors: Cleanouts shall have cast iron body with integral pipe stop, adjustable round scoriated nickel bronze cover and rim, vandal-proof securing screw, and countersunk bronze plug. Cleanouts shall be Jay R. Smith, Josam, Zurn, or Watts.

G. Quarry Tile or Ceramic Tile Floors: Cleanouts shall have cast iron body with integral pipe stop, adjustable square scoriated nickel bronze cover and rim, vandal-proof securing screw, and countersunk bronze plug. Cleanouts shall be Jay R. Smith, Josam, Zurn, or Watts.

H. Resilient Tile Floors: Cleanouts shall have cast iron body with integral pipe stop, adjustable square nickel bronze cover recessed for tile, vandal-proof securing screw, and countersunk bronze plug. Cleanouts shall be Jay R. Smith, Josam, Zurn, or Watts.

I. Exterior Areas: Cleanouts to grade shall have cast iron body with integral pipe stop, heavy duty round cast iron tractor cover with vandal-proof screw, and countersunk bronze plug. Cleanouts shall be Jay R. Smith, Josam, Zurn, or Watts.

J. Wall Cleanouts: shall consist of a threaded recessed tapped cleanout tee with tapered thread bronze plug, vandal-proof securing screw, and round stainless-steel wall plate. Cleanouts shall be Jay R. Smith, Josam, Zurn, or Watts.

2.4 DRAINAGE ACCESSORIES:

A. Flashing for Plumbing Vent Piping Passing Through Roofs: Unless otherwise indicated, flashing for plumbing VTR's shall be Stoneman "Stormtite" Model S1000-4, open top, 4-pound seamless lead flashing assembly or equivalent. Install flashing in accordance with manufacturer's instructions.

B. Escutcheon Plates: Metal split-ring type units, with nickel or chrome plated finish. Provide units sized to fit closely outside of pipe insulation or bare pipe where no covering is required.

C. Inline Floor Drain Trap Sealer: Provide trap sealer with ASB plastic body, keeper pin neoprene rubber diaphragm and sealing gasket. Trap sealer unit shall comply with the requirements of ASSE 1072. Basis of design is Sure Seal.

PART 3 - EXECUTION

3.1 INSTALLATION OF PIPING:

A. General: Comply with the requirements of section 220310 for installation of basic materials.

B. Testing: The piping of the soil, waste and vent system shall be tested with water before installing fixtures. Water test shall be applied to the soil, waste, and venting system either in its entirety or in sections. If the test is applied to the entire system, all openings in the piping shall be closed except the highest opening, and the system shall be filled with water to the point of overflow. If the system is tested in sections, each opening of the section under test shall be plugged and each section shall be filled with water and tested with at least a 10’ head of water. In testing successive sections, at least the upper 10’ of the next preceding section shall be tested so that each joint or pipe in the building except the upper most 10’ of the system has been submitted to a test of at least 10’ head of water. The water shall be kept in the system, or in the portion under test, for at least (30) minutes before the inspection starts; the system shall be tight at all joints. Joints that fail the test shall be remade and retested.

C. Protection: The installer of drains shall advise the Contractor of required protection for the drains during the remainder of the construction periods, to avoid clogging with construction materials and debris to prevent damage from traffic and construction work.

D. During construction all pipe openings shall be capped or plugged, when not being worked on, to prevent foreign objects and construction debris from entering system.

E. Horizontal drainage piping 2-1/2" and smaller shall be graded at a minimum of 1/4” per foot, unless noted otherwise. Horizontal drainage piping 3" and larger shall be graded at a minimum of 1/8” per foot, unless noted otherwise.

F. All underground plastic soil, waste and vent and storm drainage piping shall be installed in compliance with ASTM D2321.

3.2 INSTALLATION OF ACCESSORIES:

A. Install escutcheon plates at pipe sleeves where piping is exposed to view in occupied spaces of the building, on the exterior and elsewhere as indicated.

B. Cleanouts in vertical piping shall be roughed-in with the centerline 18" above the finished floor.

C. Install drains in accordance with manufacturer’s written instructions and in locations indicated.

D. Coordinate with soil and waste piping as necessary to interface drains with drainage piping system.

E. Install drain flashing collar or flange so that no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes, where penetrated.

F. Install drains at low points of the surface areas to be drained. Set tops of drains flush with finished floor or deck.

G. The installer shall advise the General Contractor of required protection for drains and cleanouts during the remainder of the construction period, to prevent damage from traffic and construction work.

H. After installation, cover the tops of drains with duct tape or some other strong material during the remainder of the construction process, to avoid clogging with construction materials and debris.

I. Install floor drains with inline trap seal devices.

END OF SECTION 221210

SECTION 221410 - GAS PIPING SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

1.2 SUBMITTALS:

A. Provide manufacturer's data, test reports, and product warranties as applicable for all items.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS:

A. General: Comply with the Section 220310 for product requirements of piping materials. For each service, provide the piping materials indicated including pipe, tube, fittings, hangers, supports, anchors, valves, and accessories. Where more than one type is indicated, selection is Installer's option.

B. Above Ground: Schedule 40 black steel pipe of the size indicated with Class 150 malleable iron threaded fittings, Class 150 welded fittings or steel press joint fittings.

C. Below Ground: Plastic pipe and fittings conforming to ASTM D2513, Grade 2406.

2.2 ACCESSORIES:

A. Gas Pressure Regulators: shall be a locking type, diaphragm actuated with cast iron body, aluminum diaphragm chamber, and all internal parts designed for use with natural gas. Regulators shall be adjustable, with automatic loading, automatic low pressure cut-off, and full internal relief. The regulator shall be adjusted for outlet pressure indicated on the drawings. The outlet pressure shall not vary more than 1” w.c. from the set point at specified capacity. The regulator shall be capable of complete shut-off in the event the supply pressure is interrupted or the gas demand exceeds the regulator capacity and shall remain off until the regulator is manually reset. The regulator shall have a weatherproof, bug proof, screened vent cap installed in the vent tapping. Regulators shall be:

1. Regular:
   a. Sensus (Rockwell)
   b. Fisher
   c. Singer
   d. Maxitrol
   e. Pietro Fiorentini

2. With Full Relief:
    a. Sensus (Rockwell)
    b. Fisher
    c. Singer
    d. Maxitrol
    e. Pietro Fiorentini

B. Plug Valves: Valves shall have iron body (semi-steel) lubricated type cast bronze plug, and threaded ends rated for 175 psig W.O.G. working pressure. Plug valves shall be Nordstrom, Rockwell, Walworth, Homestead, or Powell.

C. Shutoff Valves: Valves 2" and smaller shall be ball valves. Valves shall have threaded inlet and outlet connections, two-piece brass body, meeting MSS-SP110, full or standard port, blowout-proof stem, and adjustable packing nut independent of handle. Valves shall be ASME B16.44 and UL listed for use with gas. Valve shall be rated for 250 psi, 600 CWP. Valves shall be by Maxitrol, Apollo, Hays, Milwaukee, Nibco, or Watts.

D. Flexible Hoses: Provide flexible hose connector(s) as indicated on the contract drawings or as required to accommodate any thermal expansion, contraction, or seismic movement of the piping system. Flexible hose connectors shall be capable of compensating for lateral movement and vibration. Flexible hose connectors shall be manufactured complete with section of stainless-steel corrugated metal hose, stainless steel compatible braid, with inlet and outlet connections as required. Fitting materials of construction and end fitting type shall be consistent with pipe material and equipment/ pipe connection fittings. Copper fittings shall not be attached to stainless-steel hose. For flammable liquid or gas service up to 4", flexible hose connector shall be CSA / AGA certified. Flexible hose connector(s) shall be rated with an operating pressure of 750 psi and shall be based on burst pressure with a 4 to 1 safety factor. Hoses shall be Metraflex, Southeastern Hose, or Twin City Hoses.

PART 3 - EXECUTION

3.1 INSTALLATION OF PIPING SYSTEM:

A. General: Comply with the requirements of the Section 220310 for installation of basic piping materials. Install piping products in accordance with manufacturer's written instructions, and in accordance with recognized industry practices to ensure that products serve the intended function.

B. Use sealants on metal gas piping threads which are chemically resistant to natural gas. Use sealants sparingly and apply to only male threads of metal joints.

C. Remove cutting and threading burrs before assembling piping.

D. Do not install defective piping or fittings. Do not use pipe with threads which are chipped, stripped, or damaged.

E. Plug each gas outlet, including valves with a threaded cap or plug immediately after installation and retain until continuing piping or equipment connection is completed.

F. Ground gas piping electrically and continuously within project, and bond to grounding electrode.

G. Install drip-legs in gas piping at regulator station and other low points in the system.

H. Grade horizontal lines 1/4” in 15’ to drip-legs.

I. Support piping in accordance with the International Gas Code.

J. Plastic pipe joints shall be made using the heat-fusion method.

K. For welded pipe, the contractor shall provide test weld piping coupons for review and approval by the owner’s representative prior to commencing welding of gas piping.

L. Protection of Gas Piping Against Corrosion: Protect metal gas piping in contact with the earth, or other corrosive material, against corrosion. Protect pipe with corrosion-resistant pipeline coating over a rubber-based primer by Polyken. Joints shall be primed and wrapped with Foster Cold-Applied Pipeline Joint Tape.

M. Install underground piping with a minimum 18” of cover. Trench shall be graded to provide a firm, continuous bearing for pipe. Connections between plastic pipe and steel pipe shall be made only outside, underground, and with approved transition fittings.

N. Coordinate with gas utility company as necessary to interface gas distribution piping with gas service supply work.

O. Painting: All exposed metal gas piping outside the building shall be made free of rust, cleaned, primed and painted with a minimum of two coats of paint. All gas piping outside the building shall be painted dark gray enamel. All gas piping inside the building shall be painted yellow enamel.

3.2 EQUIPMENT CONNECTIONS:

A. General: Connect gas piping to equipment in accordance with the equipment manufacturer's instructions. Provide ground joint union and accessible cut-off valve at each connection to equipment.

3.3 FIELD QUALITY CONTROL:

A. Fuel Gas Piping Tightness Test: Prior to initial operation, test gas distribution piping system with air or inert gas at 3 psig or two times operating line pressure, whichever is greater. Do not use oxygen for tests.

B. Repair or replace fuel gas piping as required to eliminate leaks and retest as specified to demonstrate compliance.

END OF SECTION 221410

SECTION 221610 – PLUMBING PIPING SYSTEM INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

1.2 SCOPE:

A. Plumbing piping systems to be insulated include:

1. Domestic Hot and Cold Water Piping, Above Ground

1.3 QUALITY ASSURANCE:

A. Manufacturers: Provide insulation products produced by one of the following for each type and temperature range of insulation: Certainteed, Knauf, Johns Manville, Owens-Corning, Pittsburgh Corning, or Manson.

B. Flame/Smoke Ratings: Provide composite piping insulation (insulation, jackets, covering, sealers, mastics, and adhesives) with flame-spread rating not exceeding 25 and smoke developed rating not exceeding 50, as tested by ASTM E 84 (NFPA 255) method and UL 723.

1.4 SUBMITTALS:

A. Provide manufacturer's data, test reports, and product warranties for all items.

PART 2 - PRODUCTS

2.1 PIPE INSULATION:

A. Fiberglass Insulation: Insulation shall be preformed, two-piece, heavy density fiberglass with self-sealing ASJ facing conforming to ASTM C 547. Valves and fittings shall be insulated with fiberglass insulation of the same material thickness as insulation on adjacent pipe and having a molded PVC jacket. Jackets shall be Certainteed, Knauf, or Zeston. Insulation thickness shall be as follows:

1. Domestic Cold Water Piping: 1” thick for all sizes.
2. Domestic Hot Water Piping: 1” thick for all sizes up to and including 1¼” in size.
3. Domestic Hot Water Piping: 1-1/2” thick for all sizes greater than 1-1/4” in size.

B. Aluminum Jacket: Corrugated, embossed or smooth sheet, 0.016” nominal thickness, ASTM B 209, temper H14, type 3003, 5005 or 5010. Provide stainless steel bands, minimum width of 1/2”.

PART 3 - EXECUTION

3.1 APPLICATION REQUIREMENTS:

A. General: Insulate all above ground domestic hot and cold water piping except do not insulate supplies to fixtures unless specifically required. Insulate horizontal waste lines receiving the discharge from HVAC drains.

B. Aluminum jackets shall be provided on all exterior insulated pipes.

C. In high abuse areas such as janitor closets and traffic areas in equipment rooms, kitchens and mechanical rooms aluminum jackets shall be provided. Pipe insulation to the 6’ level shall be protected.

3.2 INSTALLATION OF PIPING INSULATION:

A. General: Install insulation products in accordance with the manufacturer's written instructions, and in accordance with recognized industry practices to ensure that the insulation serves its intended purpose. Do not use cut pieces or scraps abutting each other.

B. Insulation shall be applied on clean dry surfaces. All insulation shall be continuous through wall and ceiling openings and sleeves. Insulation on all cold surfaces, where vapor barrier jackets are used, will be applied with continuous unbroken vapor seal. Seal off ends of insulation on cold piping systems with white vapor barrier coating at valves, flanges, supports and exposed ends. Supports that are secured to cold surfaces shall be insulated and vapor sealed to prevent condensation.

C. Pipe covering protection shields shall be provided around exterior of pipe insulation at pipe hangers which fit around pipe insulation. Shields shall be 12” long by 180 degrees and shall be 18-gauge galvanized steel sheet. High density isolation inserts shall be provided at pipe saddles.

D. Unions shall not be insulated.

E. Cover valves, flanges, fittings, and similar items in each piping system.

F. Extreme care shall be taken to insure a neat, uniform exterior surface on insulation applied to exposed pipes. Insulation in finished areas shall be painted in accordance with the paint specifications.

3.3 PROTECTION AND REPLACEMENT:

A. Replace damaged insulation which cannot be repaired satisfactorily, including units with

vapor barrier damage and moisture saturated units.

B. Protection: The installer of the insulation shall advise the Contractor of required protection for the insulation work during the remainder of the construction period, to avoid damage and deterioration.

END OF SECTION 221610

SECTION 222210 – WATER HEATERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

1.2 QUALITY ASSURANCE:

A. Industry Standards:

1. Provide electric water heaters which have been listed and labeled by Underwriters' Laboratories.
2. Comply with National Electrical Code (NFPA 70) as applicable to installation and connection to electric water heaters.
3. Provide water heaters which have been listed and labeled by National Sanitation Foundation (NSF).
4. Provide water heaters with safety relief valves bearing ASME valve markings, all heaters.
5. Comply with American Gas Association (AGA) as applicable to certification of gas-fired water heaters.
6. Heaters(s) shall meet the requirements of ASHRAE 90.1, state energy requirements, and the BOCA Energy Conservation Code.
7. Coordinate power requirements of water heaters and accessories with electrical drawings and specifications.

1.3 SUBMITTALS:

A. Provide manufacturer's data, test reports, certifications, and product warranties on all items.

PART 2 - PRODUCTS

2.1 GAS-FIRED WATER HEATERS:

A. Commercial High Efficiency Gas Water Heaters: Water heater(s) shall have storage and recovery capacities indicated on plans. Water heater shall be gas fired commercial type with glass lined steel tank, non-CFC foam or fiberglass insulation, and enameled jacket. The heater shall be provided with replaceable magnesium anode rod(s) to protect against electrolytic corrosion, draft diverter, flue damper, anti-scale build-up protection device, dielectric connection fittings, ASME temperature and pressure relief valve, drain valve, and hand hole access. Water heater shall include a power burner, electronic flame monitoring with direct spark ignition, and low water cut-off. Voltage shall be 120-volt, 1-phase, 60 Hz. The water heater shall be CSA certified, meet or exceed the energy requirements of ASHRAE, have a minimum rated working pressure of 150 psi, and shall have manufacturer’s

standard 3-year limited warranty. Water heaters shall be A.O. Smith, Bradford White, or Rheem-Ruud.

2.2 ACCESSORIES:

A. Domestic Hot Water Circulation Pump: Pump shall be the in-line centrifugal type designed for 125 psi working pressure with stainless steel body and impeller, mechanical seals. and stainless-steel impeller shaft. The pump motor shall be the open drip-proof design with sleeve bearings, built-in thermal over-load protectors, and shall operate at 1750 RPM. Pump shall have the capacities as shown on the drawings. Pump shall be Bell & Gossett - Booster Series, Taco - Circulation Series, Thrush - Circulator Series, or Grundfos - UP Circulator Series.

B. Gas Vents: Gas vents for high efficiency gas-fired water heaters shall be as recommended by the water heater manufacturer. Provide with the manufacturer's concentric vent kit accessory.

C. Thermal Expansion Tanks: Provide bladder type captive air expansion tanks with tank volume as indicated on the drawings. The shell shall be fabricated steel designed and constructed per ASME Section VIII. Tanks shall be suitable for potable water systems and maximum working pressure of 125 psig and a maximum operating temperature of 240 F. Tanks shall be by Taco, Amtrol, Watts, Proflo, Zilmet or Wheatley.

D. Vacuum Relief Valve: Provide a vacuum relief valve for automatic venting of a closed system to atmosphere when a vacuum is created. Valve shall be tested and rated under ANSI Z21.22. Vacuum relief valves shall be a Watts LFN36, Cash-Acme FRM-V, or Wilkins VR10XL.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Install water heaters and accessories where shown, in accordance with equipment manufacturer's written instructions and with recognized industry practices. Comply with requirements of state and local codes and applicable NFPA and ASME Boiler and Pressure Vessel Code Standards.

B. Flush water heaters upon completion of installation in accordance with manufacturer's instructions.

C. Start-up water heaters in accordance with manufacturer's written procedures, upon completion of heater installation and demonstrate compliance with requirements.

D. Venting of fuel fired appliances shall be in accordance with manufacturer's requirements and applicable codes and standards.

E. Condensate from condensing water heaters shall be treated and discharged to the sanitary system in accordance with the manufacturer's instructions.

3.2 FIELD QUALITY CONTROL:

A. Test assembled water heater and accessories in accordance with applicable sections of ASME Boiler and Pressure Vessel Code.

3.3 BALANCING:

A. Balance the hot water return system(s) to provide the water flowrates required on the drawings. To the greatest extent possible, balance the system using manual balancing valves located at the pump. The Design Professional shall be notified five days in advance of the time when balancing readings will be taken so that he may observe the readings if he so desires. After balancing is complete, submit a typed report indicating the pump identification/ number, manufacturer model number and serial number, verification of proper impeller rotation, design and actual water flow, final design and actual total dynamic head in psi and ft. hd. for each pump in the system.

END OF SECTION 222210

SECTION 223110 - PLUMBING FIXTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

1.2 QUALITY ASSURANCE:

A. Industry Standards: Comply with ANSI Standards pertaining to plumbing fixtures and systems.

B. Comply with ANSI A117.1 standard pertaining to plumbing fixtures for handicapped.

C. Comply with standards established by Plumbing and Drainage institute (PDI) pertaining to plumbing fixture supports.

D. Comply with applicable Federal Standard FS WW-P-541/Series sections pertaining to plumbing fixtures.

PART 2 - PRODUCTS

2.1 PLUMBING FIXTURES:

A. General: Provide factory-fabricated fixtures of the type, style and material indicated. For each type of fixture, unless otherwise specified, provide fixture manufacturer's standard trim, carrier seats and valves as indicated by their published product information, either as designed and constructed, or as recommended by the manufacturer, and as required for a complete installation. Where more than one type or manufacturer is indicated, selection is Installer's option.

2.2 MATERIALS:

A. General: Unless otherwise specified, comply with applicable Federal Specification WW-P-541/series sections pertaining to plumbing fixtures, fittings, trim, metals, and finishes. Comply with requirements of WW-P-541/specification relative to quality of ware, glazing, enamel, composition and finish of metals, air gaps and vacuum breakers, even though some plumbing fixtures specified in this section are not described in WW-P-541.

B. Unless otherwise specified, faucets shall comply with National Sanitation Foundation International NSF Standard 61, and where applicable NSF Standard 61, Section 9. Faucets shall be NSF certified and bear the NSF mark.

C. Provide materials which have been selected for their surface flatness and smoothness. Exposed surface which exhibit pitting, seam marks, roller marks, foundry sand holes, stains, discoloration, or other surface imperfections on finished units are not acceptable.

D. Where fittings, trim, and accessories are exposed or semi-exposed, provide bright chrome-plated or polished stainless-steel units.

E. Comply with additional fixture requirements contained in the fixture schedule.

F. The basis of design for each fixture shall be shown below Plumbing Fixture Schedule. Equivalent name brand equipment that meets performance, capacity, space, and other requirements of the design documents shall be accepted.

1. The following manufacturers are approved for all mop sinks and laundry sinks: Fiat, Swan, Zurn, and Proflo.
2. The following manufacturers are approved for all can wash, mop sink, and laundry sink faucets: Fiat, Swan, Zurn, Chicago, and T & S Brass.
3. The following manufacturers are approved for all connection boxes (ice maker, washing machine, dishwasher, and condensate): Oatey, Sioux Chief, Guy Gray, Water Tite, and Acorn.
4. The following manufacturers are approved for all security and anti-ligature fixtures: Whitehall, Acorn, Bradley, and Willoughby.

G. Flush valves shall be the size, roughing height, and flow rate specified hereinafter for each fixture. Flush valve shall be piston or diaphragm actuated type with chrome plated exterior, angle stop with cover, vacuum breaker, adjustable tailpiece, and cast escutcheon with setscrew.

H. Carriers shall be commercial grade and selected to match the fixtures for which they are used. Carriers shall be floor mounted and designed to transfer any fixture loading to the floor and not the wall unless specified otherwise. Carriers provided for wall hung urinals shall be two plate type. Carriers for wall hung water closets and urinals shall be provided with chrome plated mounting hardware.

I. Fixture stops shall be provided for all fixtures and shall be chrome plated with cast escutcheons with set screws. Stops for flush valves shall be by the flush valve manufacturer. Stops for shower valves shall be either angle or straight type and shall be concealed behind the shower cover plate. Stops for lavatories and sinks shall be loose key or wheel handle type as specified for each fixture, and stops shall be only from those manufactures listed for each fixture. The following manufacturers are approved for fixture supplies: McGuire, Zurn, Sloan, Watts, and Brass Craft.

J. Fixture drains shall be by the same manufacturer as the lavatory and sink faucets, with a matching finish. Lavatory and sink drains shall be pop-up, grid, or crumb cup type as specified for each fixture. Drains shall be chrome plated brass or stainless-steel unless noted otherwise. Drain tailpieces shall be minimum 17-gauge chrome plated cast brass. The following manufacturers are approved for fixture drains: McGuire, Zurn, Sloan, and Watts.

K. All p-traps, continuous wastes and fixture drain piping shall be 17-gauge chrome plated cast brass and of the size indicated in the fixture schedule on the plumbing drawings. The following manufacturers are approved: McGuire, Zurn, Sloan, and Watts.

L. Insulation kits shall be provided for all handicap lavatories and sinks with exposed supply and waste piping. Insulation kits shall include covers for fixture drains, p-traps and supplies. The following manufacturers are approved for fixture drains: Dearborn – Oatey, McGuire, Truebro, Plumberex (Pro Extreme Series), and Proflo.

2.3 PLUMBING FIXTURE SCHEDULE:

A. Water Closet P-1: shall be a floor mounted, floor outlet ligature resistant 304 stainless steel unit. Construction shall be seamless welded and exterior surfaces are powder coated white. Housing to include side access panels. Toilet shall be concealed siphon jet type with an elongated bowl and self-draining flushing rim. Toilet shall be ASME A112.19.3, CSA B45.4, and ADA 2010 compliant. Toilet requires a minimum of 25 PSI flow pressure and uses a water consumption of 1.28 GPF. Toilet trap shall have a minimum 3-1/2" seal and shall pass a 2-1/8" diameter ball and is fully enclosed. Provide with ligature resistant ABS toilet seat, concealed flush valve and flush valve cover accessory. Basis of design:

Water Closet:	Whitehall WH2142-ADA-T-3-EGE10_X
Seat:	Whitehall WH-LRSC
Flush Valve Cover:	Whitehall WH2802-SLPT-ADA

B. Urinal P-2: shall be an ADA-compliant, ligature resistant stainless steel high efficiency urinal. Interior to have a contoured surface to facilitate cleaning. Unit has an enclosed bottom with removable access panel and concealed flush valve (0.125 GPF). Fixture shall be fabricated of 18 gauge, with 16 gage bowl, type 304 stainless steel. All exposed surfaces are powder coated white. Provide with flush valve cover accessory. Basis of design:

Urinal:	Whitehall WH2158-T-EB-EG10
Flush Valve Cover:	Whitehall WH2802SLPT

C. Lavatory P-3: shall be an ADA-compliant ligature resistant lavatory. Unit shall have 34" standard rim height to conform with ANSI, UFAS and ADA Accessibility Standards. Provide integral "D" shaped basin with an integral, rear overflow. Basin, countertop, backsplash and sidesplash to be constructed of 16 gauge stainless steel. Lavatory shall conform to ANSI Z124.3 and ANSI Z124.6. Trap enclosure to be constructed of heavy gauge, type 304 stainless steel and powder coated white. The lavatory shall be fitted with an ADA-compliant ligature resistant faucet. Faucet shall be dual temperature (hot and cold) with hemispherical pneumatic pushbutton operation with chrome plated bronze body with a 0.5 GPM multi stream laminar flow nozzle. Lavatory shall also be fitted with a thermostatic mixing valve, off-set perforated grid drain, 1-1/4" p-trap, wheel handle angle supplies, chair carrier with concealed arm supports. Basis of design:

Lavatory:	Whitehall WH3740
Faucet:	Whitehall WH3377L
Mixing Valve:	Whitehall WHST70-12
P-trap:	McGuire
Supplies:	McGuire
Carrier:	Whitehall

D. Mop Sink P-4: shall be a 24" x 24" 16 gauge stainless steel basin with 10" high sides and integral 3" chrome plated dome drain. The mop sink shall be fitted with a chrome plated

faucet with vacuum breaker and vandal resistant screws, a hose with hose bracket, and stainless steel wall guards. Mop sink shall have a satin finish and the faucet shall be mounted on the wall 36 inches above the floor. Basis of design:

Basin:	Acorn 1630
Faucet:	T&S B-0665-CRBSTRVR
Hose/Bracket:	Acorn KH36
Wall Guards:	Acorn KWG24

E. Shower P-5: shall be a ligature resistant component shower. Exposed trim shall be chrome plated. Fixture shall be furnished with two conical showerheads (1.5 gpm), an ASSE 1016 compliant control valve and diverter valve with ADA-compliant ligature resistant tri-lever handles. The floor drain shall be a type "A" as specified in Section 22 1210. Basis of design:

Shower: Whitehall WH538-FH-CSH-SRCH

F. Washing Machine Connection Box P-6: shall be a fire rated, recessed flush mounting painted steel box with ¼ turn cold and hot water angle valves with hose thread outlets and water hammer arrestors, and plugged 2" drain outlet. Box shall be approved for installation in rated walls (if applicable). Basis of design:

Washer Box: Oatey 38470

G. Condensate Drain Box P-7: shall be a fire rated, recessed flush mounting drain box with plugged 2" drain outlet. Box shall have a nominal 1-1/2" wall flange, mounting tabs, paintable access panel, and 2" drain connection. Box shall be approved for installation in rated walls (if applicable). Basis of design:

Condensate Box: Sioux Chief 696 Series

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Install plumbing fixtures of types indicated where shown and at indicated heights or where not shown in accordance with manufacturer's written instruction, roughing-in drawings and with recognized industry practices.

B. Fasten plumbing fixtures securely to indicated supports or building structure and ensure that fixtures are level and plumb and tight against mounting surface.

C. Seal the outer perimeter of wall mounted lavatories and urinals and water closets to the wall and floor mounted water closets to the floor with a smooth bead of white silicone compound.

D. All fixtures provided under another division of the specifications shall be roughed-in and connected under this section. Provide individual shut-off valves or supply stops to all fixtures with a water or gas supply. Provide p-traps and extensions to waste stack in wall or to drain, as shown on the drawings, if not provided by the fixture supplier. Supply stops and p-traps shall be Mcguire, EBC, or Brass-Craft.

E. Provide and install undercounter mixing valves for all sinks and lavatories except those in commercial kitchens.

3.2 FIELD QUALITY CONTROL:

A. Upon completion of installation of plumbing fixtures and after units are water pressurized, test and adjust fixtures for proper operation.

END OF SECTION 223110

SECTION 223210 – ELECTRIC WATER COOLERS AND DRINKING FOUNTAINS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

1.2 QUALITY ASSURANCE:

A. Industry Standards:

1. Provide drinking-water coolers which have been listed and labeled by Underwriters' Laboratories (UL399).
2. Provide drinking-water coolers which are rated and certified in accordance with Air Conditioning and Refrigeration Institute (ARI) Standard 1010.
3. Provide wheelchair water coolers which comply with ANSI A117.1 and ADA guidelines.
4. Provide drinking-water coolers which are manufactured using lead-free components and solder in all waterways.

1.3 SUBMITTALS:

A. Provide manufacturer's data, test reports, and product warranties as applicable.

PART 2 - PRODUCTS

2.1 DRINKING FOUNTAIN “DF-1”:

A. Provide a ligature resistant, ADA 2010 compliant drinking fountain. Fixture shall be fabricated from 14 gage, type 304 stainless steel. Construction shall be seamless welded and exposed surfaces shall have a satin finish. Cabinet interior is sound-deadened with fire-resistant material. Fixture shall be furnished with necessary fasteners for proper installation. Units to conform with ANSI, UFAS and ADA requirements for accessibility, Valve and bubbler conform with lead-free requirements of NSF61, Section 9 and CHSC 116875. Unit shall be WILLOUGHBY WBDF-1519-HC-FA or equal by ACORN and WHITEHALL.

2.2 DRINKING FOUNTAIN “DF-2":

A. Unit shall be the same as drinking fountain DF-1 except for the mounting height. Refer to drawings for mounting height.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. General: Install water coolers in accordance with manufacturer's written instructions and in accordance with the National Electrical Code and recognized industry practices.

B. After water coolers are mounted on wall, bolt a 1-1/2” steel angle bracket to bottom of unit and attach to wall. Paint to match wall.

3.2 FIELD QUALITY CONTROL:

A. Test operates installed water coolers to demonstrate compliance with the requirements.

END OF SECTION 223210

SECTION 230110 – MECHANICAL GENERAL PROVISIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

B. It is recognized that separate sub-contracts may be instituted by THIS CONTRACT'S GENERAL CONTRACTOR with others. It is the responsibility of THIS CONTRACT'S GENERAL CONTRACTOR to completely inform, coordinate, and advise those sub-contractors of the requirements, conditions, and information associated with providing and installing their portion of the total job.

1.2 IMPOSED REGULATIONS:

A. Applicable provisions of the State and Local Codes and of the following codes and standards in addition to those listed elsewhere in the specifications are hereby imposed on a general basis for mechanical work. In each case, the prevailing edition shall be the current adopted edition of the state where the project is located.
   1. *International Mechanical Code.*
   2. *International Gas Code.*
   3. *International Energy Conservation Code.*
   4. *International Fire Code.*

1.3 SCOPE OF WORK:

A. Provide all permits, labor, materials, equipment, tests, and supervision to construct complete and operable mechanical systems as indicated on the drawings and specified herein. All materials and equipment used shall be new, undamaged, and free from any defects.

1.4 EXISTING SERVICES AND FACILITIES:

A. Damage to Existing Services: Existing services and facilities damaged by the Contractor through negligence or through use of faulty materials or workmanship shall be promptly repaired, replaced, or otherwise restored to previous conditions by the Contractor without additional cost to the Owner.

B. Interruption of Services: Interruptions of services necessary for connection to or modification of existing systems or facilities shall occur only at prearranged times approved by the Owner. Interruptions shall only occur after the provision of all temporary work and the availability of adequate labor and materials will ensure that the duration of the interruption will not exceed the time agreed upon.

C. Removed Materials: Existing materials made unnecessary by the new installation shall be

removed, shall remain the property of the Owner and shall be stored at a location and in a manner as directed, or, if classified by the Owner's authorized representative as unsuitable for further use, shall become the property of the Contractor and shall be removed from the site.

1.5 WARRANTIES:

A. Provide manufacturers' standard printed commitment in reference to a specific product and normal application, stating that certain acts of restitution will be performed for the Purchaser or Owner by the manufacturer, when and if the product fails within certain operational conditions and time limits. Where the warranty requirements of a specific specification section exceed the manufacturer's standard warranty, the more stringent requirements will apply, and modified manufacturer's warranty shall be provided. The Contractor shall provide a warranty on all parts and labor per the Div 01 requirements.

1.6 PRODUCT SUBSTITUTIONS:

A. General: Materials specified by manufacturer's name shall be used unless prior approval of an alternate is given by addenda. Requests for substitutions must be received in the office of the Design Professional at least (10) days prior to opening of bids.

PART 2 - PRODUCTS

2.1 GENERAL MECHANICAL PRODUCT REQUIREMENTS:

A. Standard Products: Provide not less (quality) than manufacturers' standard products, as specified by their published product data. In addition to the indication that a particular product/model number is acceptable, comply with the specified requirements. Do not assume that the available off-the-shelf condition of a product complies with the requirements; as an example, a specific finish or color may be required.

B. Uniformity: Where multiple units of a general product are required for mechanical work, provide identical products by the same manufacturer, without variations except for sizes and similar variations as indicated.

C. Product Compatibility, Options: Where more than one product selection is specified, either generically or proprietarily, selection is Purchaser's or Installer's option. Provide mechanical adaptations as needed for interfacing selected products in the work.

PART 3 - EXECUTION

3.1 PRODUCT INSTALLATION, GENERAL:

A. Except where more stringent requirements are indicated, comply with the product manufacturer's installation instructions and recommendations, including handling, anchorage, assembly, connections, cleaning and testing, charging, lubrication, startup, test operation and

shut down of operating equipment. Consult manufacturers' technical experts for specific instructions on unique product conditions and unforeseen problems.

B. Protection and Identification: Deliver products to project properly identified with names, model numbers, types, grades, compliance labels and similar information needed for distinct identifications; adequately packaged or protected to prevent deterioration during shipment, storage, and handling. Store in a dry, well ventilated, indoor space, except where prepared and protected by the manufacturer specifically for exterior storage.

END OF SECTION 230110

SECTION 230120 - MECHANICAL STANDARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

1.2 QUALITY ASSURANCE:

A. Industry Standards: It is a general requirement that mechanical work comply with applicable requirements and recommendations of standards published by listed agencies and trade associations, except to the extent more detailed and stringent requirements are indicated or required by governing regulations.

B. Listing of Associations, Standards, and Abbreviations:

1. *AGA* — *American Gas Association*, 1515 Wilson Blvd., Arlington, VA 22209
2. *AMCA* — *Air Movement & Control Association*, 30 W. University Dr., Arlington Heights, IL 60004
3. *ARI* — *Air-Conditioning and Refrigeration Institute*, 4301 North Fairfax Drive, Suite 425, Arlington, VA 22203
4. *ASHRAE* — *American Society of Heating, Refrigerating & Air Conditioning Engineers, Inc.*, 1791 Tullie Circle, NE, Atlanta, GA. 30329
5. *AWS* — *American Welding Society, Inc.*, 2501 NW 7th St., Miami, FL 33125
6. *CISPI* — *Cast Iron Soil Pipe Institute*, 2020 K. St., NW, Washington, DC
7. *NEBB* — *National Environmental Balancing Bureau*, 1611 North Kent St., Arlington, VA 22209
8. *NEC* — *National Electrical Code* by NFPA
9. *NEMA* — *National Electrical Manufacturers Association*, 1300 N 17th Street, Suite 1847, Rosslyn, VA 22209
10. *NFPA* — *National Fire Protection Association*, 407 Atlantic Ave., Boston, MA 02210
11. *SMACNA* — *Sheet Metal & Air Conditioning Contractors National Association, Inc.*, 8224 Old Courthouse Rd., Tysons Corner, Vienna, VA 22180
12. *TIMA* — *Thermal Insulation Manufacturers Association*, 7 Kirby Plaza, Mt. Kisco, NY 10549

13. *UL* *Underwriters' Laboratories, Inc.*
207 East Ohio St.,
Chicago, IL 60611

PART 2 AND 3 - PRODUCTS AND EXECUTION

A. Not applicable.

END OF SECTION 230120

SECTION 230210 - MECHANICAL COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

1.2 QUALITY ASSURANCE:

A. Mechanical Coordination Plans: Prepare a set of coordination plans showing the coordination of the major elements, components, and systems of the mechanical work, and showing the coordination of mechanical work with other work. Prepare plans at accurate scale and sufficiently large to show locations of every item, including clearances for installing, maintaining, insulating, breaking down equipment, replacing motors and similar requirements. Prepare plans to include plans, elevations, sections, and details as needed to conclusively show successful coordination and integration of the work. Submit plans for review by the Design Professional.

B. Coordinate the actual location of all mechanical work visible in finished spaces with the Design Professional. This includes air distribution devices, exposed ductwork, thermostats, humidistats, switches, sensors, etc.

C. Mechanical Coordination Affidavit: Prior to ordering materials, provide the Coordination Affidavit required by Section 230220.

PART 2 - PRODUCTS

2.1 MECHANICAL PRODUCT COORDINATION:

A. Power Characteristics: Refer to the electrical sections of the specifications and the electrical drawings for the power characteristics available for the operation of each power-driven item of equipment. The electrical design was based on the typical power requirements of the equipment manufacturers scheduled or specified. Any modifications to the electrical system which are required due to the use of an approved equivalent manufacturer shall be made at no additional cost to the owner. All changes must be clearly documented and submitted for review by the Design Professional prior to purchasing equipment. Coordinate purchases to ensure uniform interface with electrical work. The mechanical contractor shall furnish a detailed list of equipment electrical characteristics to the electrical contractor for the purpose of preparing the coordination affidavit required by Division 26.

B. Coordination of Options and Substitutions: Where the contract documents permit the selection from several product options, and where it becomes necessary to authorize a substitution, do not proceed with purchasing until coordination of interface of equipment has been checked and satisfactorily established.

C. Firestopping: Refer to architectural drawings for the locations of all fire rated ceilings, floors, and walls. The contractor shall furnish detailed shop drawings of all firestopping details to be used for both piping and ductwork. All firestopping details shall be U.L. listed and subject to approval by the State Fire Marshal.

PART 3 - EXECUTION

3.1 INSPECTION AND PREPARATION:

A. Substrate Examination: The Installer of each element of the mechanical work must examine the condition of the substrate to receive the work, and the conditions under which the work will be performed and must notify the Contractor in writing of conditions detrimental to the proper completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

B. Do not proceed with the installation of sleeves, anchors, hangers, roof penetrations and similar work until mechanical coordination drawings have been processed and released for construction. Where work must be installed prior to that time to avoid a project delay, review proposed installation in a project coordination meeting including all parties involved with the interfacing of the work.

3.2 CUTTING AND PATCHING:

A. Structural Limitations: Do not cut structural framing, walls, floors, decks, and other members intended to withstand stress, except with the Design professional written authorization.

B. Where authorized, cut opening through concrete (for pipe penetrations and similar services) by core drilling or sawing. Do not cut by hammer-driven chisel or drill.

C. Other work: Do not endanger or damage other work through the procedures and processes of cutting to accommodate mechanical work. Review the proposed cutting with the Installer of the work to be cut and comply with recommendations to minimize damage. Where necessary, engage the original Installer or other specialists to execute the cutting in the recommended manner.

D. Where patching is required to restore other work, because of either cutting or other damage inflicted during the installation of mechanical work, execute the patching in the manner recommended by the original Installer. Restore the other work in every respect, including the elimination of visual defects in exposed finishes, as judged by the Design Professional. Engage the original Installer to complete patching of the following categories of work:
   1. Exposed concrete finishes and exposed masonry.
   2. Waterproofing and vapor barriers.
   3. Roofing, flashing and accessories.
   4. Interior exposed finishes and casework, where judged by the Design Professional to be difficult to achieve an acceptable match by other means.

3.3 COORDINATION OF MECHANICAL INSTALLATION:

A. General: Sequence, coordinate and integrate the various elements of mechanical work so that the mechanical plant will perform as indicated and be in harmony with the other work of the building. The Design Professional will not supervise the coordination, which is the exclusive responsibility of the Contractor. Comply with the following requirements:
   1. Install piping, ductwork, and similar services straight and true, aligned with other work and with overhead structures and allowing for insulation. Conceal where possible.
   2. Arrange work to facilitate ease of maintenance and repair or replacement of equipment and filters. Locate items requiring more maintenance such as valves, etc. in front of items requiring less maintenance. Connect equipment for ease of disconnecting, with minimum of interference with other work.
   3. Equipment located above ceilings shall be installed in a position and elevation which allows complete and adequate maintenance access through the ceiling grid or access panel while standing safely on a ladder. If this is not possible, a suitable maintenance platform must be provided per IMC.
   4. Give the right-of way to piping systems required to slope for drainage (over other service lines). Piping shall be located to avoid interference with ductwork and light fixtures.
   5. Store materials off the ground and protected from standing water and weather.

B. Drawings: Conform with the arrangement indicated by the contract documents to the greatest extent possible, recognizing that portions of the work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, comply with the Design Professional's decision on resolution of the conflict.

C. Electrical Work: Coordinate the mechanical work with electrical work, and properly interface with the electrical service. In general, and except as otherwise indicated, install mechanical equipment ready for electrical connection. Refer to electrical sections of the specifications for electrical connection of mechanical equipment.

D. Duct Smoke Detectors: In buildings equipped with a fire alarm system, all HVAC duct smoke detectors, including smoke detectors for smoke dampers, shall be furnished by Division 26 and installed by Division 23. All duct smoke detectors must be compatible with the fire alarm system and must be connected to the fire alarm system for notification. All fire alarm wiring and associated devices shall be furnished and installed by the fire alarm system installer. In buildings not equipped with a fire alarm system, all HVAC duct smoke detectors and accessories shall be furnished and installed by Division 23. Each duct smoke detector must have a remote device where actuation of the duct smoke detector shall activate a visible and an audible signal in an approved location. Duct smoke detector trouble conditions shall activate a visible or audible signal in an approved location and shall be identified as “Air Duct Detector Trouble.” Each smoke detector shall be wired into the respective fan control circuit to automatically shut down the fan upon sensing products of combustion.

E. Utility Connections: Coordinate the connection of mechanical systems with exterior underground utilities and services. Comply with the requirements of governing regulations, franchised service companies and controlling agencies. Provide a single connection for each service except where multiple connections are indicated.

3.4 COORDINATION OF MECHANICAL STARTUP:

A. Seasonal Requirements: Adjust and coordinate the timing of mechanical system start-ups with seasonal variations, so that demonstration and testing of specified performance can be observed and recorded. Exercise proper care in off-season start-ups to ensure that systems and equipment will not be damaged by the operation.

B. Painting and Air Distribution: Coordinate the initial cleaning and start-up of the air distribution system, to occur prior to preparatory cleaning and general interior painting and decorating on the project. The HVAC system should not be operated until drywall work is completed. Drywall dust must not be allowed to contaminate the interior of air handing units and ductwork. Use high efficiency temporary filters until project closeout.

END OF SECTION 230210

SECTION 230220 - MECHANICAL SUBMITTALS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

1.2 SUBMITTAL FORMS AND PROCEDURES:

A. The purpose of submittals is to demonstrate to the Design Professional that the Contractor understands the design concept. The Design Professional's review of such drawings, schedules, or cuts shall not relieve the Contractor from responsibility for deviation from drawings or specifications unless he has, in writing, called the Design Professional's attention to such deviations at the time of submission, and has received from the Design Professional, in writing, permission for such deviations. All submittals must be completely checked by the Contractor prior to submission for review.

B. Hard Copy Submittals: Submittal data shall be placed in one or more hard-back 3-ring binders, arranged, and labeled according to specification section. Each binder shall contain a title page and table of contents. Provide separator tabs, and label by specification section. Make note in the table of contents, any drawings that accompany the submittal. Title page shall contain Project Name, Contractor's Name, Division 23 Superintendent's name, Suppliers and point of contact for each, and date. Except as otherwise indicated in other sections, submit 5 complete copies. Quantity indicated does not include copies required for regulatory agencies.

C. Electronic Submittals: All electronic submittal files shall be organized to match the bid documents for specification section and name. Each submittal file shall be complete for each specification section. Multiple partial submittals per specification section will be rejected. Make note in the table of contents, any drawings that accompany the submittal. Title page shall contain Project Name, Contractor's Name, Division 23 Superintendent's name, Suppliers and point of contact for each, and date.

D. Submittals shall be made for all items contained in the Mechanical Submittal List in PART 3 - EXECUTION.

E. Response to Submittals: A Mechanical Submittal Review Report shall be issued by the Engineer with the following classifications for each item:
   1. **"No Exceptions Taken"**: No corrections, no marks. Contractor shall submit copies for distribution.
   2. **"Make Corrections Noted"**: A few minor corrections. Items may be ordered as marked up without further resubmission. Submit copies for distribution.
   3. **"Revise and Resubmit"**: Minor corrections. Item may be ordered at the Contractor's option. Contractor shall resubmit drawings with corrections noted.
   4. **"Rejected"**: Major corrections or not in accordance with the contract documents. No items shall be ordered. Contractor shall correct and resubmit drawings.

PART 2 - PRODUCTS

2.1 SUBMITTAL REQUIREMENTS:

A. General: Each specification section shall list the required submittal items. All submittal items shall conform to the requirements listed below. For each major section of submittal data, include a summary page which lists items and model numbers for each piece of equipment.

B. Shop Drawings: Prepare mechanical shop drawings to accurate scale except where diagrammatic representations are specifically indicated. Show clearance dimensions of critical locations and show dimensions of spaces required for operation and maintenance of equipment. Show piping connections and other service connections and show interface with other work including structural support. Indicate by note, the portions of mechanical work shown on the shop drawings which deviated from the indication of work in the contract documents and explain the reasons for the deviations. Show how such deviations coordinate with interfacing deviations on shop drawings for other portions of the work, currently or previously submitted.

C. Manufacturer's Data: Where pre-printed data is submitted for more than one distinct product, size, type, material, trim, accessory group or other variation, mark submitted copy with black pen to indicate which of the variations is to be provided. Delete or mark-out significant portions of preprinted data which are not applicable. Where operating ranges are shown, mark data to show portion of range required for project application. Expansion or elaboration of standard data to describe a non-standard product must be processed as a shop drawing submittal. For each product include the manufacturer's production specifications, installation or fabrication instructions, nearest source of supply (including telephone number), sizes, weights, speeds, operating capacities, piping and service line connection sizes and locations, statements of compliance with required standards and governing regulation (include manufacturer's signed statements if not covered in printed data), performance data (where applicable) and similar information needed to confirm compliance with the requirements.

D. ATTACHMENT NO. 1 (Mechanical Coordination Affidavit):
1. The intent of Attachment Number 1 is to ensure that the electrical requirements for mechanical equipment have been reviewed and coordinated by the Contractor. No mechanical equipment shall be ordered, nor shall rough-in begin, before this coordination has taken place. This document shall be returned appropriately marked whether or not any changes are deemed to be necessary by the contractor.

PART 3 - EXECUTION

3.1 MECHANICAL SUBMITTAL LIST:

23 0210 – Mechanical Coordination:
Mechanical Coordination Plans.
Mechanical Coordination Affidavit (see Attachment No. 1 below)

23 0230 – Mechanical Identification:
Pipe Markers.
Pipe Tape.
Engraved Nameplates.

23 0240 – Mechanical Work Closeout:
Record Plans.
Maintenance Manuals.
Mechanical TAB Report.
Owner Training Videos.

23 0310 – Mechanical Pipe, Tube, and Fittings:
Galvanized Steel Pipe, Schedule 40.
Copper Tube.
PVC Pipe.
Soldering Materials.
PVC Cement.
Pipe Sleeves.
Fire Caulk.
Latex Paint for PVC Pipe.

23 0320 – Mechanical Hangers and Supports:
Refrigerant Pipe Hangers.
HVAC Drain Pipe Hangers (Clevis Type).
Pipe Supports, Guides, Shields, and Saddles.
Piping Roof Supports.
Pipe Portals.
Roof Equipment Support Rails.

23 1210 – Mechanical Piping and Equipment Insulation:
Closed Cell Elastomeric Insulation and Fittings.
Refrigerant Pipe Insulation Cover.

23 2110 – Ductwork:
Duct Construction Standards.
Galvanized Steel Ducts.
Flexible Ducts.
Flexible Connectors.
Manual Balancing Dampers.
Round Takeoff Fittings.
Rectangular Takeoff Fittings.
Fire Dampers.
Duct Access Doors.
Wall Vents.
Flexible Duct Elbow Support.
Duct Wrap Type ‘A’.
Duct Liner Type ‘A’.
Duct Insulation Accessories.
Duct Insulation Compounds.
Duct Sealant.

Duct Leakage Test Results.

23 2210 – Air Distribution:
All devices in AIR DISTRIBUTION SCHEDULE and/or plans and/or specifications.

23 2310 – Fans:
All equipment in FAN SCHEDULE and/or plans and/or specifications.

23 3110 – Electric Heaters:
All equipment in ELECTRIC HEATER SCHEDULE and/or plans and/or specifications.

23 4320 – Air Treatment Systems:
All equipment in noted in equipment schedules and/or plans and/or specifications.

23 5310 –Air Conditioners:
All equipment in AIR CONDITIONER SCHEDULES and/or plans and/or specifications.

23 6110 – Heat Pumps:
All equipment in HEAT PUMP SCHEDULES and/or plans and/or specifications.

23 8310 – EMCS (Energy Management Control System):
All controls equipment, sequences, control diagrams, etc. in plans and/or specifications.

23 9110 – Mechanical Sound, Vibration, Wind, and Seismic Control:
Wind Calculations for all roof mounted equipment.
All equipment in plans and/or specifications.

23 9210 – Mechanical TAB (Test, Adjust, Balance):
Qualifications package.
Testing procedures.
Instrument list.
Sample test forms.

END OF SECTION 230220

ATTACHMENT NO. 1

SHOP DRAWING COORDINATION AFFIDAVIT

I, the Division 23 Superintendent, certify that I have reviewed the mechanical shop drawings for electrically driven equipment and that the accompanying mechanical shop drawings reflect the requirements of the actual equipment to be furnished for use on this project. In addition, the electrical requirements of said equipment have been coordinated with the Division 26 contractor.

NOTE: If no deviations are required please indicate by circling the appropriate answer above your signature.

PROJECT: _____ DEVIATIONS: Yes / No

COMPANY: _____

TITLE: _____ SIGNATURE: _____

TELEPHONE: _____ DATE: _____

FAILURE TO PERFORM THE WORK REQUIRED BY THIS AFFIDAVIT, PRIOR TO ORDERING MATERIALS OR ROUGHING-IN, MAY RESULT IN IMPROPER CONNECTIONS BEING PROVIDED. THE EXPENSE OF CORRECTIVE MEASURES, IF REQUIRED, SHALL BE BORNE BY THE CONTRACTOR.

SECTION 230230 - MECHANICAL IDENTIFICATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

1.2 QUALITY ASSURANCE:

A. Manufacturers: Firms regularly engaged in the manufacture of identification systems required for this product.

B. Submittals: Submit manufacturer's data on materials and submit a sample of each type required.

PART 2 - PRODUCTS

2.1 MECHANICAL IDENTIFICATION MATERIALS:

A. Pipe Markers:
   1. General: Product manufacturer's standard pre-printed, flexible or semi-rigid, permanent, color-coded, plastic-sheet pipe markers, complying with ANSI A13.1.
   2. Small Pipe: For external diameters less than 6” (including insulation, if any), provide full band pipe markers, extending 360 degrees around pipe at each location, fastened by one of the following methods:
      a. Snap-on application of pre-tensioned semi-rigid plastic pipe marker.
      b. Adhesive lap joint in pipe marker overlap.
      c. Laminated or bonded application of pipe marker to pipe (or insulation).
      d. Taped to pipe (or insulation) with color-coded plastic adhesive tape, not less than 3/4” wide; full circle at both ends of pipe marker, tape lapped 1-1/2”.
   3. Large Pipes: For external diameters of 6” and larger (including insulation, if any), provide either full-band or strip-type pipe markers, but not narrower than 3 x letter height (and of required length), fastened by one of the following methods:
      a. Laminated or bonded application of pipe marker to pipe (insulation).
      b. Taped to pipe (or insulation) with color-coded plastic adhesive tape, not less than 1-1/2” wide: full circle at both ends of pipe marker, tape lapped 3”.
   4. Lettering: Comply with piping system names as specified, scheduled, or shown, and abbreviate only as necessary for each application length.
   5. Arrows: Print each pipe marker with arrow indicating direction of flow, either integrally with piping system service lettering or as separate unit of plastic (to accommodate both directions).
   6. Install pipe markers on the following systems:
      a. Refrigerant Piping

B. Pipe Tape: Manufacturer's standard color-coded pressure-sensitive (self-adhesive) vinyl tape, not less than 3 mils thick.
   1. Width: Provide 1-1/2" wide tape markers on pipes with outside diameters including insulation of less than 6", and 2-1/2" wide tape on larger pipes.
   2. Color: Comply with ANSI A13.1.

C. Engraved Plastic-Laminate Labels:
   1. General: Provide engraving stock melamine plastic laminated, 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.
   2. Thickness: 1/16", except as otherwise indicated.
   3. Fasteners: Self-tapping stainless-steel screws, except contact type permanent adhesive where screws cannot or should not penetrate the substrate.
   4. Install engraved equipment labels on all mechanical equipment. Match equipment names as scheduled.
   5. Install "Permanent Label of Equivalent Length" in each laundry area near the clothes dryer. Label shall match the example shown in *2024 IMC, Section 504*. The contractor shall fill in the actual equivalent length for each dryer exhaust duct.

2.2 LETTERING AND GRAPHICS:

A. General: Coordinate names, abbreviations and other designations used in the mechanical identification work, with the corresponding designations shown, specified, or scheduled. Provide numbers, lettering recommended by manufacturers or as required for proper identifications and operation/maintenance of the mechanical systems and equipment.

PART 3 - EXECUTION

3.1 APPLICATION AND INSTALLATION:

A. Coordination: Where identification is to be applied to surfaces which require insulation, painting and other covering or finish, including valve tags in finished mechanical spaces, install identification after completion of covering or painting.

B. All equipment, dampers, filters, valves, etc. located above ceiling grids shall be located with an engraved marker permanently attached to the ceiling grid. The marker shall describe the item located above the ceiling.

C. Piping System Identification: Install pipe markers on each system indicated to receive identification and include arrows to show normal direction of flow.

D. Locate pipe markers as follows wherever piping is exposed to view in mechanical rooms, accessible maintenance spaces (including accessible areas above ceilings) and exterior non-concealed locations:
   1. Near each valve and control device.
   2. Near each branch, excluding short take-offs for fixtures. Mark each pipe at branch,

where there could be a question of flow pattern.

3. Near locations where pipes pass through walls or ceilings or enter non-accessible enclosures.
4. Near major equipment items and other points of origination and termination.
5. Spaced intermediately at maximum spacing of 50’ along each piping run, except reduce spacing to 25’ in congested areas of piping and equipment.

E. Do not mark piping exposed in finished occupied spaces.

F. Mechanical Equipment Identification: Install an engraved plastic laminate label 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. Each label shall include the equipment name, room number and electrical panel name. Confirm installed final room numbers and electrical panel names prior to ordering labels.

END OF SECTION 230230

SECTION 230240 - MECHANICAL WORK CLOSEOUT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

1.2 DOCUMENTATION PROCEDURES:

A. Signed Commitments: Do not proceed with transfer of mechanical plant to the Owner for operation until warranties, performance certifications and similar commitments to be signed by Contractor and other entities have been executed and transmitted to Design Professional (for Owner's records).

PART 2 – PRODUCTS

2.1 RECORD PLANS:

A. Explanation: Except where otherwise indicated, mechanical plans (contract plans) prepared by Engineer are diagrammatic in nature and may not show locations accurately for various components of mechanical systems. Shop drawings, including coordination plans, prepared by Contractor shall show certain portions of work more accurately to scale and location, and in greater detail.

B. General Recording Procedure: Maintain a white-print set, blue-line or black-line, of mechanical contract plans and shop drawings in clean, undamaged condition, for mark-up of actual installations which vary substantially from the work as shown. Mark-up whatever plans are most capable of showing the installed conditions accurately; however, where shop drawings are marked, record a reference note on appropriate contract drawing. Mark with erasable pencil and use multiple colors to aid in the distinction between work of separate mechanical systems. In general, record every substantive installation of mechanical work which previously is either not shown or shown inaccurately, but in any case record the following:
   1. Underground and aboveground piping, both exterior and interior, drawn to scale and fully dimensioned.
   2. *"Mechanical Project Record"* shall be maintained as part of the *"Project Record"* specified in Division 1.

2.2 MAINTENANCE MANUALS:

A. Organize each copy of the required system maintenance manuals to include an index followed by thumb-tab marked sections for each of the following:
   1. Operating Instructions: Submit manufacturer's operating instructions for each item of

mechanical equipment and supplement with additional project application instructions where necessary. Prepare and submit specific operating instructions for charging, start-up, control or sequencing of operation, phase, or seasonal variations, shut-down, safety and similar operational instructions. Prepare in typewritten form in completely explained and easily understood English language.

2. Emergency instructions including addresses and telephone numbers of service sources.
3. Regular system maintenance procedures including lubrication.
4. List of all filters required for each unit.
5. Spare parts listing and stocking recommendations.
6. Inspection, adjusting, rebalancing, cleaning, parts replacement, and similar maintenance instructions and recommendations, including the proper use of tools and accessories.
7. Valve schedule and control diagram for each system.
8. Manufacturer's data and test reports for each operating item in each system.
9. Manufacturer's product warranties and guarantees relating to the system and equipment items in the system.
10. Corrected or approved issues of submittal items relating to the system.

B. Bind each maintenance manual in one or more vinyl-covered, 2", 3-ring binder, plus pocket-folder type binders for folded drawings, and mark the back spine of each binder with system identification and volume number.

C. Certifications: Where specifically indicated, submit with notarized execution.

D. Test Reports: Submit test reports which have been signed and dated by the firm performing the test and prepared in the manner specified in the standard or regulation governing the test procedures as indicated.

E. Manufacturer's Product Warranties: Where pre-printed and published warranty includes substantial deviation from required warranty (as judged by the Design Professional or Engineer), product is automatically disqualified from use on the project, except where manufacturer prepares and issues a specific product warranty on the product, stating that it is in lieu of the published warranty, and is executed by an authorized officer, and complies with the requirements. Warranties shall comply with the requirements of individual specification section where those requirements exceed the manufacturer's standard warranty.

F. Guarantees: Where indicated as "Certified", provide guarantee which, in addition to execution by an authorized officer of each guarantor, is attested to by the Secretary of each guarantor and bears the corporate seal

2.3 MECHANICAL TEST, ADJUST, BALANCE REPORT:

A. See Section 239210.

PART 3 - EXECUTION

3.1 CLOSEOUT PROCEDURES:

A. General Coordination: Sequence closeout procedures properly, so that work will not be

endangered or damaged, and so that every required performance will be fully tested and demonstrated.

B. System Performance Test Run: At the time of mechanical work closeout, check each item in each system to determine that it is set for proper operation. With Owner's representative and Design Professional present, operate each system in a test run of appropriate duration to demonstrate compliance with performance requirements. During or following test runs, make final corrections or adjustments of system to refine and improve performances wherever possible, including noise and vibration reductions, elimination of hazards, better response of controls, signals and alarms, and similar system performance improvements. Provide testing or inspection devices as may be requested for Design Professional's observation of actual system performances. Demonstrate that controls and items requiring service or maintenance are accessible. Test run shall be scheduled to coincide with Design Professional's final inspection of the mechanical work.

C. Cleaning and Lubrication: After final performance test run of each mechanical system, clean system both externally and internally. Clean dirt and debris from air handling systems and install new filters. Flush piping system by operating drains and similar means, and clean strainers and traps. Lubricate both power and hand operated equipment and remove excess lubrication. Touch-up minor damage to factory painted finishes and other painting specified as mechanical work; refinish work where damage is extensive.

D. General Operating Instructions: In addition to specified training of Owner's operating personnel specified in individual mechanical sections, and in addition to preparation of written operating instructions and compiled maintenance manuals specified, provide general operating instructions for the total mechanical plant. Conduct a walk-through explanation and demonstration for orientation and education of Owner's personnel to be involved in continued operation of building and its mechanical plant.
   1. Describe each basic mechanical system and how its control system functions, including flow adjustments, temperature control and similar operations.
   2. Explain and point out identification system, displayed diagrams, signals, alarms and similar provisions of the work.
   3. Describe basic sequencing requirements and interlock provisions for system start-up, phasing, coast-down, shut-down, and seasonal operations.
   4. Emphasize emergency procedures and safety provisions for protection of equipment and safety of occupants during equipment malfunction, disasters, power failures and similar unusual circumstances, and describe system limitations and precautions including weather adjustments.
   5. Outline basic maintenance procedures.

E. Demonstrate what adjustments have been made and can continue to be made to reduce noise and vibration, improve system output, decrease energy consumption and similar performance improvements.

F. Point out operational security provisions, safety, unavoidable hazards, and similar operator limitations. Display and conduct a "thumb-through" explanation of maintenance manuals, record drawings, meter readings and similar service items.

G. All training sessions shall be digitally recorded (audio/video) and submitted to the Owner.

H. Construction Equipment: After completion of performance testing and Owner's operating

instructions and demonstrations, remove installers tools, test facilities, construction equipment and similar devices and materials used in execution of the work but not incorporated in the work.

3.2 CONTINUED SYSTEM OPERATIONS:

A. Final Acceptance: At time of substantial completion of mechanical work, Owner's operating personnel will take over operation of mechanical systems. However, until time of final acceptance, respond promptly with consultation and services on whatever operation or maintenance problems may remain or arise in continued operation of mechanical plant.

END OF SECTION 230240

SECTION 230310 – MECHANICAL PIPE, TUBE AND FITTINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

1.2 QUALITY ASSURANCE:

A. Industry Standards:
   1. Qualify welding procedures, welders, and operators in accordance with ASME B31.1 for shop and project site welding of piping work.
   2. Certify welding of piping work using the *Standard Procedure Specifications* by, and welders tested under supervision of, the *National Certified Pipe Welding Bureau*.
   3. Where plastic piping is indicated to transport potable water, provide pipe and fittings bearing approval label by the *National Sanitation Foundation* (NSF).

B. Submittals:
   1. Submit manufacturer's data, welding certifications, test reports, and product warranties as applicable for all piping materials.
   2. Grooved joint couplings and fittings and press joint fittings shall be shown on drawings and product submittals and be specifically identified with the applicable style number.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS:

A. General: Provide pipe and tube of the 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. Galvanized Steel Pipe: *ASTM A 53*, Schedule 40.

C. Copper Tube: *ASTM B88* Type L as indicated for each service; hard drawn temper, except as otherwise indicated. Soft copper tubing may be used for ACR piping 3/4” and smaller from heat recovery controllers to air handlers.

D. Plastic Pipe:
   1. PVC-WATER: *ASTM D2466-88*:

2.2 PIPE/TUBE FITTINGS:

A. General: Provide factory-fabricated fittings of the type, materials, grade, class, and pressure rating indicated for each service and pipe size. Provide sizes and types matching pipe, tube valve or equipment connections in each case. Where not otherwise indicated, comply with governing regulations and industry standards for selections, and with pipe manufacturer's recommendations where applicable.

B. Soldering Materials: Except as otherwise indicated, provide soldering materials as determined by the Installer to comply with installation requirements.
   1. Tin-Antimony Solder: *ASTM B 32*, Grade 95TA.

C. ACR Copper Press Joint Fittings: Fittings 2" and smaller size shall be wrought-copper or cast copper alloy with HNBR O-ring seal and inboard bead design in each end. Fittings shall be compatible with seamless K or L copper tube conforming to *ASTM B280*, *ASTM-B88* and have a maximum operating pressure of 700 psi, burst pressure of 2100 psi, vacuum rating of 200 microns, O-ring temperature range of -40 F to 284 F and UL Listed continuous operating temperature of -40 F to 250 F.

D. Solvent Cement for PVC Joints: *D2564-88*.

E. Pipe Sleeves:
   1. Iron Pipe Sleeves: Fabricate from Schedule 40 galvanized steel pipe; remove burrs.
   2. Sheet Metal Pipe Sleeves: Fabricate from galvanized sheet metal closed with lock-seam joints. For following pipe sizes provide gauge indicated: 3" pipe and smaller, 20-gauge; 4" to 6" pipe, 16-gauge; over 6" pipe, 14-gauge.
   3. Pipe Sleeve Caulking: *3M Fire Barrier Caulk*, *STI* or *Grabber*.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. General: Install pipe, tube, and 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 a minimum of 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" misalignment tolerance.
   1. Comply with *ASME B31.1* Code for Pressure Piping.
   2. Comply with *ASME B31.9* Code for Building Services Piping.

B. Locate piping runs as indicated on the drawings. Route vertically and horizontally (pitched to drain) and avoid diagonal runs wherever possible. 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 the shortest route which does not obstruct usable space or block access for servicing the building and its equipment. Where possible, locate insulated piping for 1" clearance outside insulation. Changes in direction shall be made with fittings.

C. Piping System Joints: Provide joints of the type indicated in each piping system.

D. Soldered Joints: Solder copper tube and fitting joints where required, 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 with steel wool. 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. Use a non-corrosive paste flux and wire solder composed of 95% tin and 5% antimony.

E. Press Joints: Press tube and fitting joints where required, in accordance with the manufacturer's installation instructions. Cut tube ends squarely, ream to full inside diameter, and clean outside of tube ends and inside of fittings before assembly. The tubing end shall be clean and dry before being inserted into the fitting and the tubing marked at the shoulder of the fitting. The fitting alignment shall be checked against the mark on the tubing to assure the tubing is fully engaged (inserted) in the fitting. The joints shall be pressed using the tool(s) approved by the manufacturer. Installing contractor shall be familiar with the installation of press joint systems and qualified through training provided directly by the fitting manufacturer.

F. Plastic Pipe/Tube Joints: Comply with manufacturer's instructions and recommendations and with applicable industry standards.

G. Insulating (Dielectric) Nipples: Comply with manufacturer's instructions for installing nipples in a manner which will prevent galvanic action and stop corrosion where the joining of ferrous and non-ferrous piping occurs.

H. Pipe Sleeves: Install pipe sleeves of the types specified wherever piping passes through the walls, floors, or structural members of the work. Provide sleeves of adequate size, accurately centered in pipe runs. Size sleeves so that piping and insulation will have free movement in the sleeve, including allowance for thermal expansion. Where insulation includes a vapor barrier covering provide sleeve with sufficient clearance for installation of vapor barrier. Install length of sleeve equal to thickness of construction penetrated, except extend floor sleeves 1/4" above floor finish. Provide temporary support of sleeves during placement of concrete and other work around sleeves and provide temporary closure to prevent concrete and other materials from entering pipe sleeves.
   1. Sleeve Type: At interior partitions and ceilings, install sheet metal sleeves.
   2. Sleeve Type: At exterior penetrations both above and below grade, install iron pipe sleeves.
   3. Sleeve Type: Except as otherwise specified, install steel pipe sleeves.
   4. Caulk pipe sleeves at exterior penetrations and at other locations where indicated.

I. PVC piping exposed to sunlight shall be coated with water-based latex white paint to prevent UV light degradation.

3.2 CLEANING, FLUSHING, AND INSPECTING:

A. General: Clean exterior surfaces of installed piping systems of superfluous materials and prepare for application of specified coatings.

B. Flush out piping system with clean water before proceeding with required tests. Inspect each run of each system for completion of joints, supports and accessory items.

3.3 PIPING TESTS:

A. General: Provide temporary equipment for testing, including pump and gages. Test piping systems 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.
   1. Required test period is 2 hours.

B. Unless otherwise specified for specific systems, hydraulically test each pressurized piping system at 150% of operating pressure indicated, but not less than 100 psig test pressure.

C. Observe each test section for leakage at end of test period. Test fails if leakage is observed or if pressure drop exceeds 5% of test pressure.

D. Repair piping systems sections which fail the required piping test, by disassembly and re-installation, using new materials to the extent required to overcome leakage. Do not use chemicals, stop-leak compound, mastics, or other temporary repair methods. Drain test water from piping systems after repair work and retesting has been completed.

END OF SECTION 230310

SECTION 230320 – MECHANICAL HANGERS AND SUPPORTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

1.2 SUBMITTALS:

A. Provide manufacturer's data, test reports, and product warranties on all items.

PART 2 - PRODUCTS

2.1 HANGERS AND SUPPORTS:

A. General: Except as otherwise indicated, provide factory-fabricated piping hangers, and supports of the type specified complete with bolts and washers. Comply with the manufacturer's published product information. Size hangers and supports properly for piping and weight of the medium being transported. Provide insulation shields for all insulated piping.

B. Hangers for refrigerant lines shall be copper plated band type with adjusting nut; *Anvil* Fig. CT-69, *B-Line Fig. B3170CT*, or equivalent by *Erico Caddy*, *PHD Manufacturing* or *Hubbard Enterprises/Holdrite*.

C. Piping installed above a roof shall be supported on prefabricated, non-penetrating supports by *Pipe Pier, B-Line* or *Cooper*. Provide matching adjustable elevation kits and method for positive attachment to roof.

D. Piping roof penetrations shall be made with a factory-built pipe portal assembly with minimum 20-year warranty. The pipe portal shall be aluminum construction with removable lid, UV protected powder coating, full thermal break interior with gaskets and insulation, stainless steel fasteners and exit seal locater/starter dimples. The roof curb shall be aluminum construction with full thermal break interior. Exit seals shall be the manufacturer’s standard as required by the pipe size and / or application. All pipe penetrations shall be through housing walls, not the lid. Select housing size in accordance with number of pipe penetrations needed. Pipe portal shall be by *Alta, Roof Penetration Housings, Pate, Thybar,* or *RPS.*

E. Equipment rails for roof mounted equipment shall be 18-gauge galvanized steel construction with integral base plate, continuous welded corner seams, pressure treated wood nailer and counterflashing with screws. Equipment support rails shall be by *Aladdin, Pate, Thybar* or *RPS.*

PART 3 - EXECUTION

3.1 PIPING SUPPORT:

A. Minimum spacing of hangers and supports for above-ground horizontal and vertical pipe and tubing shall be as required in the applicable *International Mechanical Code*.

B. Prevent electrolysis in the support of copper tubing by the use of hangers and supports which are copper plated, or by other recognized industry methods.

C. Branch piping located in walls, partitions or pipe chases shall be rigidly supported inside the wall or chase.

3.2 ADJUSTMENT OF HANGERS AND SUPPORTS:

A. Adjust hangers and supports to bring piping to proper level, elevations, and slopes.

END OF SECTION 230320

SECTION 231210 – MECHANICAL PIPING AND EQUIPMENT INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

1.2 SCOPE:

A. Piping and equipment to be insulated include:
   1. HVAC Drain Piping (Indoor)
   2. Refrigerant Piping

1.3 QUALITY ASSURANCE:

A. Manufacturers: Provide insulation products produced by one of the following for each type and temperature range of insulation: *Armacell, Aeroflex USA,* or *K-Flex USA.*

B. Flame/Smoke Ratings: Provide composite piping insulation (insulation, jackets, covering, sealers, mastics, and adhesives) with flame-spread rating not exceeding 25 and smoke developed rating not exceeding 50, as tested by *ASTM E 84 (NFPA 255)* method and *UL 723*.

1.4 SUBMITTALS:

A. Provide manufacturer's data, test reports, and product warranties for all items.

PART 2 - PRODUCTS

2.1 PIPE INSULATION:

A. Closed Cell Elastomeric Insulation: Closed cell elastomeric glass insulation shall comply with *ASTM C 534*, Type I, Tube Grade 1. Jacketing for outdoor applications shall be 0.016" aluminum. Insulation on valves, elbows and fittings shall be pre-formed closed cell elastomeric with same material thickness as adjacent pipe. Insulation thickness shall be as follows:
   1. HVAC Drain Piping: 1" thick for all sizes.
   2. Refrigerant Piping: Per equipment manufacturer's recommendations. See paragraph F. for insulation cover.

B. Refrigerant Pipe Insulation Cover: Provide flexible PVC plastic UV/weather protective cover for all refrigerant piping located outdoors. The pipe insulation cover shall have an outdoor industrial grade combined method with molecular bonding and integral pre-fastening system

that allows removable/reusable use for maintenance and full-enclosure including cut-to-length capabilities without the use of adhesives as an attachment. All pipe insulation material (whether it is exterior surface coated or non-coated) must be completely covered and protected. Provide matching elbow covers. Insulation protector shall be tested and meet *ASTM E 96 (Vapor Transmission of Materials), ASTM G 153 (Carbon Arc Light Exposure – Accelerated Weathering), ASTM D 412 (Tensile Strength after UV Exposure and Water Immersion) ASTM 570 (Water Absorption of Plastics) ASTM E 84 (Surface Burning Characteristics of Building Materials), and ASTM G 21 (Fungal Growth).* Pipe insulation cover shall meet Class II vapor retarder per *ASTM E 96 (vapor/moisture permeability test)* "1 perm or less". Color shall be white. Pipe cover shall be by *Airex Manufacturing* or equal approved by the Design Professional.

PART 3 - EXECUTION

3.1 INSTALLATION OF PIPING INSULATION:

A. General: Install insulation products in accordance with the manufacturer's written instructions, and in accordance with recognized industry practices to ensure that the insulation serves its intended purpose. Do not use cut pieces or scraps abutting each other.

B. Insulation shall be applied on clean dry surfaces. All insulation shall be continuous through wall and ceiling openings and sleeves. Insulation on all cold surfaces, where vapor barrier jackets are used, will be applied with continuous unbroken vapor seal. Seal off ends of insulation on cold piping systems with white vapor barrier coating at valves, flanges, supports and exposed ends. Supports that are secured to cold surfaces shall be insulated and vapor sealed to prevent condensation.

C. Pipe covering protection shields shall be provided around exterior of pipe insulation at pipe hangers which fit around pipe insulation. Shields shall be 12" long by 180 degrees and shall be 18-gauge galvanized steel sheet. High density isolation inserts shall be provided at pipe saddles.

D. Unions shall not be insulated.

E. Cover valves, flanges, fittings, and similar items in each piping system.

F. Extreme care shall be taken to insure a neat, uniform exterior surface on insulation applied to exposed pipes. Insulation in finished areas shall be painted in accordance with the paint specifications.

3.2 PROTECTION AND REPLACEMENT:

A. Replace damaged insulation which cannot be repaired satisfactorily, including units with vapor barrier damage and moisture saturated units.

B. Protection: The Installer of the insulation shall advise the Contractor of required protection for the insulation work during the remainder of the construction period, to avoid damage and deterioration.

END OF SECTION 231210

SECTION 232110 - DUCTWORK AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

1.2 QUALITY ASSURANCE:

A. Industry Standards:
   1. Comply with *SMACNA (Sheet Metal and Air Conditioning Contractor's National Association)* recommendations for fabrication, construction and details and installation procedures, except as otherwise indicated.
   2. Comply with *ASHRAE (American Society of Heating, Refrigerating and Air Conditioning Engineers)* recommendations, except as otherwise indicated.
   3. Provide composite ductwork insulation (insulation, coverings, sealers, mastics, and adhesives) with flame-spread rating of 25 or less and a smoke-developed rating of 50 or less, as tested by *ASTM E84 (NFPA 255)* method.
   4. Provide duct connectors which comply with applicable portion of *UL 181* and bear label of *Underwriter's Laboratories*.

1.3 SUBMITTALS:

A. Provide manufacturer's data, test reports, and product warranties as applicable for all items.

PART 2 - PRODUCTS

2.1 ABOVE GROUND DUCTWORK:

A. General: Galvanized steel ductwork shall be used for all supply, return, exhaust, and ventilation ducts except as indicated otherwise by the contract documents. Preinsulated flexible duct shall be used to make final concealed connections to diffusers, registers, and grilles. Length of flexible duct shall not exceed 5'.

B. Galvanized Steel Ductwork: Ducts shall be fabricated from G90 galvanized sheet steel complying with ASTM A653, lock-forming quality. Concealed round ducts shall be the spiral seam type or snap-lock type with matching fittings.

C. Flexible Ducts: Flexible ducts shall be *U.L. Listed* as *Class 1 Flexible Air Duct Material* and shall comply with *NFPA Standards 90A and 90B*. Duct shall be a factory fabricated assembly composed of a polymeric liner duct bonded permanently to a coated spring steel wire helix and supporting a fiberglass insulating blanket with a minimum R-value of 6.0. Low permeability outer vapor barrier of fiberglass reinforced film laminate shall complete the

assembly. Duct shall be suitable for low and medium pressure systems and shall carry a full 5-year warranty. For all flexible duct connections to diffusers, registers, and grilles, provide rigid elbow brace accessory with one duct diameter centerline radius. Flexible duct shall be by *Atco*, *Flexmaster*, *Genflex,* or *Thermaflex*.

2.2 DUCTWORK ACCESSORIES:

A. General: Except as otherwise indicated for each ductwork accessory, provide metal type, gauge, weight, construction and reinforcing as required by size limitations, and applicable SMACNA standards, including fittings, supports and appurtenances.

B. Flexible Connectors: Provide flexible connectors between supply and return duct connections to equipment and as otherwise indicated on the drawings. Flexible connector shall be constructed of neoprene permanently attached to 3" wide metal bands. Connector shall be *UL* listed and shall be by *Durodyne*, *Ventfabrics, Cain,* or *Ductmate*.

C. Flexible Duct Elbow Support: Support shall be a radius forming composite polymer brace designed to form flexible duct into a 90-degree elbow. Support shall be *UL* approved for use in a return air plenum and sized to accommodate 4" to 16" flexible ductwork. Support shall be by *FlexRight*, *Thermaflex*, *Titus*, *Malco*, or *ThermoFlo*.

D. Manual Balancing Dampers: Provide single blade dampers for round ducts and rectangular ducts less than 12" as indicated on the drawings. Dampers shall be constructed of galvanized steel. Damper shall be installed complete with locking quadrants. For rectangular ducts 12" and wider, provide opposed-blade type dampers constructed of galvanized steel mounted in a galvanized steel channel frame. Blade spacing shall not exceed 6" and the top and bottom edges of the blades shall be crimped to stiffen the blades. Damper blades shall be interconnected by rods and linkages to provide simultaneous operation of all blades. Damper shall be provided with an extended rod to permit installation of a damper regulator. Dampers shall be by *Air Balance*, *Arrow*, *Dowco*, *Jer-Air*, *Nailor, National Controlled Air*, *Pottorff*, *Ruskin*, *Phillips-Aire*, *Safe-Air,* or *United Enertech*.

E. Round Take-Offs: Round take-offs shall be made using collars constructed of galvanized steel equipped gasket flange and manual balancing damper with 2" handle standoff. Do not furnish extractors or air scoops. Takeoffs from VAV system trunk ducts to terminal units shall have a conical entry. Take-offs from low pressure trunk ducts shall have 45-degree entry. Takeoffs shall be by *Celcon*, *Crown*, *Flexmaster*, *Jer-Air*, *Metalcraft*, *Sheet Metal Connectors*, or *Thermaflex.*

F. Rectangular Take-Offs: Rectangular take-offs shall be made using collars constructed of galvanized steel equipped with gasket flange and manual balancing damper with 2" handle standoff. Do not furnish extractors or air scoops. All takeoffs shall have 45-degree entry. Takeoffs shall be by *Celcon*, *Crown*, *Flexmaster*, *Jer-Air*, *Metalcraft*, *Sheet Metal Connectors*, or *Thermaflex,*

G. Fire Dampers (Walls and Floors): Provide curtain type, hinged blade, vertical and/or horizontal mounting fire dampers, suitable for duct penetration or opening protection as required on the drawings. Style 'A' dampers shall be used at wall register/grille locations. Style 'B' dampers shall be used at duct penetrations. Dampers shall meet the requirements of *NFPA 90A* and *UL-555*. Frame shall be minimum 20-gauge galvanized steel with 165 F

fusible link. Blades shall be minimum 24-gauge galvanized steel. Dampers shall be by *Air Balance*, *Greenheck*, *Nailor*, *National Controlled Air*, *Phillips-Aire*, *Pottorff, Prefco*, *Ruskin*, *Safe-Air,* or *United Enertech*.

H. Duct Access Doors: Duct access doors shall be provided at all fire dampers, smoke dampers, combination fire/smoke dampers, and at control items mounted within ducts. Access doors shall be the double-wall insulated type constructed of galvanized steel not less than 24-gauge for the door and 22-gauge for the frame. Insulation shall be 1" thick and shall be rigid and self-sealing. Doors shall have cam locks on at least two sides. Frame shall have knock over edges for attachment to duct by preening and a vinyl gasket shall be provided between duct and frame. Doors shall match the pressure rating of the ductwork system and be as large as possible and as close as possible to the item served. Door shall be by *Air Balance*, *Greenheck*, *Nailor*, *National Controlled Air*, *Phillips-Aire*, *Pottorff, Prefco*, *Ruskin*, *Safe-Air,* or *United Enertech*.

I. Wall Vents: Exterior wall vents shall be used to terminate residential exhaust ducts and residential clothes dryer ducts where shown on the plans. Wall vents shall be modular design with multiple mounting options and custom color options. Wall vents shall be available in single, double, or triple outlet suitable for bathroom exhaust, residential kitchen hood exhaust, residential clothes dryer exhaust and intake air applications. Wall vents shall be UV stabilized, high impact polypropylene. Each fully assembled unit shall consist of a seamless, monolithic box cavity with removable front louver, positive pitch sidewalls and integrated removable recessed gravity backdraft dampers. Provide 4" and/or 6" duct port connections as shown on the plans. Wall vents shall be by *X Vent Box* or equal approved by the Design Professional.

J. Dryer Box: Residential clothes dryer exhaust shall discharge into a UL Classified dryer box recessed in the wall behind the dryer. Box shall be 22-gauge aluminized steel with depth suitable for wall thickness. Box shall have extension rim, mounting holes, tapered sides, paintable surface and 4" exhaust duct opening. Dryer box shall be by *In-O-Vate Technologies* or equal approved by the Design Professional.

2.3 DUCTWORK INSULATION:

A. General: Refer to the mechanical plans for duct insulation types and locations. Insulation shall be by *Certainteed*, *Knauf*, *Manville,* or *Owens Corning*.

B. Duct Wrap: Type "A" Duct wrap shall be 2" thick, 0.75 pcf density, blanket type fiberglass insulation with vapor barrier and minimum R-Value of 6.7.

C. Duct Liner: Type "A" Duct liner shall be 1-1/2" thick, 1.5 pcf density, flexible black fiberglass with minimum R-Value of 6.0.

D. Ductwork Insulation Accessories: Provide mechanical fasteners as recommended by the insulation manufacturer.

E. Ductwork Insulation Compounds: Provide cement, adhesives, wire wrap, coatings, sealers, protective finishes, and similar compounds as recommended by the insulation manufacturer for the applications indicated.

2.4 MISCELLANEOUS MATERIALS:

A. General: Provide miscellaneous materials and products of the types and sizes indicated and where not otherwise indicated, provide type and size required to comply with ductwork system requirements including proper connection of ductwork and equipment.

B. Duct Sealant: Duct Sealant for above ground ductwork shall be a mastic suitable for the pressure classification in accordance with *SMACNA HVAC Duct Construction Standard*". All joints and seams shall be sealed.

C. Ductwork Support Materials: Provide hot-dipped galvanized steel rods, fasteners, anchors, straps, angles, and trim for support of ductwork. Wires shall not be acceptable. Ductwork installed above a roof shall be supported on prefabricated, non-penetrating supports by *Pipe Pier* or approved equal. Provide matching adjustable elevation kits.

2.5 DUCT FABRICATION:

A. Shop fabricate ductwork in 4', 8', 10' or 12' lengths, unless otherwise indicated or required to complete runs. Preassemble in the shop to the greatest extent possible to minimize field assembly of systems. Disassemble systems only to the extent necessary for shipping and handling. Match-mark sections for re-assembly and coordinated installation.

B. Fabricate ductwork with joints, seams and reinforcements as required in the latest edition of *SMACNA HVAC Duct Construction Standards*, 2" static pressure rating unless otherwise noted on the drawings.

C. Fabricate duct fittings to match adjoining ducts and to comply with duct requirements as applicable to fittings. Elbows shall be either the curved radius type or the square type with 4" single wall turning vanes. Double wall turning vanes are not allowed. Provide stacked single wall turning vanes for larger ducts. Curved radius elbows shall have a centerline radius equal to 1.5 times the duct width. Curved radius elbows with square throats shall not be acceptable.

D. Fabricate ductwork with accessories installed during fabrication to the greatest extent possible. Where ducts are specified to lined, make allowances for the thickness of the liner. Duct sizes shown on the drawings are clear, inside dimensions.

PART 3 - EXECUTION

3.1 INSTALLATION OF DUCTWORK:

A. General: Assemble and install ductwork in accordance with the latest edition of *SMACNA HVAC Duct Construction Standards* and with recognized industry practices which will achieve airtight noiseless systems, capable of performing each indicated service. Install each run with a minimum of joints. Align ductwork accurately at connections, and with internal and external surface smooth. Support ducts rigidly with suitable ties, braces, hangers, and anchors of the type which will hold ducts true-to-shape and prevent buckling. Hanger

locations shall be coordinated with the building structure and finish conditions.

B. Complete fabrication of work at the project as necessary to match shop fabricated work and accommodate installation requirements.

C. Locate ductwork runs, except as otherwise indicated, vertically and horizontally and avoid diagonal runs wherever possible. Locate runs as indicated by plans, diagrams, details, and notations or, if not otherwise indicated, run ductwork in the shortest route which does not obstruct usable space or block access for servicing the building and its equipment. Coordinate the layout with piping, lighting layouts and similar finished work and plumbing risers. Duct layouts shown are diagrammatic and actual location of duct shall be field verified and coordinated by the duct fabricator prior to beginning fabrication of duct systems.

D. Duct collars shall be provided where ducts pass through walls and partitions which extend full height to the underside of the roof structure. Collars shall be fabricated from 22-gauge galvanized steel sheet. Duct collars shall be provided on both sides of walls and partitions, except collar shall be omitted on that side of the wall where registers and grilles are installed. Flanges shall be installed tight against the wall. The space between the duct and the wall shall be packed with mineral wool.

E. Coordinate duct installations with installation of accessories, dampers, equipment, controls, and other associated work of the ductwork system.

3.2 INSTALLATION OF INSULATION:

A. Duct Wrap: Wrap shall be wrapped around duct work with all circumferential joints butted and longitudinal joints overlapped a minimum of 2". On circumferential joints, the 2" flange on the facing shall be taped with minimum of 3" wide foil reinforced *Kraft* tape. On longitudinal joints the overlap shall be stapled on 6" centers or held in place with four evenly spaced 8" long tape tabs, then the full joint shall be taped with a minimum 3" wide foil reinforced *Kraft* tape. On ends of insulation use 3" wide foil reinforced *Kraft* tape to fasten insulation ends to duct. For duct widths 24" and greater, provide additional mechanical fasteners on 18" centers on the bottom of the duct to prevent sagging. Insulate that part of the supply diffusers above the ceiling so that there is no uncovered metal surface subject to condensation. Provide taped-on 12"x12" squares of insulation over damper regulators located above ceilings. In lieu of foil reinforced tape listed above for vapor barrier sealing, alternative glass fabric and mastic may be used. All duct insulation installed on duct exterior to building envelope shall have joints and seams taped and covered with mastic, including connections to equipment.

B. Duct Liner: Liner shall be applied to the flat sheet with 100% coverage of fire-resistant adhesive. The duct liner shall be cut to assure snug corner closing joints. The black surface of the liner shall face the air stream. On horizontal runs, tops of ducts over 12" in width and sides over 16" in height shall be additionally secured with welded pins and speed clips or grip nails spaced on a maximum of 16" pin centers. On vertical runs, welded pins and speed clips or grip nails shall be spaced on maximum 16" pin centers on all widths over 12". Pins shall start within 2" of the leading edge of each section. Pins shall be cut close to the speed clip. Clips shall be drawn flush only and shall not compress the liner. Coat all exposed edges and the leading edge of all cross joints with fire-resistant sealant.

3.3 CLEANING AND PROTECTION:

A. Clean ductwork internally, unit-by-unit as it is installed, of dust and debris. Clean external surfaces of foreign substances which might cause corrosive deterioration of the metal or, where ductwork is to be painted, might interfere with painting or cause paint deterioration.

B. Temporary Closure: At ends of ducts which are not connected to equipment or air distribution devices at the time of ductwork installation, provide temporary closure of polyethylene film or other covering which will prevent the entrance of dust and debris.

END OF SECTION 232110

SECTION 232210 - AIR DISTRIBUTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

1.2 QUALITY ASSURANCE:

A. *Titus* is the Basis of Design manufacturer for grilles, registers, and diffusers. Equivalent equipment by *Carnes, Greenheck, Krueger, Metalaire, Nailor, Price,* and *Tuttle & Bailey* that meets performance, capacity, space, and other requirements of the design documents shall be acceptable.

B. *Greenheck* is the Basis of Design manufacturer for louvers. Equivalent equipment by *Airolite, Nailor, Pottorff, Ruskin,* and *United Enertech* that meets performance, capacity, space, and other requirements of the design documents shall be acceptable.

C. Industry Standards: Comply with *National Fire Protection Association Standard No. 90A*, as applicable to construction and installation of required devices.

1.3 SUBMITTALS:

A. Provide manufacturer's data, test reports, and product warranties for all items as applicable.

B. Provide standard color selection charts for all air distribution devices. All colors shall be selected by the Design Professional during Submittal Review.

C. Provide similar air distribution devices as those specified herein and / or indicated on the plans in steel construction for installation with ceiling radiation dampers.

PART 2 - PRODUCTS

2.1 GRILLES, REGISTERS, AND DIFFUSERS:

A. Ceiling Diffusers: Minimum security surface mounted style diffusers shall be the louvered face type with flanged frame, heavy gauge lattice face, tamper-proof screws and one-way, two-way, three-way, or four-way throw as indicated. Diffusers shall be of steel construction with opposed blade damper. Provide manufacturer’s molded backpan R-6 insulation. Provide *Torx* equivalent 6-lobe tamper resistant security screws.

B. Ceiling Diffusers: Maximum security surface mounted style diffusers shall be the perforated face type with flanged frame, tamper-proof screws, rear operated opposed blade damper and

angle mounting frame. Face plate shall be 3/16” steel with 5/16” diameter holes on 7/16” staggered centers. Diffusers shall be nominal 24”x24” in size with neck size scheduled.

C. Security Return/Exhaust Grilles: Security grilles shall be minimum security, aluminum louvered face grilles. Faceplate shall be 3/16” louvers and 3/4” welded aluminum bars to an aluminum sleeve with angle provided on backside for securing.

D. Wall Return/Exhaust Grilles: Horizontal fixed-blade grilles shall be of extruded aluminum construction with 45-degree blades on 3/4” centers.

2.2 LOUVERS:

A. Standard Louvers: Louvers shall be *AMCA Listed for Class A - Wind Driven Rain Performance*. Louvers shall be constructed of minimum 0.08” thick extruded aluminum with drainable head, full jamb section and channel frame. Blades shall be horizontal rain resistant style on approximate 2” spacing. Provide a removable aluminum 1/2” mesh bird screen on the inside face of the louver. Provide motorized damper behind louver with insulated blades, low leakage seals, and 2-position actuator at 120VAC. Finish shall be selected by the Architect.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. General: Install devices as detailed on the drawings and in accordance with manufacturer's written instructions and in accordance with recognized industry practices.

B. Coordinate with other work, including ductwork and ductwork accessories and ceiling system as necessary to interface installation of grilles and diffusers properly with other work.

C. Ceiling mounted devices to be installed in lay-in tile ceilings shall be compatible with 2’x2’ or 2’x4’ T-bar grid as applicable. Refer to Architectural Reflected Ceiling Plans for exact locations of grilles, registers, and diffusers. For flush mounted devices in T-bar ceilings, special care shall be taken to install devices in the center of ceiling tiles. Sagging will not be permitted. Provide rear sheet metal angle bracing.

END OF SECTION 232210

SECTION 232310 - FANS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

1.2 QUALITY ASSURANCE:

A. *Greenheck* is the Basis of Design manufacturer unless noted otherwise. Equivalent name brand equipment manufactured by *Acme, Carnes, Cook, Penn, Stanley,* and *Twin City* that meets performance, capacity, space, and other requirements of the design documents shall be acceptable.

B. Industry Standards:
   1. Provide fans which bear *Air Movement and Control Association (AMCA)* certified performance rating seals.
   2. Provide fan components which have been listed and labeled by *Underwriters' Laboratories*.
   3. Comply with applicable portion of *National Electrical Manufacturer's Association* standards for motors.

1.3 SUBMITTALS:

A. Provide manufacturer's data, test reports, and product warranties on all items.

PART 2 - PRODUCTS

2.1 ROOF CENTRIFUGAL EXHAUST FANS:

A. Roof centrifugal exhaust fans shall be the size and type shown on the drawings. Fan shall be direct drive or belt drive as scheduled with heavy gauge spun aluminum weatherproof housing. Motor shall be in a compartment out of the air stream. Fan wheel shall be of composite or aluminum, dynamically and statically balanced, non-overloading backward-curved blades mounted on steel shaft. Provide self-aligning, permanently lubricated heavy-duty bearings, motor, integral thermal overload protection and electrical disconnect switch under ventilator cap.

B. Provide ECM motor for direct drive fan, aluminum bird screen and backdraft damper. Provide speed controller for direct drive fan. Provide matching roof curb suitable for the roof slope. Curb shall extend minimum 8” above roof surface. Fan shall be capable of resisting wind loads specified in 239110.

PART 3 - EXECUTION

3.1 INSTALLATION OF FANS:

A. General: Except as otherwise shown or specified, install fans in accordance with manufacturer's written instructions and in accordance with *National Electrical Code (NEC)* and recognized industry practices.

B. The mounting height of each wall mounted thermostat or temperature sensor shall comply with ADA for maximum side reach. The thermostat or sensor shall be at 48" maximum above the floor.

3.2 TESTING:

A. After installation of fans has been completed, test each unit to demonstrate proper operation at performance requirements specified, including, but not limited to, proper rotation of impeller. When possible, field correct malfunctioning units, then retest to demonstrate compliance. Replace units which cannot be satisfactorily corrected.

END OF SECTION 232310

SECTION 233110 - ELECTRIC HEATERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

1.2 QUALITY ASSURANCE:

A. *QMark* is the Basis of Design manufacturer. Equivalent name brand equipment by *Berko, Chromalox, Markel, Reddi, Raywall,* and *Warren* that meets performance, capacity, space, and other requirements of the design documents shall be acceptable.

B. Industry Standards: Each unit shall be *UL* listed.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT:

A. Unit Heaters: Unit heaters shall be the propeller**,** horizontal discharge type with adjustable louvers. Heating elements shall be the fin-tube type with steel sheath. Cabinet shall be heavy gauge steel with baked enamel finish. Provide bracket for wall mounting. Motor and fans shall be direct drive. Motors shall be the permanently lubricated, resiliently mounted, totally enclosed type with a thermal overload protection with automatic reset. Provide integral thermostat. Provide built-in fan delay switch. Provide built-in disconnect switch.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Install heaters in accordance with the manufacturer's instructions.

B. The mounting height of each wall mounted thermostat or temperature sensor shall comply with ADA for maximum side reach. The thermostat or sensor shall be at 48” maximum above the floor.

END OF SECTION 233110

SECTION 234320 - AIR TREATMENT SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

1.2 REFERENCED CODES & STANDARDS:

A. The following codes and standards are referenced throughout. The edition to be used is that currently enforced by the Authority Having Jurisdiction (AHJ) or in absence of such direction that referenced by the current enforceable *IMC* code or as indicated by the contract documents, except where specifically referenced by this section of the specifications.
   1. *ASHRAE Standards 62, 52, and 145.2*.
   2. *National Electric Code NFPA 70*.
   3. *UL 2998*.

1.3 QUALITY ASSURANCE:

A. *Global Plasma Solutions* is the Basis of Design manufacturer. Equivalent name brand systems manufactured by *BioClimatic* and *Phenomenal Aire* that meets performance, capacity, space, and other requirements of the design documents shall be acceptable.

B. A qualified representative from the manufacturer shall be available to inspect the installation of the air treatment system to ensure installation in accordance with manufacturer's recommendations.

C. Technologies that do not address gas disassociation such as UV lights, powered particulate filters and/or polarized media filters shall not be considered. Uni-polar ion generators shall not be acceptable. “Plasma” particulate filters shall not be acceptable.

D. ASHRAE 62.1 Compliance: Projects designed using *ASHRAE Standard 62.1, IAQ Procedure* shall require the manufacturer to provide Indoor Air Quality calculations using the formulas within *ASHRAE Standard 62.1-2022* to validate acceptable indoor air quality at the quantity of outside air scheduled with the submitted technology. The manufacturer shall provide independent test data on a previous installation performed within the last two years and in a similar application, that proves compliance to *ASHRAE 62.1-2022* and the accuracy of the calculations.

E. ASHRAE 145.2 Compliance: Evaluation of Air Purifier removal efficacies of design compounds shall comply with ASHRAE 145.2 – 2016. Gas-phase cleaning efficiencies must meet the below detailed minimums for single pass air cleaning with regard to the following design compounds:

Design Compound	Design Target ($\mu g/m^3$)	Filter Removal Efficiency (minimum)
Acetaldehyde	140	53%
Acetone	1,200	77%
Ammonia	200	22%
Benzene	3	99%
Carbon Monoxide	10,310	1%
Dichloromethane	400	63%
Formaldehyde	33	63%
Naphthalene	9	99%
Ozone	137	99
Phenol	70	45%
$PM_{2.5}$/Particulate Matter	12	77%
Tetrachloroethylene	35	99%
Toluene	300	99%
Xylene	500	99%

F. Air Treatment Systems shall have been tested by *UL* or *Intertek/ETL* to prove conformance to *UL 867-2007* including the ozone chamber testing and peak ozone test for electronic devices. Manufacturers that achieved *UL 867* prior to December 21, 2007 and have not been tested in accordance with the newest *UL 867* standard with the ozone amendment shall not be acceptable. All manufacturers shall submit their independent *UL 867* test data with ozone results to the engineer during the submittal process. All manufacturers shall submit a copy with their quotation. Contractors shall not accept any proposal without the proper ozone testing documentation.

G. The maximum allowable ozone concentration per the *UL 867-2007* chamber test shall be 0.007 ppm. The maximum peak ozone concentration per the *UL 867-2007* peak test as measured 2" away from the electronic air cleaner output shall be no more than 0.0042 ppm. Manufacturers with ozone output exceeding these ozone values shall not be acceptable.

1.4 SUBMITTALS:

A. Provide manufacturer's data, test reports, and product warranties. The following information shall be included in the submittal:
   1. Schedule of air treatment systems indicating unit designation and number of each type required for each unit/application.
   2. Data sheet for each type of air treatment systems and accessories furnished indicating construction, sizes, and mounting details.
   3. Performance data for each type of air treatment system furnished.
   4. Indoor Air Quality calculations using the formulas within *ASHRAE Standard 62.1* to validate acceptable indoor air quality at the quantity of outside air scheduled.
   5. Product drawings detailing all physical, electrical and control requirements.
   6. Copy of *UL 2998* test.
   7. Operating and Maintenance Data: Submit O&M data and recommended spare parts lists.

1.5 WARRANTY:

A. Equipment shall be warranted by the manufacturer against defects in material and workmanship for a period of eighteen months after shipment or twelve months from Owner acceptance, whichever occurs first. Labor to replace equipment under warranty shall be provided by the Owner or installing contractor.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT:

A. General: Air Treatment Systems shall be the needlepoint bipolar ionization type. Provide an air treatment system for every HVAC unit scheduled on the plans unless noted otherwise on the plans.

B. The Bipolar Ionization system shall be capable of:
   1. Effectively killing microorganisms downstream of the bi-polar ionization equipment (mold, bacteria, virus, etc.).
   2. Controlling gas phase contaminants generated from human occupants, building structure and furnishings.
   3. Reducing static space charges.
   4. Increasing the interior ion levels, both positive and negative.
   5. Self-cleaning requiring no maintenance or replacement parts (where specified).
   6. Producing the specified minimum ions/cc.
   7. When mounted to the air entering side of a cooling coil, keep the cooling coil free from pathogen and mold growth.

C. Air Treatment Systems shall operate in a manner such that equal amounts of positive and negative ions are produced. Unipolar ion devices shall not be acceptable. Air exchange rates may vary through the full operating range of a constant volume or VAV system. The quantity of air exchange shall not be increased due to requirements of the system. The air treatment system shall not have a maximum velocity profile.

D. Air Treatment Systems shall not require preheat protection when the relative humidity of the entering air exceeds 85%. Relative humidity from 0-100% shall not cause damage, deterioration, or dangerous conditions within the systems. Air treatment systems shall be capable of wash down duty.

E. Dual Electrode Air Treatment Systems Up To 2,400 cfm (Basis of Design is *GPS-CI-2*):
   1. Where so indicated on the plans and/or schedules, air treatment systems shall be supplied and installed. The mechanical contractor shall mount the systems and wire to the HVAC unit control power (24VAC) or EMCS low voltage power per the manufacturer's instructions or line voltage subject to power available. Each system shall be designed with a molded casing, automatic self-cleaning system, self-cleaning test button, power status LED and dry contacts to prove ion output is operating properly. The dry contacts shall close to prove the ion generator is working properly and may be daisy chained in series such that only one dry contact per HVAC unit is required to interface to the EMCS or the optional

DDC controller. Dry contacts proving power has been applied in lieu of the ion output operating are not acceptable. Manufacturers providing multiple ion modules that have alarm status wired in parallel, and not in series, shall not be acceptable.

2. Each system shall include the required number of electrodes and power generators sized to the HVAC unit capacity. A minimum of one electrode pair per 2,400 cfm of air flow shall be provided. Bipolar ionization tubes manufactured of glass and steel mesh shall not be acceptable due to replacement requirements, maintenance, performance output reduction over time, ozone production and corrosion.
3. Electrodes shall be energized when the main unit disconnect is turned on and the fan is operating. Electrodes shall be made from carbon fiber to prevent oxidation over time. Internal circuitry shall be provided to sense air flow across the electrode output. Ionization systems requiring the use of a mechanical air pressure switch to cycle the electrodes only when the fan is operating shall not be acceptable due to high failure rates and pressure sensitivity.
4. Electrode pair shall provide a minimum of 160M ions/cc/sec as measured at 2", both positive and negative ions, in equal quantities. Devices providing less than 160M ions/cc per electrode pair shall not be acceptable.
5. Each system shall have an automatic self-cleaning feature. Systems without a no-maintenance, automatic self-cleaning feature shall not be acceptable.
6. Each electrode pair shall be designed with a banana style plug such that it can be field replaced, if necessary.
7. Each system shall be provided with an inline on/off switch, universal voltage input (24VAC to 240VAC or DC), and replaceable carbon fiber emitters.
8. Units shall be mounted in the supply fan inlet(s) and oriented in the airstream to prevent ionization cancellation. For blow-thru equipment, mount the unit downstream of the evaporator coil. Secure to the equipment with magnets.

F. Dual Electrode Air Treatment Systems Up To 2,400 cfm (Basis of Design is *GPS-FC-24-AC*):
1. Where so indicated on the plans and/or schedules, air treatment systems shall be supplied and installed. The mechanical contractor shall mount the systems and wire to the HVAC unit control power (24VAC) or EMCS low voltage power per the manufacturer's instructions or line voltage subject to power available. Each system shall be designed with a molded casing, automatic self-cleaning system, self-cleaning test button, power status LED and dry contacts to prove ion output is operating properly. The dry contacts shall close to prove the ion generator is working properly and may be daisy chained in series such that only one dry contact per HVAC unit is required to interface to the EMCS or the optional DDC controller. Dry contacts proving power has been applied in lieu of the ion output operating are not acceptable. Manufacturers providing multiple ion modules that have alarm status wired in parallel, and not in series, shall not be acceptable.
2. Each system shall include the required number of electrodes and power generators sized to the HVAC unit capacity. A minimum of one electrode pair per 2,400 cfm of air flow shall be provided. Bipolar ionization tubes manufactured of glass and steel mesh shall not be acceptable due to replacement requirements, maintenance, performance output reduction over time, ozone production and corrosion.
3. Electrodes shall be energized when the main unit disconnect is turned on and the fan is operating. Electrodes shall be made from carbon fiber to prevent oxidation over time. Internal circuitry shall be provided to sense air flow across the electrode output. Ionization systems requiring the use of a mechanical air pressure switch to cycle the electrodes only when the fan is operating shall not be acceptable due to high failure rates and pressure sensitivity.
4. Electrode pair shall provide a minimum of 300M ions/cc/sec as measured at 2", both

positive and negative ions, in equal quantities. Devices providing less than 300M ions/cc per electrode pair shall not be acceptable.
5. Each system shall have an automatic self-cleaning feature. Systems without a no-maintenance, automatic self-cleaning feature shall not be acceptable.
6. Each electrode pair shall be designed with a banana style plug such that it can be field replaced, if necessary.
7. Each system shall be provided with an inline on/off switch, universal voltage input (24VAC to 240VAC or DC), and replaceable carbon fiber emitters.
8. Units shall be mounted in the supply fan inlet(s) and oriented in the airstream to prevent ionization cancellation. For blow-thru equipment, mount the unit downstream of the evaporator coil. Secure to the equipment with magnets.

G. Dual Electrode Air Treatment Systems Up To 4,800 cfm (Basis of Design is *GPS-FC-48-AC*):
1. Where so indicated on the plans and/or schedules, air treatment systems shall be supplied and installed. The mechanical contractor shall mount the systems and wire to the HVAC unit control power (24VAC) or EMCS low voltage power per the manufacturer's instructions or line voltage subject to power available. Each system shall be designed with a molded casing, automatic self-cleaning system, self-cleaning test button, power status LED and dry contacts to prove ion output is operating properly. The dry contacts shall close to prove the ion generator is working properly and may be daisy chained in series such that only one dry contact per HVAC unit is required to interface to the EMCS or the optional DDC controller. Dry contacts proving power has been applied in lieu of the ion output operating are not acceptable. Manufacturers providing multiple ion modules that have alarm status wired in parallel, and not in series, shall not be acceptable.
2. Each system shall include the required number of electrodes and power generators sized to the HVAC unit capacity. A minimum of one electrode pair per 4,800 cfm of air flow shall be provided. Bipolar ionization tubes manufactured of glass and steel mesh shall not be acceptable due to replacement requirements, maintenance, performance output reduction over time, ozone production and corrosion.
3. Electrodes shall be energized when the main unit disconnect is turned on and the fan is operating. Electrodes shall be made from carbon fiber to prevent oxidation over time. Internal circuitry shall be provided to sense air flow across the electrode output. Ionization systems requiring the use of a mechanical air pressure switch to cycle the electrodes only when the fan is operating shall not be acceptable due to high failure rates and pressure sensitivity.
4. Electrode pair shall provide a minimum of 400M ions/cc/sec as measured at 2", both positive and negative ions, in equal quantities. Devices providing less than 400M ions/cc per electrode pair shall not be acceptable.
5. Each system shall have an automatic self-cleaning feature. Systems without a no-maintenance, automatic self-cleaning feature shall not be acceptable.
6. Each electrode pair shall be designed with a banana style plug such that it can be field replaced, if necessary.
7. Each system shall be provided with an inline on/off switch, universal voltage input (24VAC to 240VAC or DC), and replaceable carbon fiber emitters.
8. Units shall be mounted in the supply fan inlet(s) and oriented in the airstream to prevent ionization cancellation. For blow-thru equipment, mount the unit downstream of the evaporator coil. Secure to the equipment with magnets.

H. Electrical Requirements: Wiring, conduit and junction boxes shall be installed within housing plenums in accordance with *NEC NFPA 70*. The contractor shall coordinate electrical requirements with system manufacturer during submittals. Where necessary,

provide matching dedicated power supply transformer.

I. Control Requirements:
   1. Air Treatment Systems shall have internal short circuit protection, overload protection, and automatic fault reset circuit breakers. Systems with manual fuses shall not be allowed.
   2. Integral airflow sensing shall modulate the plasma output as the airflow varies or stops. A mechanical airflow switch shall not be acceptable to activate the Plasma device due to high failure rates and possible pressure reversal.
   3. The installing contractor shall mount and wire the systems within the HVAC units specified or as shown or the plans. The contractor shall follow all manufacturer IOM instructions during installation.
   4. All systems shall have a means to interface with an EMCS system. Dry contacts shall be provided to prove ions being produced. Systems providing indication that power is applied to the system but not directly sensing the power at the ion output shall not be acceptable.

PART 3 - EXECUTION

3.1 GENERAL:

A. The Contractor shall be responsible for maintaining all Air Treatment Systems until the Owner accepts the building.

B. Dual electrode systems (*CI-2*) shall be provided for all thru-wall heat pumps (THP), and ductless wall, cassette and multi-position air handlers (DAH). Provide multiple systems as needed based on cfm.

C. Dual electrode systems (*FC24, FC48*) shall be provided for all roof air conditioners (RAC). Provide multiple systems as needed based on cfm.

3.2 INSTALLATION:

A. All equipment shall be assembled and installed in a workman like manner.

B. Any material damaged by handling, water or moisture shall be replaced by the Contractor at no cost to the Owner.

C. All equipment shall be protected from dust and damage daily throughout construction.

3.3 TESTING:

A. Provide the manufacturer’s recommended electrical tests.

3.4 STARTUP AND TRAINING:

A. A manufacturer's authorized representative shall provide start-up supervision and training of

owner's personnel in the proper operation and maintenance of all equipment.

END OF SECTION 234320

SECTION 234330 - GAS DETECTION SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

1.2 DESCRIPTION OF WORK:

A. Contractor to provide and install gas detection systems to detect and monitor carbon monoxide and methane (natural gas). The system shall control building exhaust fans as needed in response to elevated gas levels.

1.3 QUALITY ASSURANCE:

A. Manufacturers: Provide gas detection systems manufactured by one of the following: *American Gas Safety, Brasch, Honeywell, Johnson Controls, Macurco, MSA,* and *Siemens.*

B. Industry Standards: Provide products with *UL* labels.

1.4 SUBMITTALS:

A. Submit shop drawings, manufacturer's data, operating instructions, maintenance manuals and wiring diagrams for mechanical control systems.

PART 2 - PRODUCTS

2.1 GAS DETECTION SYSTEM:

A. The carbon monoxide / methane detection system shall include a control panel with integral gas detection sensors, an audible alarm horn, strobe light and emergency shunt switches.

B. The control device panel will be 120 Vac powered, individually powered and capable of accepting the inputs from the emergency shunt switch and de-energizing the gas solenoid valve. The detector shall enter alarm condition when the emergency shunt switch is pressed, or when alarm levels of methane and/or carbon monoxide are present in the mechanical room. The device will clearly display the condition of an alarm and provide hazardous or toxic gas levels via ppm or % of LEL. The device shall provide a re-set and test function. The device shall incorporate dual sensor technology to detect Methane and CO (Carbon Monoxide) without the requirement for additional components. The device shall be UL certified and listed. Mount the device per manufacturer’s instructions and recommendations.

C. The control device panel will be capable of transmitting alarm conditions to an Energy Management System (EMS) through its dry contact relay output. For local activation of fans or louvers (or other equipment), the relay will change state in alarm and revert to its original state once the alarm has been removed. For activation of local audible alarms, the device shall have an on-board siren able to generate an audible output of 85 dBA @ 10 ft. The unit shall provide a traffic signal type colored TFT display, Green – all clear, Yellow – warning (low alarm) Red – Alarm.

D. Power for the control panel shall be single point 120V/1-phase. Provide low voltage transformer as needed. Low voltage power for sensors and accessories shall be provided from the control panel. Provide with the gas detection system manufacturer's enclosed relay or contactor accessory for connecting the equipment safety shutdown circuit. Coordinate relay or contactor requirements with the equipment (water heater(s)).

E. Detection system shall be *UL 1244* labeled and *CSA 22.2* labeled. Unit shall be manufactured within an *ISO 9001* production environment.

F. Provide emergency shunt switches labeled "***EMERGENCY GAS SHUT OFF"*** with clear lift cover to prevent inadvertent shutdowns with a red mushroom twist release button for reset after emergency. Switches shall utilize a set of normally closed contacts for control input to gas detector setting it into alarm. When the detector enters alarm, it will in turn de-energize and close the gas solenoid valve.

G. Provide a Gas Solenoid Valve: UL Listed 429, CSA certified, gas safety shut-off valve. Aluminum body two-way normally closed valve rated for natural gas (methane). Size to be same as pipe size indicated on plans, 120VAC single phase actuator, 15 watts, and 2 PSI maximum operating pressure capacity. Gas solenoid valve shall be placed to shut down the fuel supply to the water heaters located inside the room. Powered by the gas detector via 120VAC de-energizing output.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Emergency gas shutdown equipment shall be provided by the manufacturer as a complete system.

B. Install emergency gas shutdown equipment including sensors, emergency shunt switches, and gas solenoid valves as shown on Contract Drawings, and as recommended by manufacturer of equipment. Control panel shall be connected to the building's fire alarm and energy management system (EMS).

C. Coordinate exact locations of panel and sensors with the electrical drawings. All control wiring, devices, and conduit associated with the system shall be furnished and installed under the Mechanical Specifications.

3.2 SEQUENCE OF OPERATION:

A. Detection system shall have 2 alarm levels. The first alarm shall be set a 25 ppm for carbon monoxide and 8% LEL / 4% of VOL for methane and shall automatically start EF-3. The second alarm level shall be set at 50 ppm for carbon monoxide and 10% of LEL / 5% of VOL for methane and shall sound the alarm horn and start the strobe light. EF-3 normally operates from a wall mounted thermostat. The gas detection system shall be wired to override the thermostat.

B. If Methane Sensor detects 8% of LEL, the detector shall indicate Low Alarm level via TFT screen. If the hazardous gas level reaches 10% of LEL the detector shall indicate High Alarm level via TFT screen and audible alarm. The high alarm shall de-energize the power output to the gas valve isolating the gas supply to the mechanical room. The internal relay outputs shall change state communicating the alarm condition to the EMS and Fire Alarm Control Panel (F.A.C.P).

C. If CO sensor detects Carbon Monoxide the detector shall indicate Low Alarm level via TFT screen. If CO levels continue to rise or trigger alarm thresholds of 50PPM detector shall indicate High Alarm via TFT screen and audible alarm. The high alarm shall de-energize the power output to the gas valve isolating the gas supply to the mechanical room. The internal relay outputs shall change state communicating the alarm condition to the EMS and Fire Alarm Control Panel (F.A.C.P).

D. Remote Panic Button input shall activate high alarm protocol.

E. The device shall provide a manual re-set function that will re-energize the gas valve and electrical power outputs allowing the gas supply and the appliances to resume. The re-set function shall only be permitted by the device if all detectors are reporting a clean and safe condition.

F. Water Heater(s) shut down via safety circuit when carbon monoxide rises above the high alarm setpoint, and / or natural gas rises above the high alarm setpoint, and / or remote emergency shutoff button is pressed. Equipment shall return to normal operation after carbon monoxide and / or methane levels return to levels lower than the first alarm level.

G. Water Heater(s) shall shut down upon loss of power to the gas detection control panel.

3.3 TESTING:

A. The gas detection system shall be tested to demonstrate proper gas detection and monitoring, fan control and alarms.

END OF SECTION 234330

SECTION 235310 – AIR CONDITIONERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

1.2 QUALITY ASSURANCE:

A. Manufacturers:
   1. *Carrier* is the Basis of Design manufacturer for Roof Air Conditioners. Equivalent name brand equipment manufactured by *Aaon*, *Daikin*, *Trane, York,* and *Johnson* that meets performance, capacity, space, and other requirements of the design documents shall be acceptable.

B. Industry Standards:
   1. Units shall be rated and certified in accordance with *ARI Standard 210/240/270/340/360/380* as applicable.
   2. Units will be certified for capacity and efficiency and be listed in the latest *AHRI* directory.
   3. Unit construction will comply with latest editions of *ASHRAE and NEC*.
   4. Units will be constructed in accordance with *UL* standards and will carry *UL* label of approval.
   5. Comply with installation requirements of *ANSI/ASHRAE 15 - Safety Code for Mechanical Refrigeration*.
   6. Roof curbs shall be designed to *NRCA* Standards.
   7. Roof units shall be designed in accordance with *UL Standard 1995*, including tested to withstand rain.
   8. Where A2L refrigerant is involved, include an integral UL certified refrigerant leak dissipation system as applicable.

C. Warranty:
   1. In addition to the standard one-year warranty on all components, compressors shall bear an additional four-year manufacturer's warranty against material and design defects.
   2. In addition to the standard one-year warranty on all components, gas heat exchangers shall bear an additional nine-year manufacturer's warranty against material and design defects.

1.3 SUBMITTALS:

A. Provide manufacturer's data, test reports, and product warranties for all items as applicable.

PART 2 - PRODUCTS

2.1 ROOF AIR CONDITIONERS (NOMINAL 5 TONS AND BELOW):

A. General: Each unit shall be a self-contained, packaged unit complete with precharged refrigerant circuits and ready to operate as a year-round HVAC system. Units shall be complete with features and accessories listed below and as noted on the plans.

B. Unit cabinet shall be constructed of galvanized steel, bonderized, and coated with baked enamel finish on all externally exposed surfaces. Evaporator fan compartment interior cabinet insulation shall conform to *AHRI Standards 210/240* minimum exterior sweat criteria. Interior surfaces shall be insulated with flexible fiberglass insulation with neoprene coating on the air side. Aluminum foil-faced fiberglass insulation shall be used in the heating compartment. Provide minimum 16-gauge base rails. Provide IAQ drain pan of corrosion resistant material with drain connection. Top panel shall be a single piece on all sizes. Provide hinged access panels with UV modified composite recessed handles. Provide units with condenser coil hail guards. Provide matching full perimeter roof curb suitable for the roof slope. Curbs shall extend minimum 8” above roof surface. Units shall be capable of resisting wind load specified in 239110.

C. Compressor shall be a hermetically sealed 2-stage scroll type factory-mounted on rubber vibration isolators. Compressor motor shall be cooled by refrigerant gas passing through the motor windings. Compressor shall be internally protected from high discharge temperature conditions and shall be protected from over-temperature and over-amperage conditions by an internal motor overload device. Compressor motor shall have internal line break thermal, current overload, and high-pressure differential protection. Refrigerant circuit shall include TXV cooling metering, refrigerant filter drier, service gauge connections on suction and discharge lines, and suction line accumulator.

D. Indoor and outdoor coils shall be constructed of copper tubes with aluminum fins mechanically bonded to the tubes. Evaporator coils and hot gas reheat coils shall be leak tested to 150 psig, pressure tested to 450 psig, and qualified to *UL 1995* burst test at 1775 psig. Condenser coils shall be leak tested to 150 psig, pressure tested to 650 psig, and qualified to *UL 1995* burst test at 1980 psig.

E. Evaporator fan shall be centrifugal ECM direct drive vane axial fan, constant cfm type, permanently lubricated, statically and dynamically balanced. The stator shall be cast aluminum with high impact composite material on rotor and air inlet casing. Provide automatic-reset thermal overload protection, slow ramp up speed capability, electrical phase reversal and loss protection, and slide-out design. Provide a unit control board to provide connection points for control functions. The fan speed shall be automatically controlled to meet the *AHRI* performance requirement at 75% low fan speed and 100% high fan speed.

F. Condenser fan shall be direct-drive propeller type with forward swept blade, discharging air upward. Condenser fan motor shall be totally enclosed type with permanently lubricated bearings and thermal overload protection with automatic reset. Fan shaft will be corrosion resistant. Fan blades shall be statically and dynamically balanced. Condenser fan opening shall have a coated steel wire safety guard.

G. Air filters shall be located inside the unit casing and shall be 2” thick pleated MERV 13.

Filters shall be listed by *UL* as Class 2. Initial resistance at 500 fpm velocity shall not exceed 0.30" wg. The media support shall be a welded wire grid.

H. Gas-fired heaters shall be the induced draft combustion type for use with natural gas. Heat exchanger and burners shall be aluminized steel. Gas burner controls shall include automatic safety pilot, redundant automatic gas valves, manual gas cock, and pressure regulator. Ignition shall be direct spark type with intermittent pilot with 100% shutoff. Induced draft blower shall provide pre-purge and shall be provided with a proving switch to prevent burner operation if venter is not in operation. Provide fan switch and limit control to delay the fan until heat is available and to continue fan operation until heat is dispersed. Limit switch shall shut the burners down in case of failure of operating controls.

I. Outdoor Air Control: All units shall have an economizer accessory with gear driven opposed blade modulating dampers for control of outdoor air. Damper blades shall be galvanized steel with composite gears with low leakage rate not to exceed 4.0 cfm/ft of damper area at 1" wg pressure differential. Provide dampers for outdoor air and return air for positive air stream control. Outdoor air hood shall include aluminum water entrainment filter. During normal operation, constant scheduled outdoor air cfm shall be provided regardless of fan speed; therefore, the dampers shall be configured to provide three positions: closed / low fan speed open / high fan speed open. Where scheduled on the plans, the dampers shall also be configured for integrated differential enthalpy control capable of simultaneous economizer and compressor operation. Economizer control shall be capable of up to 100% outdoor air and shall be equipped with a barometric relief damper capable of relieving 100% outdoor air.

J. Units shall have full DDC control per Section 238310. See Section 238310 for additional control information.

K. Provide units with controls equipped with time-delay devices with the capability to prevent short cycling of compressor. Provide units with 24V internal control wiring with plug-in type relays for reliability and ease of maintenance. Provide power phase monitoring accessory to protect equipment from phase loss and / or phase reversal for units with 3-phase power requirements. Each unit shall have high pressure stats, low pressure stats, loss of charge protection, indoor coil freeze stats and current and temperature-sensitive overload devices. Provide low ambient cooling.

L. Provide factory-installed unit non-fused disconnect switch for units with MOCP of 80 amps or less. Provide factory installed GFCI 120V convenience outlet with transformer powered from the line side of the disconnect switch. Provide single point power. Provide factory thru-base electrical connections.

M. HVAC drain piping shall be Schedule 40 PVC pipe with socket type fittings and solvent cement joints. Piping exposed above the roof shall receive two coats of white latex paint for UV protection. Provide non-penetrating neoprene roof pedestal pipe supports with clamps on maximum five foot spacing.

PART 3 - EXECUTION

3.1 INSPECTION:

A. Installer must examine areas and conditions under which heat pumps are to be installed and notify the Contractor in writing of conditions detrimental to the proper completion of the work. Do not proceed with the work until the unsatisfactory conditions have been corrected in a manner acceptable to Installer.

3.2 INSTALLATION:

A. Install air conditioners where shown, in accordance with equipment manufacturer's written instructions and recognized industry practices, to ensure that units comply with requirements and serve intended purposes.

B. Coordinate with other work, including structural, ductwork, piping and electrical work, as necessary to interface installation of air conditioners with other work. Control wiring and devices for complete, operable systems shall be provided and installed under the Mechanical specifications. Wiring shall be installed in conduit provided and installed under the Electrical specifications.

C. Piping: Condensate lines shall be installed with traps and vents in each line. Pipe supports shall be on maximum 6-foot centers on horizontal lines. Open ends of lines and connection fittings of equipment shall be properly capped or plugged during construction to protect from damage and entry of dirt or foreign material.

D. The mounting height of each wall mounted thermostat or temperature sensor shall comply with ADA for maximum side reach. The thermostat or sensor shall be at 48” maximum above the floor.

3.3 TESTING:

A. Upon completion of installation of air conditioners and connection to the completed air distribution system, start-up, and test equipment in accordance with the manufacturer's recommendations. Operate units to demonstrate capability and compliance with requirements. Where possible, field-correct malfunctioning units, then retest to demonstrate compliance.

END OF SECTION 236110

SECTION 236110 – HEAT PUMPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

1.2 QUALITY ASSURANCE:

A. Manufacturers:
   1. *Amana* is the Basis of Design manufacturer for Thru-Wall Heat Pumps. Equivalent name brand equipment manufactured by *General Electric, Gree*, *LG*, *Trane,* and *York* that meets performance, capacity, space, and other requirements of the design documents shall be acceptable.
   2. *Carrier* is the Basis of Design manufacturer for Ductless Heat Pumps. Equivalent name brand equipment manufactured by *Mitsubishi, Daikin, LG, Trane, York, and Johnson* that meets performance, capacity, space, and other requirements of the design documents shall be acceptable.

B. Industry Standards:
   1. Units shall be rated and certified in accordance with *ARI Standard 210/240/270/340/360/380* as applicable.
   2. Units will be certified for capacity and efficiency and be listed in the latest *AHRI* directory.
   3. Unit construction will comply with latest editions of *ASHRAE* and *NEC*.
   4. Units will be constructed in accordance with *UL* standards and will carry *UL* label of approval.
   5. Comply with installation requirements of *ANSI/ASHRAE 15 - Safety Code for Mechanical Refrigeration*.
   6. Where A2L refrigerant is involved, include an integral UL certified refrigerant leak dissipation system as applicable.

C. Extended Warranty: In addition to the standard one-year warranty on all components, compressors shall bear an additional four-year manufacturer's warranty against material and design defects.

1.3 SUBMITTALS:

A. Provide manufacturer's data, test reports, and product warranties for all items as applicable.

PART 2 - PRODUCTS

2.1 THRU-WALL HEAT PUMPS:

A. General: Each unit shall be a self-contained, packaged unit complete with precharged refrigerant circuits and ready to operate as a year-round HVAC system. Units shall be complete with features and accessories listed below and as noted on the plans.

B. The chassis shall slide into the wall sleeve and shall house the refrigeration section and the fans/heater/controls section. The compressor shall be fully hermetic with internal and external vibration isolation. Coils shall consist of seamless copper tubing with aluminum fins. All refrigerant piping, devices, and accessories shall be prepiped and fully charged with refrigerant.

C. The fan motor shall be The PSC type, double shaft, totally enclosed, permanently lubricated, multiple speed. The evaporator fan shall be a dynamically balanced single inlet, squirrel cage blower with corrosion resistant finish. The condenser fan shall be a dynamically balanced propeller type with corrosion resistant finish. Provide an outside air intake damper.

D. The wall sleeve and front panel shall be a polymeric material. The front panels shall have louvers in the front surface. The aluminum discharge grille shall be invertible to allow horizontal or vertical air delivery. The filter shall be the one-piece type with cleanable frame and foam filter. The outdoor grille shall be the standard architectural type with dark bronze finish.

E. Controls shall consist of a push-button OFF/FAN/HEAT/COOL selector switch, adjustable thermostat, VENT OPEN/CLOSE and FAN CYCLE switches. Provide defrost control and outdoor thermostat. Provide automatic reset thermal and overload protection. Electrical connection shall be hard wired with matching electrical subbase. Provide the following special features: universal drain kit and corrosion protection chassis.

2.2 DUCTLESS HEAT PUMPS:

A. General: Outdoor heat pumps and indoor air handlers shall be a matched pair of one manufacturer rated for operation together by the manufacturer's published literature as a year-round HVAC system. Units shall be complete with features and accessories listed below and as noted on the plans.

B. Ductless Heat Pumps (Inverter-Driven): Cabinets shall be constructed of galvanized steel, bonderized, and coated with powder coat paint. Provide a hermetically sealed heat pump duty rotary compressor mounted on rubber vibration isolators. Compressor motor shall be NEMA rated Class E. Condenser coil shall be constructed of aluminum fins mechanically bonded to copper tubes. Condenser fan shall be direct-drive propeller type with horizontal discharge. Condenser fan motor shall be totally enclosed type with Class E insulation and permanently lubricated. Fan shaft will be corrosion resistant. Fan blades shall be statically and dynamically balanced. Condenser fan opening shall have a PVC metal/mesh coated safety guard. Refrigeration circuit components shall include liquid-line back-seating shutoff valve with sweat connections, vapor-line back-seating shutoff valve with sweat connections, system charge, POE compressor oil, crankcase heater, accumulator, reversing valve, and refrigerant filter drier.

C. Ductless Air Handlers: Provide horizontal wall mounted type complete with statically and dynamically balanced centrifugal direct drive fan, indoor coil, standard filters, expansion

valves and relays, and controls all housed in a factory-fabricated and insulated steel housing with baked enamel finish. Provide single point power connection. Provide a spare washable filter for each unit.

D. Unit controls and protective devices shall include high pressure stat, loss of charge pressure stat, suction line accumulator and pressure relief device. Motor compressors shall have a thermal and current sensitive overload device. The outdoor unit shall have short cycle protection and safety lock-out compressor protection. Automatic defrost controls shall be provided. Factory charge with refrigerant. Provide condensate overflow switch.

E. Refrigerant piping shall be hard drawn seamless copper tubing suitable for a working pressure of 600 psig. Fittings shall be wrought copper or brass suitable for use with high temperature solder and designed for 600 psig working pressure. Suction line insulation shall be plenum rated closed cell foam plastic insulation.

F. HVAC drain piping shall be Schedule 40 PVC pipe with socket type fittings and solvent cement joints. Insulate with 1" thick closed-cell flexible elastomeric pipe insulation.

G. Thermostats shall be the manufacturer's digital wall mounted programmable thermostat.

H. See section 238310 for more information.

PART 3 - EXECUTION

3.1 INSPECTION:

A. Installer must examine areas and conditions under which heat pumps are to be installed and notify the Contractor in writing of conditions detrimental to the proper completion of the work. Do not proceed with the work until the unsatisfactory conditions have been corrected in a manner acceptable to Installer.

B. Confirm suitable refrigerant pipe length and lift before submitting equipment.

3.2 INSTALLATION OF HEAT PUMPS:

A. Install heat pumps where shown, in accordance with equipment manufacturer's written instructions and recognized industry practices, to ensure that units comply with requirements and serve intended purposes.

B. Coordinate with other work, including structural, ductwork, piping and electrical work, as necessary to interface installation of heat pumps with other work. Control wiring and devices for complete, operable systems shall be provided and installed under the Mechanical specifications. Wiring shall be installed in conduit provided and installed under the Electrical specifications.

C. Piping: Refrigerant line joints shall be brazed with silver solder. Lines shall be sized, installed, and insulated in accordance with equipment manufacturer's instructions. Suction line insulation joints shall be sealed with an adhesive recommended by the insulation

manufacturer. All refrigerant line insulation exposed to weather shall be protected with a weatherproof coating supplied by the insulation manufacturer. Suction and hot gas line sets shall be secured together with plastic ties. Tape or coated wire shall not be allowed. Hot gas lines located within walls shall also be insulated for vibration isolation. Bare copper piping shall not be allowed to come in contact with masonry, mortar, or steel items. Condensate lines shall be installed with traps and vents in each line. Pipe supports shall be on maximum 6-foot centers on horizontal lines. Open ends of lines and connection fittings of equipment shall be properly capped or plugged during construction to protect from damage and entry of dirt or foreign material.

D. The mounting height of each wall mounted thermostat or temperature sensor shall comply with ADA for maximum side reach. The thermostat or sensor shall be at 48" maximum above the floor.

3.3 TESTING:

A. Upon completion of installation of heat pumps and connection to the completed air distribution system, start-up, and test equipment in accordance with the manufacturer's recommendations. Operate units to demonstrate capability and compliance with requirements. Where possible, field-correct malfunctioning units, then retest to demonstrate compliance.

END OF SECTION 236110

SECTION 238310 - ENERGY MANAGEMENT CONTROL SYSTEM

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

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

1.2 OVERVIEW:

A. General: The control system shall consist of a high-speed, peer-to-peer network of DDC controllers, a control system server, and a web-based operator interface connecting to an existing controls system.

B. System software shall be based on a server/thin client architecture, designed around the open standards of web technology. The control system server shall be accessed using a Web browser over the control system network, the owner's local area network, and (at the owner's discretion) over the Internet.

C. The intent of the thin-client architecture is to provide operators complete access to the control system via a Web browser. Web browser shall be used to access graphics, point displays, and trends, configure trends, configure points and controllers, or to download programming into the controllers. Control system should support several web based browsers, including Google, Chrome, Mozilla Firefox and Apple Safari.

D. System shall use the BACnet protocol for communication to the operator workstation or web server and for communication between control modules. I/O points, schedules, setpoints, trends and alarms specified herein shall be BACnet objects.

E. The following controls companies are allowed to bid: *Carrier*.
   1. The Contractor shall use only operator workstation software, controller software, custom application programming language, and controllers from the corresponding manufacturer and product line unless Owner approves use of multiple manufacturers.
   2. Other products specified herein (such as sensors, valves, dampers, and actuators) need not be manufactured by the above manufacturers.

1.3 SCOPE OF WORK

A. System Requirements:
   1. All material and equipment used shall be standard components, regularly manufactured and available and not custom designed especially for this project. All systems and components, except site specific software, shall have previously been thoroughly tested and proven in actual use prior to installation on this project.
   2. The system architecture shall be fully modular permitting expansion of application software, system peripherals, and field hardware.
   3. The system, upon completion of the installation and prior to acceptance of the project, shall perform all operating functions as detailed in this specification.

B. Equipment:

1. System Hardware: The Contractor shall provide the following unless identified as existing:
   a. Local site computer and stand-alone DDC controllers.
   b. All relays, switches, indicating devices, sensing devices and transducers required to perform the functions listed in this section.
   c. All monitoring and control wiring and associated conduit.
   d. All control power wiring and associated conduit.
   e. All air valve actuators.
   f. All gas detection monitors and accessories.
2. System Software: The Contractor shall provide all software identified in PART 3 of this specification. The database required for implementation of this specification shall be provided by the Contractor, including point descriptor, alarm limits, calibration variables, graphics, reports, and point summaries.

1.4 REFERENCES:

A. Codes and Regulations: All electrical equipment and material and its installation shall conform to the current requirements of the following authorities:
   1. *Occupational Safety and Health Act (OSHA)*
   2. *National Electric Code (NEC)*
   3. *International Fire Code*
   4. *International Building Code*
   5. *International Mechanical Code*
   6. *International Energy Efficiency Code*

B. Note: Where two or more codes conflict, the most restrictive shall apply. Nothing in these plans and specifications shall be construed to permit work not conforming to applicable codes.

1.5 GENERAL CONDITIONS:

A. Changes in the Work: Within the general scope of the contract, the Owner, without invalidating the contract may order changes in the work consisting of additions, deletions, or other revisions, the contract sum and the contract time being adjusted accordingly. All such changes in the work shall be authorized by written Change Order, and shall be executed under the applicable conditions of the Contract Documents.

B. Correction of Work:
   1. The Contractor shall promptly correct all work the Owner finds defective or failing to conform to the Contract Documents. The Contractor shall bear all cost of correcting such work.
   2. Within the warranty period required by the Contract Documents, if any of the work is found to be defective or not in accordance with the contract documents, the Contractor shall correct it promptly after receipt of a written notice from the Owner to do so. The Owner shall give notice promptly after discovery of the condition. The Contractor shall guarantee a maximum 4-hour response time, 365 days per year, to have a technician on site to address EMCS problems.

C. Coordination During Construction:
   1. The Contractor shall coordinate any necessary changes in work scheduling with the Owner to minimize the disruption. The Contractor shall protect the installed works by other trades. The Contractor shall coordinate with other trades.
   2. The Contractor shall repair any damage caused by his work to building(s) and equipment at no additional cost to the owner.

D. Warranty: The Contractor shall warrant that all systems, subsystems, component parts, and software are fully free from defective design, materials, and workmanship for a period of one year.

1.6 SUBMITTALS, DOCUMENTATION AND ACCEPTANCE:

A. Submittals:
1. Submittals shall consist of a complete list of equipment and materials, including manufacturer's descriptive and technical literature, catalog cuts, and installation instructions. Submittals shall also contain complete wiring, routing, schematic diagrams, tag number of devices, software descriptions, calculations, and any other details required to demonstrate that the system will function properly. Drawings shall show proposed layout and installation of all equipment and the relationship to other parts of the work.
2. Submittals shall be approved before any equipment is installed. Submittals must be submitted in time for the Engineer's review so that all installations can be completed per the project's completion schedule. Ten working days shall be allowed to review submittals.
3. All drawings shall be reviewed after the final system checkout and updated or corrected to provide "as-built" drawings to show exact installation. All submittals will be acknowledged in writing by the Engineer before installation is started and again after the final checkout of the system. The system shall not be considered complete until the "as-built" drawings have received their final approval. The Contractor shall deliver 4 sets of 'as-built' drawings. Before final configuration, the Contractor shall provide I/O Summary forms to the Engineer that include:
   a. Description of all points.
   b. Listing of binary and analog hardware required to interface them to equipment for each function.
   c. Listing of all application programs associated with each piece of equipment.
   d. Failure modes for control functions to be performed in case of failure.
4. The Contractor shall provide an accurate graphic flow diagram for each software program proposed to be used on the project as part of the submittal process. Revisions made as a result of the submittal process, during the installation, start-up or acceptance portion of the project, shall be accurately reflected in the "as-built" graphic software flow diagrams herein required by this specification.

B. Documentation:
1. The Contractor shall be able to simulate the operation of all software application programs to ensure they are free from design errors and that they accurately accomplish the application sequence of operations. The simulation shall show each output value and how it varies in relation to an artificial time clock. The time clock shall run at normal time increments, increased increments (fast motion) or decreased increments (slow motion).
2. Operations and Maintenance Manuals: Operations and maintenance manuals for the system shall include the following categories: User’s Manual; Product Information; Graphic Programming. Project specific manuals shall include detailed information describing the specific installation.
3. User’s Manual: System reference material shall contain as a minimum, an overview of the system, its organization, the concepts of networking and central site/field hardware relationships as well as the following:
4. Product Information: It shall include detailed information on hardware and design requirements for initial installations and/or additions to existing systems. Installation mounting and connection details for field hardware, accessories and central site equipment.
5. Graphic Programming: Shall contain as a minimum descriptions of the control software

programs used in the system. A graphic flow diagram for each software application program provided as part of this project.

C. Acceptance Test and Acceptance:
   1. Upon completion of the installation, the Contractor shall start up the system and perform all necessary calibration, testing, and debugging operations. An acceptance test shall be performed by the Contractor in the presence of the Owner's representative.
   2. When the system performance is deemed satisfactory, the system parts will be accepted for beneficial use and placed under warranty. At this time, a "notice of completion" shall be issued by the Owner and the warranty period shall start.
   3. Owner's Instructions: The Contractor shall provide full instructions to designated personnel in the operation, maintenance, and programming of the system. The training shall be specifically oriented to the system and interfacing equipment installed. Provide a minimum training period of 8 hours.

1.7 SYSTEM PERFORMANCE:

A. Performance Standards: System shall conform to the following minimum standards over network connections. Systems shall be tested using manufacturer's recommended hardware and software for operator workstation (server and browser for web-based systems):
   1. Graphic Display: A graphic with 20 dynamic points shall display with current data within 10 sec.
   2. Graphic Refresh: A graphic with 20 dynamic points shall update with current data within 8 sec. and shall automatically refresh every 15 sec.
   3. Configuration and Tuning Screens: Screens used for configuring, calibrating, or tuning points, PID loops, and similar control logic shall automatically refresh within 6 sec.
   4. Object Command: Devices shall react to command of a binary object within 2 sec. Devices shall begin reacting to command of an analog object within 2 sec.
   5. Alarm Response Time: An object that goes into alarm shall be annunciated at the workstation within 45 sec.
   6. Program Execution Frequency. Custom and standard applications shall be capable of running as often as once every 5 sec. Select execution times consistent with the mechanical process under control.
   7. Performance: Programmable controllers shall be able to completely execute DDC PID control loops at a frequency adjustable down to once per sec. Select execution times consistent with the mechanical process under control.
   8. Multiple Alarm Annunciation: Each workstation on the network shall receive alarms within 5 sec of other workstations.
   9. Reporting Accuracy: System shall report values with minimum end-to-end accuracy listed in Table 1.
   10. Table 1 Reporting Accuracy / Table 2 Control Stability and Accuracy:

Measured Variable	**Reported Accuracy**
Space Temperature	±0.5ºC (±1ºF)
Ducted Air	±1ºF
Outside Air	±2ºF
Dew Point	±3ºF
Water Temperature	±1ºF
Delta-T	±0.25ºF
Relative Humidity	±5% RH
Water Flow	±2% of full scale

Airflow (terminal)	±10% of full scale (see Note 1)
Airflow (measuring stations)	±5% of full scale
Airflow (pressurized spaces)	±3% of full scale
Air Pressure (ducts)	±0.1 in. w.g.
Air Pressure (space)	±0.01 in. w.g.
Water Pressure	±2% of full scale (see Note 2)
Electrical	±1% of reading (see Note 3)

Note 1: Accuracy applies to 10%–100% of scale.
Note 2: For both absolute and differential pressure.
Note 3: Not including utility-supplied meters.

Controlled Variable	**Control Accuracy**	**Range of Medium**
Air Pressure	±0.2 in. w.g.) ±0.01 in. w.g.	0–6 in. w.g. -0.1 to 0.1 in. w.g.
Airflow	±10% of full scale	
Space Temperature	±2.0ºF	
Duct Temperature	±3ºF	
Humidity	±5% RH	
Fluid Pressure	±1.5 psi ±1.0 in. w.g.	1–150 psi 0–50 in. w.g. differential

PART 2 – PRODUCTS

2.1 MATERIALS:

A. Use new products the manufacturer is currently manufacturing and selling for use in new installations. Do not use this installation as a product test site unless explicitly approved in writing by Owner. Spare parts shall be available for at least five years after completion of this contract.

2.2 COMMUNICATION:

A. Control products, communication media, connectors, repeaters, hubs, and routers shall comprise a BACnet internetwork. Controller and operator interface communication shall conform to ANSI/ASHRAE Standard 135, BACnet.

B. Install new wiring and network devices as required to provide a complete and workable control network.

C. Each controller shall have a communication port for temporary connection to a laptop computer or other operator interface. Connection shall support memory downloads and other commissioning and troubleshooting operations.

D. Internetwork operator interface and value passing shall be transparent to internetwork architecture. An operator interface connected to a controller shall allow the operator to interface with each internetwork controller as if directly connected. Controller information such as data, status, and control algorithms shall be viewable and editable from each internetwork controller. Inputs, outputs, and control variables used to integrate control strategies across multiple controllers shall be readable by each controller on the internetwork. Program and test all cross-controller links required to execute control strategies specified herein. An authorized operator shall be able to edit cross-controller links by typing a standard object address or by using a point-and-click interface.

2.3 OPERATOR INTERFACE:

A. The Operator Workstation or server shall conform to the BACnet Operator Workstation (B-OWS) or BACnet Advanced Workstation (B-AWS) device profile as specified in ASHRAE/ANSI 135 BACnet Annex L.

B. Operator Interface: Web server shall reside on high-speed network with building controllers.

C. Communication: Web server or workstation and controllers shall communicate using BACnet protocol. Web server or workstation and control network backbone shall communicate using ISO 8802-3 (Ethernet) Data Link/Physical layer protocol and BACnet/IP addressing as specified in ANSI/ASHRAE 135, BACnet Annex J.

D. System Diagnostics: The system shall automatically monitor the operation of all building management panels and controllers. The failure of any device shall be annunciated to the operator.

E. Alarm Processing: System input and status objects shall be configurable to alarm on departing from and on returning to normal state. Operator shall be able to enable or disable each alarm

and to configure alarm limits, alarm limit differentials, alarm states, and alarm reactions for each system object. Configure and enable alarm points as specified herein. Alarms shall be BACnet alarm objects and shall use BACnet alarm services.

F. Alarm Messages: Alarm messages shall use the English language descriptor for the object in alarm in such a way that the operator will be able to recognize the source, location, and nature of the alarm without relying on acronyms.

G. Alarm Reactions: Operator shall be able to configure (by object) what, if any actions are to be taken during an alarm. As a minimum, the workstation or web server shall be able to log, print, start programs, display messages, send e-mail, send page, and audibly annunciate.

H. Alarm and Event Log: Operators shall be able to view all system alarms and changes of state from any location in the system. Events shall be listed chronologically. An operator with the proper security level may acknowledge and delete alarms, and archive closed alarms to the workstation or web server hard disk.

I. Trend Logs: The operator shall be able to configure trend sample or change of value (COV) interval, start time, and stop time for each system data object and shall be able to retrieve data for use in spreadsheets and standard database programs. Controller shall sample and store trend data and shall be able to archive data to the hard disk. Configure trends as specified herein. Trends shall be BACnet trend objects.

J. Object and Property Status and Control: Provide a method for the operator to view, and edit if applicable, the status of any object or property in the system. The status shall be available by menu, on graphics, or through custom programs.

K. Reports and Logs: Operator shall be able to select, to modify, to create, and to print reports and logs. Operator shall be able to store report data in a format accessible by standard spreadsheet and word processing programs.

L. Standard Reports: Furnish the following standard system reports:
   1. Objects: System objects and current values filtered by object type, by status (in alarm, locked, normal), by equipment, by geographic location, or by combination of filter criteria.
   2. Alarm Summary: Current alarms and closed alarms. System shall retain closed alarms for an adjustable period.
   3. Logs: System shall log the following to a database or text file and shall retain data for an adjustable period: Alarm History; Trend Data; Operator shall be able to select trends to be logged; Operator Activity. At a minimum, system shall log operator log in and log out, control parameter changes, schedule changes, and alarm acknowledgment and deletion. System shall date and time stamp logged activity.

2.4 CONTROLLER SOFTWARE:

A. Furnish the following applications for building and energy management. All software application shall reside and operate in the system controllers. Applications shall be editable through operator workstation, web browser interface, or engineering workstation.

B. Scheduling: Provide the capability to execute control functions according to a user created or edited schedule. Each schedule shall provide the following schedule options as a minimum.
   1. Weekly Schedule. Provide separate schedules for each day of the week. Each schedule shall be able to include up to 5 occupied periods (5 start-stop pairs or 10 events).

2. Exception Schedules. Provide the ability for the operator to designate any day of the year as an exception schedule. Exception schedules may be defined up to a year in advance. Once an exception schedule has executed, the system shall discard and replace the exception schedule with the standard schedule for that day of the week.
3. Holiday Schedules. Provide the capability for the operator to define up to 24 special or holiday schedules. These schedules will be repeated each year. The operator shall be able to define the length of each holiday period.

C. Demand Limiting:
1. The demand-limiting program shall monitor building power consumption from a building power meter (provided by others) which generates pulse signals or a BACnet communications interface. An acceptable alternative is for the system to monitor a watt transducer or current transformer attached to the building feeder lines.
2. When power consumption exceeds adjustable levels, system shall automatically adjust setpoints, de-energize low-priority equipment, and take other programmatic actions to reduce demand as specified herein. When demand drops below adjustable levels, system shall restore loads as specified.

D. Maintenance Management: The system shall be capable of generating maintenance alarms when equipment exceeds adjustable runtime, equipment starts, or performance limits. Configure and enable maintenance alarms as specified.

E. PID Control: System shall provide direct- and reverse-acting PID (proportional-integral-derivative) algorithms. Each algorithm shall have anti-windup and selectable controlled variable, setpoint, and PID gains. Each algorithm shall calculate a time-varying analog value that can be used to position an output or to stage a series of outputs. The calculation interval, PID gains, and other tuning parameters shall be adjustable by a user with the correct security level.

2.5 CONTROLLERS:

A. BACnet:
1. Building Controllers (BCs): Each BC shall conform to BACnet Building Controller (B-BC) device profile as specified in ANSI/ASHRAE 135, BACnet Annex L, and shall be listed as a certified B-BC in the BACnet Testing Laboratories (BTL) Product Listing.
2. Advanced Application Controllers (AACs): Each AAC shall conform to BACnet Advanced Application Controller (B-AAC) device profile as specified in ANSI/ASHRAE 135, BACnet Annex L and shall be listed as a certified B-AAC in the BACnet Testing Laboratories (BTL) Product Listing.
3. Application Specific Controllers (ASCs): Each ASC shall conform to BACnet Application Specific Controller (B-ASC) device profile as specified in ANSI/ASHRAE 135, BACnet Annex L and shall be listed as a certified B-ASC in the BACnet Testing Laboratories (BTL) Product Listing.
4. Smart Sensors (SSs): Each SS shall conform to BACnet Smart Sensor (B-SS) device profile as specified in ANSI/ASHRAE 135, BACnet Annex L and shall be listed as a certified B-SS in the BACnet Testing Laboratories (BTL) Product Listing.
5. BACnet Communication:
a. Each BC shall reside on or be connected to a BACnet network using ISO 8802-3 (Ethernet) Data Link/Physical layer protocol and BACnet/IP addressing.
b. BACnet routing shall be performed by BCs or other BACnet device routers as necessary to connect BCs to networks of AACs and ASCs.
c. Each AAC shall reside on a BACnet network using ISO 8802-3 (Ethernet) Data

Link/Physical layer protocol with BACnet/IP addressing, or it shall reside on a BACnet network using the ARCNET or MS/TP Data Link/Physical layer protocol.

d. Each ASC shall reside on a BACnet network using the ARCNET or MS/TP Data Link/Physical layer protocol.
e. Each SA shall reside on a BACnet network using the ARCNET or MS/TP Data Link/Physical layer protocol.
f. Each SS shall reside on a BACnet network using ISO 8802-3 (Ethernet) Data Link/Physical layer protocol with BACnet/IP addressing, or it shall reside on a BACnet network using ARCNET or MS/TP Data Link/Physical layer protocol.

B. Communication:
1. Service Port. Each controller shall provide a service communication port for connection to a Portable Operator's Terminal. Connection shall be extended to space temperature sensor ports where shown on drawings.
2. Signal Management: BC and ASC operating systems shall manage input and output communication signals to allow distributed controllers to share real and virtual object information and to allow for central monitoring and alarms.
3. Data Sharing: Each BC and AAC shall share data as required with each networked BC and AAC.
4. Stand-Alone Operation: Each piece of equipment specified herein shall be controlled by a single controller to provide stand-alone control in the event of communication failure. All I/O points specified for a piece of equipment shall be integral to its controller. Provide stable and reliable stand-alone control using default values or other method for values normally read over the network such as outdoor air conditions, supply air or water temperature coming from source equipment, etc.

C. Environment: Controller hardware shall be suitable for anticipated ambient conditions.
1. Controllers used outdoors or in wet ambient conditions shall be mounted in waterproof enclosures and shall be rated for operation at -20°F to 140°F.
2. Controllers used in conditioned space shall be mounted in dust-protective enclosures and shall be rated for operation at 32°F to 120°F.

D. Real-Time Clock: Controllers that perform scheduling shall have a real-time clock.

E. Serviceability: Provide diagnostic LEDs for power, communication, and processor. All wiring connections shall be made to a field-removable modular terminal strip or to a termination card connected by a ribbon cable. Each BC and AAC shall continually check its processor and memory circuit status and shall generate an alarm on abnormal operation. System shall continuously check controller network and generate alarm for each controller that fails to respond.

F. Memory:
1. Controller memory shall support operating system, database, and programming requirements.
2. Each BC and AAC shall retain BIOS and application programming for at least 72 hours in the event of power loss.
3. Each ASC and SA shall use nonvolatile memory and shall retain BIOS and application programming in the event of power loss. System shall automatically download dynamic control parameters following power loss.

G. Immunity to Power and Noise: Controllers shall be able to operate at 90% to 110% of nominal voltage rating and shall perform an orderly shutdown below 80% nominal voltage. Operation

shall be protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W at 3 ft.

H. Transformer: ASC power supply shall be fused or current limiting and shall be rated at a minimum of 125% of ASC power consumption.

2.6 AUXILIARY CONTROL DEVICES:

A. Motorized Control Dampers, unless otherwise specified elsewhere, shall be as follows:
   1. Type: Control dampers shall be the parallel or opposed-blade type as specified below or as scheduled on drawings.
   2. Outdoor and return air mixing dampers and face-and-bypass dampers shall be parallel-blade and shall direct airstreams toward each other.
   3. Other modulating dampers shall be opposed-blade.
   4. Two-position shutoff dampers shall be parallel- or opposed-blade with blade and side seals.

B. Temperature Sensors:
   1. Type: Temperature sensors shall be Resistance Temperature Device (RTD) or thermistor.
   2. Duct Sensors: Duct sensors shall be single point or averaging as shown. Averaging sensors shall be a minimum of 5 ft in length per 10 ft^2 of duct cross-section.
   3. Immersion Sensors: Provide immersion sensors with a separable stainless steel well. Well pressure rating shall be consistent with system pressure it will be immersed in. Well shall withstand pipe design flow velocities.
   4. Space Sensors: Space sensors shall have setpoint adjustment, override switch, display, and communication port as shown.
   5. Differential Sensors: Provide matched sensors for differential temperature measurement.

C. Humidity Sensors:
   1. Duct and room sensors shall have a sensing range of 20%–80%.
   2. Duct sensors shall have a sampling chamber.
   3. Outdoor air humidity sensors shall have a sensing range of 20%–95% RH and shall be suitable for ambient conditions of -40°F–170°F.
   4. Humidity sensors shall not drift more than 1% of full scale annually.

D. Relays:
   1. Control Relays: Control relays shall be plug-in type, UL listed, and shall have dust cover and LED “energized” indicator. Contact rating, configuration, and coil voltage shall be suitable for application.
   2. Time Delay Relays: Time delay relays shall be solid-state plug-in type, UL listed, and shall have adjustable time delay. Delay shall be adjustable ±100% from setpoint shown. Contact rating, configuration, and coil voltage shall be suitable for application. Provide NEMA 1 enclosure for relays not installed in local control panel.

E. Voltage Transmitters:
   1. AC voltage transmitters shall be self-powered single-loop (two-wire) type, 4–20 mA output with zero and span adjustment.
   2. Adjustable full-scale unit ranges shall be 100–130 Vac, 200–250 Vac, 250–330 Vac, and 400–600 Vac. Unit accuracy shall be ±1% full-scale at 500 ohm maximum burden.
   3. Transmitters shall meet or exceed ANSI/ISA S50.1 requirements and shall be UL/CSA recognized at 600 Vac rating.

F. Voltage Transformers:

1. AC voltage transformers shall be UL/CSA recognized, 600 Vac rated, and shall have built-in fuse protection.
2. Transformers shall be suitable for ambient temperatures of 40°F–130°F and shall provide ±0.5% accuracy at 24 Vac and 5 VA load.
3. Windings (except for terminals) shall be completely enclosed with metal or plastic.

G. Power Monitors:
1. Selectable rate pulse output for kWh reading, 4–20 mA output for kW reading, N.O. alarm contact, and ability to operate with 5.0 amp current inputs or 0–0.33 volt inputs.
2. 1.0% full-scale true RMS power accuracy, +0.5 Hz, voltage input range 120–600 V, and auto range select.
3. Under voltage/phase monitor circuitry.
4. NEMA 1 enclosure.
5. Current transformers having 0.5% FS accuracy, 600 VAC isolation voltage with 0–0.33 V output. If 0–5 A current transformers are provided, a three-phase disconnect/shorting switch assembly is required.

H. Current Switches:
1. Current-operated switches shall be self-powered, solid-state with adjustable trip current. Select switches to match application current and DDC system output requirements.

I. Pressure Transducers:
1. Transducers shall have linear output signal and field-adjustable zero and span.
2. Transducer sensing elements shall withstand continuous operating conditions of positive or negative pressure 50% greater than calibrated span without damage.

J. Local Control Panels:
1. All indoor control cabinets shall be fully enclosed NEMA 1 construction with (hinged door) key-lock latch and removable subpanels. A single key shall be common to all field panels and subpanels.
2. Interconnections between internal and face-mounted devices shall be prewired with color-coded stranded conductors neatly installed in plastic troughs and/or tie-wrapped. Terminals for field connections shall be UL listed for 600 volt service, individually identified per control/ interlock drawings, with adequate clearance for field wiring. Control terminations for field connection shall be individually identified per control drawings.
3. Provide ON/OFF power switch with overcurrent protection for control power sources to each local panel.

2.7 WIRING AND RACEWAYS:

A. General. Provide copper wiring, plenum cable, and raceways as specified in applicable sections of Division 26.

B. Insulated wire shall use copper conductors and shall be UL listed for 200°F minimum service.

2.8 FIBER OPTIC CABLE SYSTEM:

A. Optical Cable: Optical cables shall be duplex 900 mm tight-buffer construction designed for intra-building environments. Sheath shall be UL listed OFNP in accordance with NEC Article 770. Optical fiber shall meet the requirements of FDDI, ANSI X3T9.5 PMD for 62.5/125mm.

B. Connectors: Field terminate optical fibers with ST type connectors. Connectors shall have

ceramic ferrules and metal bayonet latching.

PART 3 – EXECUTION

3.1 EXAMINATION:

A. The contractor shall inspect the site to verify that equipment may be installed as shown. Any discrepancies, conflicts, or omissions shall be reported to the engineer for resolution before rough-in work is started.

B. The contractor shall examine the drawings and specifications for other parts of the work. If head room or space conditions appear inadequate—or if any discrepancies occur between the plans and the contractor's work and the plans and the work of others—the contractor shall report these discrepancies to the engineer and shall obtain written instructions for any changes necessary to accommodate the contractor's work with the work of others. Any changes in the work covered by this specification made necessary by the failure or neglect of the contractor to report such discrepancies shall be made by—and at the expense of—this contractor.

3.2 PROTECTION:

A. The contractor shall protect all work and material from damage by his/her work or employees and shall be liable for all damage thus caused.

B. The contractor shall be responsible for his/her work and equipment until finally inspected, tested, and accepted. The contractor shall protect any material that is not immediately installed. The contractor shall close all open ends of work with temporary covers or plugs during storage and construction to prevent entry of foreign objects.

3.3 COORDINATION:

A. Site:
   1. Where the mechanical work will be installed in close proximity to, or will interfere with, work of other trades, the contractor shall assist in working out space conditions to make a satisfactory adjustment. If the contractor installs his/her work before coordinating with other trades, so as to cause any interference with work of other trades, the contractor shall make the necessary changes in his/her work to correct the condition without extra charge.
   2. Coordinate and schedule work with other work in the same area and with work dependent upon other work to facilitate mutual progress.

B. Test and Balance:
   1. The contractor shall furnish a single set of all tools necessary to interface to the control system for test and balance purposes.
   2. The contractor shall provide training in the use of these tools. This training will be planned for a minimum of 4 hours.
   3. In addition, the contractor shall provide a qualified technician to assist in the test and balance process, until the first 20 terminal units are balanced.
   4. The tools used during the test and balance process will be returned at the completion of the testing and balancing.

C. Life Safety:

1. Duct smoke detectors required for air handler shutdown are provided under Division 26. Interlock smoke detectors to air handlers for shutdown as specified in Sequences of Operation.
2. Smoke dampers and actuators required for duct smoke isolation are provided under Division 23. Interlock smoke dampers to air handlers as specified in Sequences of Operation.
3. Fire and smoke dampers and actuators required for fire-rated walls are provided under Division 23. Fire and smoke damper control is provided under Division 26.

D. Coordination with controls specified in other sections or divisions. Other sections and/or divisions of this specification include controls and control devices that are to be part of or interfaced to the control system specified in this section. These controls shall be integrated into the system and coordinated by the contractor as follows:
1. All communication media and equipment shall be provided as specified in Communication.
2. Each supplier of a controls product is responsible for the configuration, programming, start up, and testing of that product to meet the Sequences of Operation.
3. The contractor shall coordinate and resolve any incompatibility issues that arise between control products provided under this section and those provided under other sections or divisions of this specification.
4. The contractor is responsible for providing all controls described in the contract documents regardless of where within the contract documents these controls are described.
5. The contractor is responsible for the interface of control products provided by multiple suppliers regardless of where this interface is described within the contract documents.

3.4 GENERAL WORKMANSHIP:

A. Install equipment, piping, and wiring/raceway parallel to building lines (i.e. horizontal, vertical, and parallel to walls) wherever possible.

B. Provide sufficient slack and flexible connections to allow for vibration of piping and equipment.

C. Install equipment in readily accessible locations as defined by Chapter 1 Article 100 Part A of the National Electrical Code (NEC).

D. Verify integrity of all wiring to ensure continuity and freedom from shorts and grounds.

E. All equipment, installation, and wiring shall comply with industry specifications and standards for performance, reliability, and compatibility and be executed in strict adherence to local codes and standard practices.

3.5 FIELD QUALITY CONTROL:

A. All work, materials, and equipment shall comply with rules and regulations of applicable local, state, and federal codes and ordinances as identified in Codes and Standards.

B. Contractor shall continually monitor the field installation for code compliance and quality of workmanship.

C. Contractor shall have work inspection by local and/or state authorities having jurisdiction over the work.

3.6 WIRING:

A. All control and interlock wiring shall comply with national and local electrical codes, and Division 26 of this specification. Where the requirements of this section differ from Division 26, the requirements of this section shall take precedence.

B. All NEC Class 1 (line voltage) wiring shall be UL listed in approved raceway according to NEC and Division 26 requirements.

C. All low-voltage wiring shall meet NEC Class 2 requirements. Low-voltage power circuits shall be subfused when required to meet Class 2 current limit.

D. Where NEC Class 2 (current-limited) wires are in concealed and accessible locations, including ceiling return air plenums, approved cables not in raceway may be used provided that cables are UL listed for the intended application.

E. All wiring in mechanical, electrical, or service rooms – or where subject to mechanical damage – shall be installed in raceway at levels below 10ft.

F. Do not install Class 2 wiring in raceways containing Class 1 wiring. Boxes and panels containing high-voltage wiring and equipment may not be used for low-voltage wiring except for the purpose of interfacing the two (e.g. relays and transformers).

G. Do not install wiring in raceway containing tubing.

H. Where Class 2 wiring is run exposed, wiring is to be run parallel along a surface or perpendicular to it and neatly tied at 10 ft intervals.

I. Where plenum cables are used without raceway, they shall be supported from or anchored to structural members. Cables shall not be supported by or anchored to ductwork, electrical raceways, piping, or ceiling suspension systems.

J. All wire-to-device connections shall be made at a terminal block or terminal strip. All wire-to-wire connections shall be at a terminal block.

K. All wiring within enclosures shall be neatly bundled and anchored to permit access and prevent restriction to devices and terminals.

L. Maximum allowable voltage for control wiring shall be 120V. If only higher voltages are available, the contractor shall provide step-down transformers.

M. All wiring shall be installed as continuous lengths, with no splices permitted between termination points.

N. Install plenum wiring in sleeves where it passes through walls and floors. Maintain fire rating at all penetrations.

O. Size of raceway and size and type of wire type shall be the responsibility of the contractor in keeping with the manufacturer's recommendations and NEC requirements, except as noted elsewhere.

P. Include one pull string in each raceway 1 in. or larger.

Q. Use color-coded conductors throughout with conductors of different colors.

R. Control and status relays are to be located in designated enclosures only. These enclosures include packaged equipment control panel enclosures unless they also contain Class 1 starters.

S. Conceal all raceways except within mechanical, electrical, or service rooms.

T. Secure raceways with raceway clamps fastened to the structure and spaced according to code requirements. Raceways and pull boxes may not be hung on flexible duct strap or tie rods. Raceways may not be run on or attached to ductwork.

U. Adhere to this specification's Division 26 requirements where raceway crosses building expansion joints.

V. Install insulated bushings on all raceway ends and openings to enclosures. Seal top end of vertical raceways.

W. The contractor shall terminate all control and/or interlock wiring and shall maintain updated (as-built) wiring diagrams with terminations identified at the job site.

X. Flexible metal raceways and liquid-tight flexible metal raceways shall not exceed 3 ft in length and shall be supported at each end. Flexible metal raceway less than ½ in. electrical trade size shall not be used. In areas exposed to moisture, liquid-tight, flexible metal raceways shall be used.

Y. Raceway must be rigidly installed, adequately supported, properly reamed at both ends, and left clean and free of obstructions. Raceway sections shall be joined with couplings (according to code). Terminations must be made with fittings at boxes, and ends not terminating in boxes shall have bushings installed.

3.7 COMMUNICATION WIRING:

A. The contractor shall adhere to the items listed in the "Wiring" article in Part 3 of the specification.

B. All cabling shall be installed in a neat and workmanlike manner. Follow manufacturer's installation recommendations for all communication cabling.

C. Do not install communication wiring in raceways and enclosures containing Class 1 or other Class 2 wiring.

D. Maximum pulling, tension, and bend radius for the cable installation, as specified by the cable manufacturer, shall not be exceeded during installation.

E. Contractor shall verify the integrity of the entire network following cable installation. Use appropriate test measures for each particular cable.

F. When a cable enters or exits a building, a lightning arrestor must be installed between the lines and ground. The lighting arrestor shall be installed according to manufacturer’s instructions.

G. All runs of communication wiring shall be unspliced length when that length is commercially

available.

H. All communication wiring shall be labeled to indicate origination and destination data.

I. All communication wiring shall be labeled to indicate origination and destination data.

J. Grounding of coaxial cable shall be in accordance with NEC regulations article on "Communications Circuits, Cable, and Protector Grounding."

K. BACnet MS/TP communications wiring shall be installed in accordance with ASHRAE/ANSI Standard 135. This includes but is not limited to:
   1. The network shall use shielded, twisted-pair cable with characteristic impedance between 100 and 120 ohms. Distributed capacitance between conductors shall be less than 30 pF per foot.
   2. The maximum length of an MS/TP segment is 4000 ft with AWG 18 cable. The use of greater distances and/or different wire gauges shall comply with the electrical specifications of EIA-485.
   3. The maximum number of nodes per segment shall be 32, as specified in the EIA 485 standard. Additional nodes may be accommodated by the use of repeaters.
   4. An MS/TP EIA-485 network shall have no T connections.

3.8 FIBER OPTIC CABLE:

A. Maximum pulling tensions as specified by the cable manufacturer shall not be exceeded during installation. Post-installation residual cable tension shall be within cable manufacturer's specifications.

B. All cabling and associated components shall be installed in accordance with manufacturers' instructions. Minimum cable and unjacketed fiber bend radii, as specified by cable manufacturer, shall be maintained.

3.9 INSTALLATION OF SENSORS:

A. Install sensors in accordance with the manufacturer's recommendations.

B. Mount sensors rigidly and adequately for environment within which the sensor operates.

C. Room temperature sensors shall be installed on concealed junction boxes properly supported by wall framing. Where temperature sensors and RH sensors are shown side-by-side, a single combination sensor shall be provided.

D. All wires attached to sensors shall be sealed in their raceways or in the wall to stop air transmitted from other areas from affecting sensor readings.

E. Sensors used in mixing plenums and hot and cold decks shall be of the averaging type. Averaging sensors shall be installed in a serpentine manner vertically across the duct. Each bend shall be supported with a capillary clip.

F. Low-limit sensors used in mixing plenums shall be installed in a serpentine manner horizontally across duct. Each bend shall be supported with a capillary clip. Provide 1 ft of sensing element for each 1 ft^2 of coil area.

G. Install outdoor air temperature sensors on north wall, complete with sun shield at designated location.

3.10 ACTUATORS:

A. General: Mount and link control damper actuators according to manufacturer's instructions.
   1. To compress seals when spring-return actuators are used on normally closed dampers, power actuator to approximately 5° open position, manually close the damper, and then tighten the linkage.
   2. Check operation of damper/actuator combination to confirm that actuator modulates damper smoothly throughout stroke to both open and closed positions.
   3. Provide all mounting hardware and linkages for actuator installation.

B. Electric/Electronic: Dampers: Actuators shall be direct mounted on damper shaft or jackshaft unless shown as a linkage installation. For low-leakage dampers with seals, the actuator shall be mounted with a minimum 5° travel available for tightening the damper seal. Actuators shall be mounted following manufacturer's recommendations.

3.11 WARNING LABELS:

A. Permanent warning labels shall be affixed to all equipment that can be automatically started by the control system.
   1. Labels shall use white lettering (12-point type or larger) on a red background.
   2. Warning labels shall read as follows.
      C A U T I O N
      This equipment is operating under automatic control and may start or stop at any time without warning. Switch disconnect to"Off"position before servicing.

B. Permanent warning labels shall be affixed to all motor starters and control panels that are connected to multiple power sources utilizing separate disconnects.
   1. Labels shall use white lettering (12-point type or larger) on a red background.
   2. Warning labels shall read as follows.

      C A U T I O N
      This equipment is fed from more than one power source with separate disconnects. Disconnect all power sources before servicing.

3.12 IDENTIFICATION OF HARDWARE AND WIRING:

A. All wiring and cabling, including that within factory-fabricated panels shall be labeled at each end within 2 in. of termination with control system address or termination number.

B. Permanently label or code each point of field terminal strips to show the instrument or item served.

C. Identify control panels with minimum ½ in. letters on laminated plastic nameplates.

D. Identify all other control components with permanent labels. All plug-in components shall be labeled such that label removal of the component does not remove the label.

E. Identify room sensors related to terminal boxes or valves with nameplates.

F. Manufacturers' nameplates and UL or CSA labels shall be visible and legible after equipment is installed.

G. Identifiers shall match record documents.

3.13 CONTROLLERS:

A. Provide a separate controller for each HVAC system. A DDC controller may control more than one system provided that all points associated with the system are assigned to the same DDC controller. Points used for control loop reset, such as outside air or space temperature, are exempt from this requirement.

B. Building Controllers and Custom Application Controllers shall be selected to provide the required I/O point capacity required to monitor all of the hardware points listed in Sequences of Operation.

3.14 PROGRAMMING:

A. Provide sufficient internal memory for the specified sequences of operation and trend logging.

B. Point Naming: Name points as shown on the equipment points list provided with each sequence of operation. See Sequences of Operation. If character limitations or space restrictions make it advisable to shorten the name, abbreviations may be used. Where multiple points with the same name reside in the same controller, each point name may be customized with its associated Program Object number. For example, "Zone Temp 1" for Zone 1, "Zone Temp 2" for Zone 2.

C. Software Programming: Provide programming for the system and adhere to the sequences of operation provided. All other system programming necessary for the operation of the system, but not specified in this document, also shall be provided by the contractor. Embed into the control program sufficient comment statements to clearly describe each section of the program. The comment statements shall reflect the language used in the sequences of operation. Use the appropriate technique based on the following programming types:
   1. Text-based:
      a. Must provide actions for all possible situations
      b. Must be modular and structured
      c. Must be commented
   2. Graphic-based:
      a. Must provide actions for all possible situations
      b. Must be documented
   3. Parameter-based:
      a. Must provide actions for all possible situations
      b. Must be documented.

D. Operator Interface:
   1. Standard Graphics. Provide graphics for all mechanical systems and floor plans of the building. This includes each chilled water system, chiller, air handler, and all terminal equipment. Point information on the graphic displays shall dynamically update. Show on each graphic all input and output points for the system. Also show relevant calculated points such as setpoints. As a minimum, show on each equipment graphic the input and output points and relevant calculated points as indicated on the applicable Points List.
   2. The contractor shall provide all the labor necessary to install, initialize, start up, and

troubleshoot all operator interface software and its functions as described in this section. This includes any operating system software, the operator interface database, and any third-party software installation and integration required for successful operation of the operator interface.

3.15 CONTROL SYSTEM CHECKOUT AND TESTING:

A. Startup Testing: All testing listed in this article shall be performed by the contractor and shall make up part of the necessary verification of an operating control system. This testing shall be completed before the owner's representative is notified of the system demonstration.

B. The contractor shall furnish all labor and test apparatus required to calibrate and prepare for service of all instruments, controls, and accessory equipment furnished under this specification.

C. Verify that all control wiring is properly connected and free of all shorts and ground faults. Verify that terminations are tight.

D. Enable the control systems and verify calibration of all input devices individually. Perform calibration procedures according to manufacturers' recommendations.

E. Verify that all binary output devices (relays, solenoid valves, two-position actuators and control valves, magnetic starters, etc.) operate properly and that the normal positions are correct.

F. Verify that all analog output devices (I/Ps, actuators, etc.) are functional, that start and span are correct, and that direction and normal positions are correct. The contractor shall check all control valves and automatic dampers to ensure proper action and closure. The contractor shall make any necessary adjustments to valve stem and damper blade travel.

G. Verify that the system operation adheres to the sequences of operation. Simulate and observe all modes of operation by overriding and varying inputs and schedules. Tune all DDC loops.

H. Alarms and Interlocks:
   1. Check each alarm separately by including an appropriate signal at a value that will trip the alarm.
   2. Interlocks shall be tripped using field contacts to check the logic, as well as to ensure that the fail-safe condition for all actuators is in the proper direction.
   3. Interlock actions shall be tested by simulating alarm conditions to check the initiating value of the variable and interlock action.

3.16 CONTROL SYSTEM DEMONSTRATION AND ACCEPTANCE:

A. Demonstration:
   1. Prior to acceptance, the control system shall undergo a series of performance tests to verify operation and compliance with this specification. These tests shall occur after the Contractor has completed the installation, started up the system, and performed his/her own tests.
   2. The tests described in this section are to be performed in addition to the tests that the contractor performs as a necessary part of the installation, start-up, and debugging process and as specified in the "Control System Checkout and Testing" article in Part 3 of this specification. The engineer will be present to observe and review these tests. The engineer shall be notified at least 10 days in advance of the start of the testing procedures.
   3. The demonstration process shall follow that approved in Part 1, "Submittals." The

approved checklists and forms shall be completed for all systems as part of the demonstration.

4. The contractor shall provide at least two persons equipped with two-way communication and shall demonstrate actual field operation of each control and sensing point for all modes of operation including day, night, occupied, unoccupied, fire/smoke alarm, seasonal changeover, and power failure modes. The purpose is to demonstrate the calibration, response, and action of every point and system. Any test equipment required to prove the proper operation shall be provided by and operated by the contractor.
5. As each control input and output is checked, a log shall be completed showing the date, technician's initials, and any corrective action taken or needed.
6. Demonstrate compliance with Part 1, "System Performance."
7. Demonstrate compliance with sequences of operation through all modes of operation.
8. Demonstrate complete operation of operator interface.
9. Additionally, the following items shall be demonstrated:
    a. DDC loop response. The contractor shall supply trend data output in a graphical form showing the step response of each DDC loop. The test shall show the loop's response to a change in set point, which represents a change of actuator position of at least 25% of its full range. The sampling rate of the trend shall be from 10 seconds to 3 minutes, depending on the speed of the loop. The trend data shall show for each sample the set point, actuator position, and controlled variable values. Any loop that yields unreasonably under-damped or over-damped control shall require further tuning by the Contractor.
    b. Demand limiting. The contractor shall supply a trend data output showing the action of the demand limiting algorithm. The data shall document the action on a minute-by-minute basis over at least a 30-minute period. Included in the trend shall be building kW, demand limiting set point, and the status of sheddable equipment outputs.
    c. Optimum start/stop. The contractor shall supply a trend data output showing the capability of the algorithm. The change-of-value or change-of-state trends shall include the output status of all optimally started and stopped equipment, as well as temperature sensor inputs of affected areas.
    d. Interface to the building fire alarm system.
    e. Operational logs for each system that indicate all set points, operating points, valve positions, mode, and equipment status shall be submitted to the architect/engineer. These logs shall cover three 48-hour periods and have a sample frequency of not more than 10 minutes. The logs shall be provided in both printed and disk formats.
    f. Any tests that fail to demonstrate the operation of the system shall be repeated at a later date. The contractor shall be responsible for any necessary repairs or revisions to the hardware or software to successfully complete all tests.

B. Acceptance:
    1. All tests described in this specification shall have been performed to the satisfaction of both the engineer and owner prior to the acceptance of the control system as meeting the requirements of completion. Any tests that cannot be performed due to circumstances beyond the control of the contractor may be exempt from the completion requirements if stated as such in writing by the engineer. Such tests shall then be performed as part of the warranty.
    2. The system shall not be accepted until all forms and checklists completed as part of the demonstration are submitted and approved as required in Part 1, "Submittals."

3.17 CLEANING:

A. The contractor shall clean up all debris resulting from his/her activities daily. The contractor

shall remove all cartons, containers, crates, etc., under his/her control as soon as their contents have been removed. Waste shall be collected and placed in a designated location.

B. At the completion of work in any area, the contractor shall clean all work, equipment, etc., keeping it free from dust, dirt, and debris, etc.

C. At the completion of work, all equipment furnished under this section shall be checked for paint damage, and any factory-finished paint that has been damaged shall be repaired to match the adjacent areas. Any cabinet or enclosure that has been deformed shall be replaced with new material and repainted to match the adjacent areas.

3.18 TRAINING:

A. Provide training for a designated staff of Owner's representatives. Training shall be provided via self-paced training, web-based or computer-based training, classroom training, or a combination of training methods.

B. Classroom training shall be done using a network of working controllers representative of installed hardware.

3.19 DUCT SMOKE DETECTION:

A. Submit data for coordination of duct smoke detector interface to HVAC systems as required in Part 1, "Submittals."

B. This Contractor shall provide a dry-contact alarm output in the same room as the HVAC equipment to be controlled.

3.20 CONTROLS COMMUNICATION PROTOCOL:

A. General: The electronic controls packaged with this equipment shall communicate with the building direct digital control (DDC) system. The DDC system shall communicate with these controls to read the information and change the control setpoints as shown in the points list, sequences of operation, and control schematics. The information to be communicated between the DDC system and these controls shall be in the standard object format as defined in ANSI/ASHRAE Standard 135 (BACnet). Controllers shall communicate with other BACnet objects on the internetwork using the Read (Execute) Property service as defined in Clause 15.5 of Standard 135.

B. Distributed Processing: The controller shall be capable of stand-alone operation and shall continue to provide control functions if the network connection is lost.

C. I/O Capacity: The controller shall contain sufficient I/ O capacity to control the target system.

D. The Controller shall have a physical connection for a laptop computer or a portable operator's tool.

E. Environment: The hardware shall be suitable for the anticipated ambient conditions.
   1. Controllers used outdoors and/or in wet ambient conditions shall be mounted within waterproof enclosures and shall be rated for operation at 40°F to 140°F.
   2. Controllers used in conditioned space shall be mounted in dust-proof enclosures and shall be rated for operation at 32°F to 120°F.

F. Serviceability: Provide diagnostic LEDs for power, communication, and processor. All wiring connections shall be made to field removable, modular terminal strips or to a termination card connected by a ribbon cable.

G. Memory: The Controller shall maintain all BIOS and programming information in the event of a power loss for at least 30 days.

H. Power: Controller shall be able to operate at 90% to 110% of nominal voltage rating.

I. Transformer: Power supply for the Controller must be rated at minimum of 125% of ASC power consumption and shall be fused or current limiting type.

3.21 START-UP AND CHECKOUT PROCEDURES:

A. Start up, check out, and test all hardware and software and verify communication between all components.

B. Verify that all control wiring is properly connected and free of all shorts and ground faults.

C. Verify that terminations are tight.

D. Verify that all analog and binary input/output points read properly.

E. Verify alarms and interlocks.

F. Verify operation of the integrated system.

PART 4 – SEQUENCES OF OPERATION

4.1 INFORMATIONAL SUBMITTALS:

A. General: Submit the following according to the Conditions of the Contract.

B. Shop Drawings showing operating sequences of various equipment, devices, components, and materials included in the Text and defining the components' contribution to the system.

4.2 SMOKE DETECTORS AND SMOKE DAMPERS:

A. In systems with air handling capacity above 2,000 CFM and up to and including 15,000 CFM and all units serving egress corridors, the smoke detector mounted in the unit or main ductwork shall, when sensing smoke, shut down the Rooftop Air Conditioner. The smoke detectors shall be connected to the fire alarm system. The actuation of smoke detector shall activate a visible and supervisory signal at a constantly attended location.

B. Smoke (or Combination) Damper/Smoke Detector: Upon sensing smoke at the detector, the damper shall close. When the damper is closed, the indicator light shall illuminate on the ceiling below the damper.

4.3 ENERGY CONSERVATION:

A. Dead Band: Where used to control both heating and cooling, zone sensors shall be capable of providing a temperature dead band of at least 5 F in accordance with 2015 IECC.

B. All HVAC systems/units shall be scheduled for operation by the DDC system. Coordinate the occupancy schedules with the Using Agency.

C. In unoccupied mode, the temperature set point shall be set back to 60 F (adjustable) for heating and 85 F (adjustable) for cooling. Units shall run only as required to maintain setback temperatures. Outside air dampers shall be closed during unoccupied mode.

D. HVAC systems shall energize to cool or warm the spaces to normal occupied setpoint in morning warm up/ cool down mode. Outside air dampers shall NOT be open during warm-up/cool-down mode where motorized dampers are indicated on the plans.

E. Outside air dampers shall only be open when the building is in occupied mode.

F. Individual HVAC units shall be equipped with override features on unit thermostats. When the button is activated, the unit shall operate in occupied mode for a period determined by the Using Agency.

4.4 SAFETY SYSTEMS:

A. All Rooftop Air Conditioners shall de-energize on any general building fire alarm activation.

B. An emergency air handling system shutdown switch shall be located adjacent to the main fire alarm panel. All Air Handling Units shall de-energize whenever the master shutdown switch located at the main fire alarm panel is activated.

4.5 RELIABILITY AND GENERAL ALARM SYSTEMS:

A. Auto Restart: All HVAC systems and equipment shall be configured such that normal operation is resumed after a power failure.

B. Data rooms shall be equipped with DDC temperature sensors. Sensors to be used for temperature monitoring. If the temperature exceeds the Using Agency's selected alarm setpoint, an alarm shall be generated in the EMCS.

4.6 PACKAGED ROOF AIR CONDITIONERS:

A. Occupied Mode: The supply fan shall run continuously during Occupied Mode and maintain 74°F (adj.) space cooling setpoint and 70°F (adj.) space heating setpoint.

B. Unoccupied Mode: The supply fan shall run intermittently and maintain 85°F (adj.) space cooling setpoint and 55°F (adj.) space heating setpoint.

C. High Zone Temp Alarm: If the zone temperature is greater than the cooling setpoint by a user definable amount (adj.).

D. Low Zone Temp Alarm: If the zone temperature is less than the heating setpoint by a user definable amount (adj.).

E. Zone Setpoint Adjust: The occupant shall be able to adjust the zone temperature heating and cooling setpoints at the zone sensor.

F. Zone Optimal Start: The unit shall use an optimal start algorithm for morning start-up. This algorithm shall minimize the unoccupied warm-up or cool-down period while still achieving comfort conditions by the start of scheduled occupied period.

G. Zone Unoccupied Override: A timed local override control shall allow an occupant to override the schedule and place the unit into an occupied mode for an adjustable period of time. At the expiration of this time, control of the unit shall automatically return to the schedule.

H. Emergency Shutdown: The unit shall shut down and generate an alarm upon receiving an emergency shutdown signal.

I. Supply Air Smoke Detection: The unit shall shut down and generate an alarm upon receiving a supply air smoke detector status.

J. Alarms shall be provided as follows:

1. Supply Fan Failure: Commanded on, but the status is off.

2. Supply Fan in Hand: Commanded off, but the status is on.

3. Supply Fan Runtime Exceeded: Status runtime exceeds a user definable limit (adj.).

K. Cooling Stages: The controller shall measure the zone temperature and stage the cooling to maintain its cooling setpoint. To prevent short cycling, there shall be a user definable (adj.) delay between stages, and each stage shall have a user definable (adj.) minimum runtime. Cooling shall be enabled whenever outside air temperature is greater than 45°F (adj.) and the economizer (if present) is disabled or fully open and the zone temperature is above cooling setpoint and the supply fan status is on and the heating is not active.

L. Heating Stages: The controller shall measure the zone temperature and stage the heating to maintain its heating setpoint. To prevent short cycling, there shall be a user definable (adj.) delay between stages, and each stage shall have a user definable (adj.) minimum runtime. Heating shall be enabled whenever outside air temperature is less than 65°F (adj.) and the zone temperature is below heating setpoint and the supply fan status is on and the cooling is not active.

M. Dehumidification: The controller shall measure the return air humidity and override the cooling sequence to maintain return air humidity at or below 60% rh (adj.). Dehumidification shall be enabled whenever the supply fan status is on.

N. Mixed Air Temperature: The controller shall monitor the mixed air temperature and use as required for economizer control (if present) or preheating control (if present). Alarms shall be provided for High Mixed Air Temp (If the mixed air temperature is greater than 110°F (adj.)) and Low Mixed Air Temp (If the mixed air temperature is less than 40°F (adj.)).

O. Supply Air Temperature: The controller shall monitor the supply air temperature. Alarms shall be provided for High Supply Air Temp (If the supply air temperature is greater than 125°F (adj.)) and Low Supply Air Temp (If the supply air temperature is less than 35°F (adj.)).

4.7 EXHAUST FAN CONTROL:

A. Exhaust Fans – Thermostat Control:
   1. OCCUPIED MODE: The unit shall maintain a zone temperature setpoint of 85 F (adj.).
   2. UNOCCUPIED MODE (night setback): Same as OCCUPIED MODE.
   3. The fan shall run anytime the zone temperature rises above setpoint unless shutdown on safeties. Intake damper shall be proven open prior to fan starting. Fan status shall be proven off prior to damper closing.
   4. The controller shall monitor the fan status and intake damper status. Alarms shall be provided as follows:
      a. High Zone temperature.
      b. Fan Failure: Commanded on, but the status is off and vice-versa.
      c. Fan in Hand: Commanded off, but the status is on.
      d. Fan Runtime Exceeded: Fan status runtime exceeds a user definable limit (adj.)
      e. Damper Failure: Commanded open, but the status is closed and vice-versa.

B. Exhaust Fans – Scheduled:
   1. OCCUPIED MODE: The exhaust fan shall run continuously during OCCUPIED MODE.
   2. UNOCCUPIED MODE: The exhaust fan shall be “off.”
   3. The controller shall monitor the fan status.
   4. Alarms shall be provided as follows:
      a. Fan Failure: Commanded on, but the status is off and vice-versa.
      b. Fan in Hand: Commanded off, but the status is on and vice-versa.
      c. Fan Runtime Exceeded: Fan status runtime exceeds a user definable limit (adj.).

C. Exhaust Fans – Interlocked with Switch:
   1. OCCUPIED / UNOCCUPIED MODE: The exhaust fan shall run upon activation of the wall switch. Provide 10 minute run time delay. Intake damper shall be proven open prior to fan starting. Fan status shall be proven off prior to damper closing.
   2. The controller shall monitor the fan status.
   3. Alarms shall be provided as follows:
      a. Fan Failure: Commanded on, but the status is off and vice-versa.
      b. Fan in Hand: Commanded off, but the status is on and vice-versa.
      c. Fan Runtime Exceeded: Fan status runtime exceeds a user definable limit (adj.).
      d. Damper Failure: Commanded open, but the status is closed and vice-versa.

D. Exhaust Fan Operation:
   1. EF-1 shall run continuously during OCCUPIED HOURS.
   2. EF-2 shall run continuously during all hours when the space temperature sensor calls for ventilation.
   3. EF-3 shall run continuously while switch is in the “on” position until 10 minute runtime delay expires.

E. Additional Fan Status Report: Provide an operating status report for each Fan
   1. Exhaust Fan Status
   2. Fan Failure Alarm Status
   3. Fan in Hand Alarm Status
   4. Fan Runtime Exceeded Alarm Status
   5. Space Temperature (EF-2 Only)
   6. High Zone Temp Alarm Status (EF-2 Only)
   7. Intake Damper Position (EF-2 & 3 Only)

4.8 ELECTRIC HEATERS:

A. Electric heaters shall run on their own internal thermostats and shall not be controlled by EMCS. EMCS shall remotely monitor space temperature. Provide Alarms for the following:
   1. High Zone Temp Alarm: If the zone temperature is greater than a user definable amount (adj.).
   2. Low Zone Temp Alarm: If the zone temperature is less than a user definable amount (adj.).

4.9 DUCTLESS HEAT PUMPS:

A. Ductless heat pumps shall run on their own programmable thermostats and shall not be controlled by EMCS. EMCS shall remotely monitor space temperature. Provide Alarms for the following:
   1. High Zone Temp Alarm: If the zone temperature is greater than a user definable amount (adj.).
   2. Low Zone Temp Alarm: If the zone temperature is less than a user definable amount (adj.).

END OF SECTION

SECTION 239110 - MECHANICAL SOUND, VIBRATION, WIND AND SEISMIC CONTROL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. The drawings and general provisions of this division of the Contract, including the General and Special Conditions and Division 01 Specifications, apply to this Section.

1.2 SCOPE OF WORK:

A. Furnish all labor, materials, tools, and equipment and perform all work necessary to complete the installation of the mechanical sound, vibration, wind, and seismic control systems required by these specifications and as detailed on the drawings.

B. All foundations and supports required for the installation of Division 23 equipment shall be furnished by the Division 23 Contractor unless specified otherwise.

C. The following criteria applies to all mechanical systems and components:
   1. Wind Pressure Velocity: 115 MPH
   2. Seismic Design Category: C
   3. Importance Factor: 1.0

D. Based on the criteria listed above, seismic restraints are not required.

1.3 QUALITY ASSURANCE:

A. Codes and Standards: The installation of the mechanical systems shall be installed in accordance with the following codes and standards:
   1. *2024 International Building Code (IBC)*
   2. *ASHRAE*
   3. *ASTM 488 Anchor Locations*
   4. *FEMA Standards*

B. The mechanical sound, vibration, and wind control equipment and products shall be sized and provided by the manufacturers listed below.

C. *Kinetics Noise Control* is the Basis of Design manufacturer. Equivalent name brand equipment by *AeroSonics, Aladdin*, *IAC Acoustics, Mason, MGM Products, Vibration Eliminator, Vibro-Acoustics,* and *Vibration Mountings and Controls* that meets performance, capacity, space, and other requirements of the design documents shall be acceptable.

D. The manufacturer and/or his representative shall select all vibration isolation products in-accordance with the Vibration Isolation Schedule listed in these specifications. All products shall provide the specified deflection as indicated based on the actual equipment weights and installation requirements of the approved equipment. The manufacturer shall provide installation instructions for all provided isolators and wind restraints. Locations of vibration

isolation products shall be coordinated with equipment details shown on the drawings and as specified in these specifications for maximum support locations for piping and other equipment.

E. Submittals:
   1. The contractor shall submit for approval by the engineer all products intended to be used to meet the requirements of these specifications. Submittal data shall include a proposed schedule for vibration isolation products, manufacturer's data and cut sheets of the specific vibration isolation or sound barrier materials. The Proposed Vibration Isolation Schedule shall list all equipment specified to be isolated, the equipment weight, proposed isolator type or base type, number of isolators required, spring or isolator color, and deflection of the spring or vibration isolator based on the equipment weight.
   2. The contractor shall submit wind anchorage requirements for all equipment and curbs. Anchorage calculations shall be prepared by a Design Professional registered in the state where the project will be constructed. The Design Professional shall stamp all calculations. Wind anchorage requirements shall be submitted for all roof mounted equipment. Fasteners shall be selected and detailed for curb connections to the building structure and for equipment connections to the curb. Calculations shall be based on the approved equipment for the project.

PART 2 - PRODUCTS

2.1 GENERAL:

A. All equipment shall be mounted or suspended from approved foundations and supports as specified herein or as detailed on the drawings.

B. The vibration isolation products and systems shall have a deflection as recommended by the manufacturer but not less than the deflection indicated in the Vibration Isolation Schedule.

2.2 ISOLATOR TYPES:

A. Type 1 –Pad Isolators:
   1. Isolation pads shall be elastomer in-shear pads, used in conjunction with steel shims where required, having static deflections as tabulated. Pads are produced from a high quality EPDM elastomer. Pads are 50 durometer and are designed for a maximum of 60 psi loading. Pads are designed for a maximum deflection of approximately 20% of its unloaded thickness, 0.15". Several layers of waffle pad pads can be stacked for additional deflection when steel separation shim stock is used. The elastomer is oil and water resistant, offers a long life expectancy consistent with neoprene compounds, and has been designed to operate within the safe stress limits of the material. Pads are available up to 18"x18"x3/4" thick sheets and are pre-scored into 2"x2" squares and can be easily cut-to-fit as needed. All pads shall be elastomer in-shear and shall be molded using 2500 psi minimum tensile strength, oil resistant EPDM compounds with no color additives. Waffle pad vibration isolators shall have minimum operating static deflections as shown on the Vibration Isolation Schedule, or as indicated on the project documents, but not exceeding published load capabilities.

B. Type 4 - Restrained Spring Isolators: Restrained spring isolation mounts for equipment which is subject to load variations and large external or torquing forces shall consist of large diameter laterally stable steel springs assembled into formed or welded steel housing assemblies designed to limit vertical movement of the supported equipment. Springs shall have a lateral stiffness greater than 0.8 times the rated vertical stiffness and shall be designed to provide up to 50% overload capacity. Springs shall be supported either with a neoprene cup of a metal base plate complete with a ribbed neoprene pad, minimum 0.25" thick, bonded to the base plate. Springs shall be selected to provide operating static deflections as required. Springs shall be color coded or otherwise identified to indicate load capacity. In capacities up to 5,000 lbs., springs shall be replaceable. Housing assembly shall be formed or fabricated steel members and shall consist of a top-load plate complete with adjusting and leveling bolts, vertical restraints, isolation washers and a bottom plate with non-skid noise stop pads and holes provided for anchoring to supporting structure. Housing shall be hot dipped galvanized.

2.3 BASES AND RAILS:

A. Type A – Direct Isolation: Equipment is unitary and rigid and does not require additional support.

B. Type D - Roof Mounted Equipment Vibration Isolation Rails: Vibration isolation rails shall be extruded aluminum or G90 galvanized steel consisting of a lower support rail, upper support rail, steel springs located between the support rails and a continuous weatherproof seal located between the upper and lower support rails. Vibration isolation rails shall be fabricated and designed to be installed and secured on top of the equipment manufacturer's roof curb. Isolation rails shall provide continuous support for the roof-mounted equipment. Isolation rails shall be designed and engineered to provide isolation against casing radiated vibration and structure born vibration from rotating equipment. The steel springs shall consist of large diameter laterally stable steel springs that have a lateral stiffness greater than 1.0 times the rated vertical stiffness and shall be designed to provide up to 50% overload capacity. Isolation rail assemblies shall include supply and return duct block-outs as an integral part of the isolation rail assembly. Springs must be removable and adjustable without disturbing the roof while equipment is in place.

2.4 SOUND CONTROL PRODUCTS:

A. Acoustical Sound Barrier:
1. Acoustic Sound Barrier shall be constructed of vinyl material with a reinforced fiberglass screen loaded with barium sulfate, 1.0 lb/sf. Tensile strength shall be 300 lb/inch and tear strength shall be 100 lbs/inch.

2.5 VIBRATION ISOLATION SCHEDULE FOR MECHANICAL SYSTEMS:

Equipment Type	Isolator Type	Base Type	Deflection
Roof Mtd RAC	Type 4 Mounts	Type D	2.0"
Roof Mtd DHP	Type 1 Pads	Type A	0.15"

PART 3 - EXECUTION

3.1 GENERAL:

A. If the equipment provided is not furnished with integral structural steel supports, mounting feet, or lifting lugs, the contractor shall provide miscellaneous steel shapes as required to install or suspend the equipment and attach the vibration isolation or seismic restraints as specified herein.

B. Support steel shall include but not be limited to rails, brackets, angles, channels, and similar components.

C. All equipment specified to be isolated shall be installed and isolators shall be attached to the building structure or floor and the vibration isolators shall be adjusted and leveled so that the vibration isolators are performing properly.

D. All vibration isolation products, seismic restraint products, flexible pipe connectors and sound control products shall be installed as outlined in the manufacturer's printed installation instructions.

END OF SECTION 239110

SECTION 239210 - MECHANICAL TESTING, ADJUSTING, BALANCING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

1.2 QUALITY ASSURANCE:

A. General: An independent test agency shall perform the TAB work as described herein. The agency shall have a minimum of 3 years of successful TAB experience on projects of similar size and scope. The name of the test agency and proof of satisfactory performance on 5 previous projects in the form of projects referenced shall be submitted to the Design Professional for approval within 30 days after receipt of the construction contract.

B. Test Agency: A firm with membership in the *Associated Air Balance Council (AABC)* or certified by the *National Environmental Balancing Bureau (NEBB)* in those testing and balancing disciplines similar to those required for this project, who is not the Installer of the system to be tested and is otherwise independent of the project.

C. Compliance: Comply with *AABC* standards or *NEBB Procedural Standards for Testing-Adjusting-Balancing of Environmental Systems* as applicable to mechanical air systems and associated equipment apparatus.

D. Industry Standards: Comply with *ASHRAE* (*American Society for Heating, Refrigeration and Air Conditioning Engineers, Inc.*) recommendations pertaining to measurements, instruments, and testing, adjusting, and balancing except as otherwise indicated.

E. Pre-Qualified TAB Agencies: Subject to compliance with requirements, engage one of the following certified Test and Balance Agencies:
   1. *Air Analysis of Atlanta*
   2. *Augusta Air Balance Company*
   3. *Air Data Macon GA*
   4. *Commissioning Services, LLC*
   5. *Georgia Balance Company*
   6. *Research Air Flo, Inc.*
   7. *TAB Services*
   8. *Thomas Balancing*
   9. *Palmetto Air & Water Balance*

1.3 SUBMITTALS:

A. Submit name of TAB Agency for approval within 60 days after Notice to Proceed.

B. Submit 5 copies of a certified test report signed by the TAB supervisor who performed the

TAB work. Test reports shall be submitted prior to the final inspection of mechanical work.

1. Include identification and types of instruments used and their most recent calibration date with submission of final test report.
2. In addition to Air Balance and operational data required to be submitted, the report shall include any observation of unusual noise or vibration observed and any malfunction of adjustable devices encountered during TAB work.

C. Submit *AABC National Performance Guaranty* or *NEBB Certificate of Conformance Certification* for the project.

1.4 JOB CONDITIONS:

A. Do not proceed with testing, adjusting and balancing work until mechanical systems are complete and operable. Do not proceed until systems are clean and free from debris, dirt, and discarded building materials.

PART 2 - PRODUCTS

2.1 PATCHING MATERIALS:

A. Except as otherwise indicated, use the same products as used by original Installer for patching holes in insulation, ductwork and housing which may have been cut or drilled for test purposes, including access for test instruments, attaching jigs and similar purposes.

2.2 TEST INSTRUMENTS:

A. Utilize test instruments and equipment for the TAB work required, of the type, precision and capacity as recommended in *AABC* standards or *NEBB* Procedural Standards for Testing-Adjusting-Balancing of Environmental Systems.

PART 3 - EXECUTION

3.1 SCOPE:

A. Test, Adjust, and Balance the following:
   1. Ductless Heat Pumps and Air Handlers
   2. Electric Heaters
   3. Thru-Wall Heat Pumps
   4. Roof Air Conditioners
   5. Fans
   6. Air Inlets and Outlets

3.2 GENERAL REQUIREMENTS:

A. Perform total system balance in accordance with one of the following:
   1. *AABC, AABC National Standards for Total System Balance*.
   2. *NEBB Procedural Standards for Testing Adjusting Balancing of Environmental Systems*.

B. Begin work after completion of systems to be tested, adjusted, or balanced and complete work and submit Report prior to the Final Observation of the project.

C. Where HVAC systems and/or components interface with life safety systems, including fire and smoke detection, alarm, and control, coordinate scheduling and testing and inspection procedures with the authorities having jurisdiction.

D. Reports shall be certified by an *AABC* Certified Test and Balance Engineer or *NEBB* Certified Testing, Balancing, and Adjusting Supervisor experienced in performance of this Work.

3.3 EXAMINATION:

A. Review the contract documents for appurtenances and arrangement for balancing prior to the installation of any equipment or material. These shall include gauges, test plugs, valves, air volume balancing dampers, etc. The contractor shall be responsible for providing these in the locations recommended by the TAB agency in addition to any shown on the drawings or specified. Verify that duct layout design allows the TAB agency to perform duct pitot traverses to verify system air flows.

B. The Contractor shall notify the Design Professional of any omissions noted within 30 days of the Contractor's notice to proceed.

C. Verify that systems are complete and operable before commencing work. Ensure the following conditions:
   1. Systems are started and operating in a safe and normal condition.
   2. Temperature control systems are installed complete and operable.
   3. Proper thermal overload protection is in place for electrical equipment.
   4. All filters are clean and in place. If required, install temporary media in addition to filters.
   5. Duct systems are clean of debris.
   6. Fans are rotating correctly.
   7. Fire and volume dampers are in place, accessible, operable, and open. Report observation on test report.
   8. All dampers and operators function smoothly from shut-off to full open.
   9. Air coil fins are cleaned and combed.
   10. Access doors are installed at specified components are accessible, are closed and duct end caps are in place.
   11. Air outlets are installed and connected.
   12. Duct system leakage is minimized.

D. Submit field reports. Report defects and deficiencies noted during performance of services which prevent system balance.

3.4 INSTALLATION TOLERANCES:

A. Air Systems: Set HVAC system's air flow rates within the following tolerances:
   1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.
   2. Air Outlets and Inlets: Plus or minus 10 percent.

B. Building Pressure: Ensure that installation tolerances result in each floor of the building being positively pressurized with respect to outside ambient pressure.

3.5 RECORDING AND ADJUSTING:

A. Field Logs: Maintain written logs including:
   1. Running logs of events and issues.
   2. Discrepancies, deficient or uncompleted work by others.
   3. Contract interpretation requests.
   4. Lists of completed task.

B. Ensure recorded data represents actual measured or observed conditions.

C. Permanently mark setting of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

D. Mark on the drawings the locations where traverse and other critical measurements were taken and cross reference the location in the final report.

E. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.

F. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

3.6 FINAL TEST AND BALANCE REPORT:

A. The report shall be a complete record of the HVAC system performance in heating and cooling modes, including conditions of operation, items outstanding, and any deviations found during the TAB process. The final report also provides a reference of actual operating conditions for the owner and/or operations personnel. All measurements and test results that appear in the reports must be made on site and dated by the TAB technicians or test and balance engineers. Report shall contain test results, including instrumentation calibration reports, in the form recommended by the applicable standards.

B. The report must be organized by systems and shall include the following information as a minimum:
   1. Title Page:
      a. Certified company name
      b. Company address
      c. Company telephone number
      d. Project identification number
      e. Location
      f. Project Design Professional
      g. Project Engineer

h. Project Contractor
i. Project number
j. Date of report
k. *AABC* or *NEBB* Certification Statement
l. Name, signature, and certification number of *AABC, TBE,* or *NEBB* Qualified TAB Supervisor

2. Table of Contents.
3. AABC National Performance Guaranty or NEBB Certificate of Conformance Certification.
4. Report Summary:
   a. The summary shall include a list of items that do not meet design tolerances, with information that may be considered in resolving deficiencies.
5. Instrument List:
   a. Type
   b. Manufacturer
   c. Model
   d. Serial Number
   e. Calibration Date
6. Test and Balance Data:
   a. Provide test data for specific systems and equipment as required by the most recent edition of the *AABC National Standards* or *NEBB Procedural Standards for Testing Adjusting and Balancing of Environmental Systems*.

3.7 MINIMUM REQUIRED TEST DATA FOR SYSTEMS:

A. The following test data shall be submitted for each system type in addition to what is required by the *AABC National Standards* or *NEBB Procedural Standards for Testing Adjusting and Balancing of Environmental Systems*.

B. Ductless Heat Pumps and Air Handlers:
   1. Identification/ Number.
   2. Manufacturer model number and serial number.
   3. Design and actual supply airflow.
   4. Design and actual outside airflow.
   5. Cooling mode: design entering and leaving air DB/WB.
   6. Cooling mode: actual entering and leaving air DB/WB. (w/ concurrent OA temp)
   7. Heating mode: design entering and leaving air DB.
   8. Heating mode: actual entering and leaving air DB. (w/ concurrent OA temp)
   9. Verification that air treatment device is installed and operational.
   10. Record all notes pertinent to the test.

C. Electric Heaters:
   1. Identification/ Number.
   2. Manufacturer model number and serial number.
   3. Design supply airflow.
   4. Heating coil: design entering and leaving air DB.
   5. Heating coil: actual entering and leaving air DB.
   6. Design and calculated KW.
   7. Record all notes pertinent to the test.

D. Thru-Wall Heat Pumps:
   1. Identification/ Number.
   2. Manufacturer model number and serial number.
   3. Design and actual supply airflow.
   4. Cooling mode: design entering and leaving air DB/WB.
   5. Cooling mode: actual entering and leaving air DB/WB. (w/ concurrent OA temp)
   6. Heating mode: design entering and leaving air DB.
   7. Heating mode: actual entering and leaving air DB. (w/ concurrent OA temp)
   8. Heating design and calculated KW.
   9. Verification that air treatment device is installed and operational.
   10. Record all notes pertinent to the test.

E. Roof Air Conditioners (Constant Volume):
   1. Identification/ Number.
   2. Manufacturer model number and serial number.
   3. Design and actual supply fan airflow, RPM, voltage, amperage, ESP and Total SP.
   4. Supply fan sheave and belt data.
   5. Design and actual outside airflow.
   6. Cooling coil: design entering and leaving air DB/WB.
   7. Cooling coil: actual entering and leaving air DB/WB. (w/ concurrent OA temp)
   8. Heating coil: design entering and leaving air DB.
   9. Heating coil: actual entering and leaving air DB.
   10. Design and calculated heater KW.
   11. Verification that air treatment device is installed and operational.
   12. Record all notes pertinent to the test.

F. Fans:
   1. Identification/ Number.
   2. Manufacturer model number and serial number.
   3. Design and actual fan airflow, RPM, voltage, amperage, ESP and Total SP.
   4. Fan sheave and belt data.

G. Air Distribution Tests:
   1. Air terminal number.
   2. Room number/ location.
   3. Terminal type and size.
   4. Design air flow.
   5. Actual (final) air flow.
   6. Percent of design air flow.
   7. Relative position of balancing damper.

H. Duct Traverses:
   1. System zone/ branch.
   2. Duct size.
   3. Area.
   4. Design velocity and air flow.
   5. Actual velocity and air flow.
   6. Duct static pressure.
   7. Air correction factor.

I. Space Temperature and Humidity:
   1. Temperature and relative humidity (whether controlled or not) of each conditioned space.
   2. Set point of each controlling thermostat or humidity sensing device.

3.8 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS:

A. Prepare test reports for both fans and outlets. Obtain approved submittals and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.

B. Prepare single-line schematic diagram of systems for the purpose of identifying HVAC components.

C. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

D. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

E. Verify that motor starters are equipped with properly sized thermal protection.

F. Check condensate drains for proper connections and functioning.

G. Check for proper sealing of air-handling-unit components.

3.9 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS:

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
   1. Measure total airflow.
      a. Set outside air, return air and relief air dampers for proper position that simulates minimum outdoor air conditions.
      b. Where duct conditions allow, measure airflow by Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses to obtain total airflow.
      c. Where duct conditions are not suitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.
      d. If a reliable Pitot-tube traverse or coil traverse is not possible, measure airflow at terminals and calculate the total airflow.
   2. Measure fan static pressures as follows:
      a. Measure static pressure directly at the fan outlet or through the flexible connection.
      b. Measure static pressure directly at the fan inlet or through the flexible connection.
      c. Measure static pressure across each component that makes up the air-handling system.
      d. Report any artificial loading of filters at the time static pressures are measured.
   3. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows.
   1. Measure airflow of submain and branch ducts.
   2. Adjust sub-main and branch duct volume dampers for specified airflow.

C. Re-measure each sub-main and branch duct after all have been adjusted.
   1. Adjust air inlets and outlets for each space to indicated airflows.
   2. Set airflow patterns of adjustable outlets for proper distribution without drafts.
   3. Measure airflow at all inlets and outlets.
   4. Adjust each inlet and outlet for specified airflow.

D. Re-measure each inlet and outlet after all have been adjusted.

E. Verify final system conditions.

F. Re-measure and confirm minimum outdoor air, return and relief airflows are within design. Readjust to design if necessary.

G. Re-measure and confirm total airflow is within design.

H. Re-measure all final fan operating data, rpms, volts, amps, static profile.

I. Mark all final settings.

J. Test system in economizer mode. Verify proper operation and adjust, if necessary.

K. Measure and record all operating data.

L. Record final fan-performance data.

3.10 AIR SYSTEM PROCEDURE:

A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities.

B. Make air quantity measurements in ducts by Pitot tube traverse if entire cross-sectional area of duct. Close openings after measurement with permanent manufactured plugs.

C. Measure air quantities at air inlets and outlets.

D. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.

E. Use volume control devices to regulate air quantities only to extend that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers.

F. Vary total system air quantities by adjustment of fan speeds by drive sheave adjustment. Provide drive changes required to place belt in mid-position at final RPM. Vary branch air quantities by damper regulation.

G. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions. Adjust operators on outside air dampers to ensure tight seal when shut.

H. Where modulating dampers are provided, take measurements and balance at extreme conditions. Balance variable volume systems at maximum air flow rate, full cooling, and at minimum air flow rate, full heating.

3.11 TESTING:

A. Tester must examine the installed work and conditions under which testing is to be done to ensure that work has been completed, cleaned and is operable. Notify the Contractor in writing of conditions detrimental to the proper completion of the test-adjusting-balancing work. Do not proceed with the TAB work until unsatisfactory conditions have been corrected in a manner acceptable to Tester.

B. Airflows shown on drawings are provided as a guide to achieve uniform room temperature throughout the building. Field correct as required to suite room condition. Any substantial alteration shall be called to the engineer's attention.

END OF SECTION 239210

SECTION 260100 - ELECTRICAL GENERAL PROVISIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

1.2 IMPOSED REGULATIONS:

A. Applicable provisions of the State and Local Codes and of the following codes and standards are hereby imposed on a general basis for electrical work:
   1. *NEC, National Electrical Code (NFPA No. 70), with Georgia Amendments*.
   2. *The Life Safety Code (NFPA No. 101), with Georgia Amendments*.
   3. *State of Georgia ADA Accessibility Guidelines for Building and Facilities*.
   4. *The International Building Code, with Georgia Amendments*.
   5. *The National Electrical Safety Code (ANSI C2.)*
   6. *UL Fire Resistance Directory*.
   7. *UL Electrical Construction Materials Directory*.
   8. *UL Electrical Appliance and Utilization Equipment Directory*.

1.3 SCOPE OF WORK:

A. Provide all labor, materials, equipment and supervision to construct complete and operable electrical systems as indicated on the drawings and specified herein. All materials and equipment used shall be new, undamaged and free from any defects.

1.4 COORDINATION:

A. Coordinate work provided under this division of the specifications with work provided under other divisions of the specifications and work provided by Owner, where applicable.

1.5 PROJECT STAFFING:

A. Superintendent:
   1. Provide a superintendent to plan, layout, supervise and coordinate the work provided by all organizations providing work under Division 26. The superintendent shall be at the job site at any time work is being performed.
   2. The superintendent shall have a minimum of 5 years of experience in projects of similar size and scope. The superintendent shall have a State of Georgia unrestricted electrical contractor's license.

B. Organizations Furnishing and Installing Electrical Systems:
   1. Traditional electrical systems work shall be furnished and installed by organizations who have successfully completed work of similar size and scope, and who have been in

business for at least 3 years.

2. Electricians, 600V and below:
   a. Electricians assigned to the project shall have proof of having completed a formal training program which certifies that they are qualified to perform electrical work of the type encountered on this project and are familiar with the building codes which apply to this project. For the purposes of this project, workers not possessing these qualifications shall be considered helpers and shall not be allowed to perform electrical work.

C. Organizations Furnishing and Installing Specialty Systems:
   1. Work of Sections 265000 (Lightning Protection Systems), 26601 (Emergency Power System – Natural Gas)**,** is specified by the name of acceptable manufacturers. Each of the systems shall be furnished and installed by an organization that:
      a. is an authorized representatives of the manufacturer, for purchase, installation and service of the specific system.
      b. stocks replacement parts for the specific system.
      c. has installation and service technicians that, in addition to the requirements specified below, have been factory-trained on the system specified.
      d. has experience on projects of similar size and scope.
      e. has been in business for at least 3 years.
   2. Specialty Systems Technicians
      a. Work specified in Sections 265000 (Lightning Protection Systems), 26601 (Emergency Power System – Natural Gas)**,** shall be installed, started (where applicable) and tested by factory trained technicians in the employ of the manufacturer or manufacturer's authorized representative.

D. Submit resumes for review and approval by the Design Professional prior to proceeding with any work on the project. Fill out Attachment 2, Section 260120 for each firm providing work under Division 26.

1.6 UTILITY CONNECTIONS:

A. The approximate point of origination for electric, telephone and television utilities is shown on the drawings. However, the contractor shall confirm the location with the respective utility prior to ordering materials or beginning any trenching. The Contractor's bid shall allow for the service point to be shifted by the utility, 25' feet in any direction from that shown.

B. The contractor shall be responsible for coordination and arrangement with serving electric utility company for service connection (including payment of all costs associated with the service).

1.7 PERMITS AND TEST; ELECTRICAL WORK:

A. Submit a record copy (for Owner's records) of electrical work notices, permits, licenses, inspection or test reports, and similar items obtained in response to governing and imposed codes, regulations and standards.

1.8 ELECTRICAL DRAWINGS:

A. Do not scale the electrical drawings. Obtain all dimensions from the Design Professional's dimensioned drawings, field measurements and shop drawings.

B. Electrical contract drawings are diagrammatic and indicate the general arrangement and connection of equipment and devices. Review product data sheets, wiring diagrams, manufacturer's installation instructions, etc. and provide the connections required to place equipment into service. Do not rely solely on the conductor counts shown on the drawings.

C. Discrepancies shown on different drawings, between drawings and specifications or between documents and field conditions shall be brought to the attention of the Design Professional. **The specifications do not override the drawings or vice-versa.**

1.9 EQUIPMENT REQUIRING ELECTRICAL SERVICE:

A. Provide connections for all electrically driven equipment, in accordance with the electrical drawings and the division of the specifications in which the equipment is specified.
   1. Connection shall include circuit breaker, wiring, control and disconnecting means (where applicable) and final connection.
   2. Prior to ordering materials, review approved shop drawings of equipment that will be ordered and verify the connections shown. Fill out and submit the Coordination Affidavit required by Section 260120.
   3. Where connection is required by other Divisions, but no connection is shown on the electrical drawings, provide connection to nearest panel of same voltage and phase based on the characteristics shown on other drawings. All added connections shall be brought to the attention of the Design Professional.
   4. Provide 120 volt, 1 phase, 20 ampere power connection for all Division 23 control panels, whether indicated on the project drawings or not. Circuit from nearest 120/208 volt, 3 phase, 4 wire panelboard from available 20 amp, single-pole spares. Revise panelboard schedules accordingly. Document and coordinate control panel requirements and locations during preparation of the Coordination Affidavit, Attachment No. 1.

1.10 SYSTEMS REQUIRING ROUGH-IN:

A. Rough-in shall consist of all outlet boxes and covers/raceway systems/supports and sleeves required for the installation of cables/devices specified by other Divisions and by the Using Agency.

B. Review shop drawings to determine rough-in requirements; do not rely solely on the information shown on the drawings. Keep a copy of these shop drawings at the project site throughout the course of construction.

C. Systems requiring rough-in shall include, but not be limited to the following:
   1. Mechanical equipment as shown in Divisions 22 and 23
   2. Building equipment as shown.
   3. Equipment furnished by the Using Agency as shown on plans.
   4. Telephone service.
   5. Television cable service.
   6. Voice / data / video cabling systems.

D. Rough-in requirements are further defined in Section 261010. Prior to performing any rough-

in, meet with the designated representative of the trade involved to confirm device locations, mounting heights, trim ring type and orientation.

1.11 RECORD DOCUMENTS:

A. The electrical superintendent shall maintain a white set (blue-line or black-line) of contract documents in clean, undamaged condition, for mark-up of actual installations which vary substantially from the work as shown. Mark-up whatever drawings are most capable of showing installed conditions accurately. These documents shall be used for no other purpose. As a minimum, record the following:
   1. Post all addenda prior to beginning work.
   2. Post all changes in the work.
   3. Document actual feeder conduit routes, both interior and exterior. For lines run below grade or slab, dimension lines off of fixed surfaces.
   4. Scope of each change order (C.O.), noting C.O. number.
   5. Mark up all branch circuit connections.

1.12 RECORD MANUALS: (CLOSEOUT REQUIREMENTS)

Record manuals shall include the following:

A. Manufacturer's operation and maintenance manuals for:
   1. Lighting Fixtures
   2. Lighting Control System.
   3. Panelboards and circuit breakers
   4. Dry Type Transformers
   5. Emergency Power System (Include manufacturer's fabrication drawings)

B. Shop drawings, revised to reflect all review comments, *supplemented with the installation instructions shipped with equipment.*

C. One copy of all panelboard directories plus USB flash drive with electronic spreadsheets containing directories.

D. Lightning Protection System layout drawings updated to reflect as-built conditions.

E. Emergency Power System connection drawings updated to reflect as-built conditions.

F. Lighting control system wiring diagrams updated to reflect as-built conditions.

G. All test results listed by specification section.

H. All required keys, tools, and spare parts.

I. Submit record manuals in quantities and in the format prescribed in the Division specifications, plus one copy for the Engineer.

1.13 TRAINING OF OWNER'S FORCES:

A. Train Owner's personnel on the operation and maintenance of the following systems :
   1. Emergency Power System - 8 hours.
   2. Lighting Control System - 2 hours.
   3. Tour of Facility - 8 hours

B. The "tour of facility" shall consist of the walk-thru of at least one space of each type. The Division 26 Superintendent shall demonstrate operation of all lighting controls, emergency shut off controls, use of receptacles, etc. The tour shall be conducted jointly with Division 27.

C. Training shall not be conducted until system has been tested by the Contractor and is 100% operational. Training shall be conducted at the project site.

D. As a minimum, the following materials shall be reviewed during the training session:
   1. Owner's operation and maintenance manual.
   2. Corrected shop drawings and as-built system drawings.
   3. Hands-on demonstration of system features and operation.

E. Schedule the training at least two weeks in advance. At that time, provide a detailed outline of the training session.

F. Training shall be conducted by authorized representatives of the system manufacturer and the Division 27 superintendent.

G. The contractor shall make a video (DVD format) of all training sessions and deliver to the Owner.

1.14 REVIEW OF THE WORK BY THE DESIGN PROFESSIONAL:

A. During the course of the project, the work will be reviewed by a representative of the Design Professional. Upon each visit, the Contractor shall also demonstrate that the record documents and shop drawing files are being kept current. The Division 26 Superintendent shall accompany the Design Professional on all reviews and shall provide all personnel, tools, ladders, etc. necessary to conduct the review.

B. Prior to reviewing of work in progress, or at the final inspection, the Contractor shall submit a letter describing the specific work to be reviewed, along with a punch-list of items that are incomplete or which require correction, based on observations made by the supervisor of the given trade. Reviews will not be scheduled until this information is submitted. The Contractor shall bear the burden of any resulting delays.

C. Construction review reports will be issued by the Design Professional for every review trip. Within five working days from the date of review, the Contractor shall submit a letter which addresses when corrections will be made for each deficiency in the report. Prior to subsequent review of the work, the Contractor shall submit a letter confirming that the work required by all comments on the report has been completed.

PART 2 - PRODUCTS

2.1 GENERAL:

A. Refer to the drawings and individual specification sections for requirements.

B. All equipment shall be suitable for the environment in which it is installed. Such considerations shall include, but not be limited to characteristics of this specific project such as wet/damp/dry locations, ambient temperature / humidity, spaces used as air plenums and hazardous locations. It shall be the responsibility of the contractor to review the contract documents and order equipment based on intended use.

2.2 MATERIALS:

A. All materials and equipment used shall be new, undamaged and free from any defects.

B. Provide materials and equipment that are *UL* listed, unless listing is unavailable.

C. All equipment of the same type or of the same product category shall be the product of a single manufacturer.

D. It is the responsibility of the Contractor to determine the shipping splits for large equipment.

E. Where product is specified by catalog number, such specification is intended only to convey general characteristics. Actual product selection shall be based on catalog number, other references on the drawings / specifications and intended use. Products not listed in these specifications or shown on drawings shall not be used.

2.3 ACCEPTABLE MANUFACTURERS:

A. Provide equipment and materials which are products of the manufacturers listed on the drawings and in the specifications. Requests for substitution of other manufacturers shall comply with Division 1 and the paragraph "B" below.

B. Requests for prior approval (i.e. before the bid opening) must contain all information listed for the specific item in Section 260120, including any applicable dimensioned layout drawings. Requests must be sent by mail or express delivery such that they are received in the Design Professional's office no later than ten working days prior to the opening of bids. **Requests that are incomplete or are sent by facsimile will not be reviewed.**

PART 3 - EXECUTION

3.1 ROLE OF THE SUPERINTENDENT:

A. The Division 26 Superintendent's duties shall include, but not be limited to the following:
   1. Preparation of submittals.
   2. Planning and layout of the work.
   3. Coordination with other trades and the local utility company.
   4. Posting addenda and changes in the work to maintain the Record Documents and to ensure that Division 26 personnel are working from up-to-date drawings and specifications.

5. Supervision of all Division 26 personnel.
6. Ongoing review of work in place to ensure compliance with the Contract Documents.
7. Administrative duties as required to fulfill the requirements of the General Conditions, Special Conditions and Division 01 specifications.
8. Training of the Owner’s personnel.

3.2 PROTECTION OF THE WORK:

A. Protect the work during the course of construction. Do not install any equipment or materials until the proper environmental conditions have been established.

B. Store materials in the manner recommended by the manufacturer until materials are installed. Materials rated for indoor use shall not be stored outdoors regardless of the packaging in which the materials are shipped.

C. Prior to the building being "dried-in", protect incomplete conduit runs, outlet boxes, equipment enclosures, etc. from the entry of water or construction debris, by installing and maintaining temporary protective covers.

D. Do not install wiring devices, equipment or panel interiors until the building is dried-in. For the purposes of this specification “dried in” shall mean the roof has been installed, all exterior openings are covered and the interior of the building is dry.

E. Maintain temporary protective covers over equipment enclosures, outlet boxes and similar items after interiors, conductors, devices, etc. are installed, to prevent the entry of construction debris and to protect the installation during finish work performed by others. Do not install device plates, equipment covers or trims until finish work is complete.

F. Install temporary protective covers over equipment mounted on the building exterior to prevent corrosion damage during cleaning of the building exterior, by others.

G. Clean all equipment, inside and out, upon completion of the work. Scratched or marred surfaces shall be touched-up with touch-up paint furnished by the equipment manufacturer.

H. Equipment or materials that are improperly stored or are installed before the proper environmental conditions are achieved will be removed and replaced with new, at no cost to the Owner. The Contractor shall bear all consequences from any resulting delays.

I. All equipment and materials that become damaged will be removed and replaced with new, at no additional cost to the Owner.

3.3 CUTTING AND PATCHING:

A. Structural Limitations: Do not cut structural framing, walls, floors, decks, and other members intended to withstand stress, except with the Design Professional's written authorization. Authorization will be granted only when there is no other reasonable method for completing the electrical work, and where the proposed cutting clearly does not materially weaken the structure.

B. Cutting Concrete: Where authorized, cut openings through concrete (for conduit penetrations

and similar services) by core drilling or sawing. Do not cut by hammer-driven chisel or drill.

C. Other Work: Do not endanger or damage other work through the procedures and process of cutting to accommodate electrical work. Review the proposed cutting with the Installer of the work to be cut, and comply with his recommendations to minimize damage. Where necessary, engage the original Installer or other specialists to execute the cutting in the recommended manner.

D. Patching: Where patching is required to restore other work, because of cutting or other damage inflicted during the installation of electrical work, execute the patching in the manner recommended by the original Installer. Restore the other work in every respect, including the elimination of visual defects in exposed finished, as judged by the Design Professional. Engage the original Installer to complete patching of various categories of work including: concrete and masonry finishing, waterproofing and roofing, exposed wall finishes, etc.

3.4 INTERFACE OF ELECTRICAL WORK WITH OTHER TRADES:

A. Where electrical work must connect to or be incorporated into work installed by other trades, engage the services of the other trade to interface the work. Under no circumstances shall the installer performing work under this division of the specifications modify or alter work installed by others. Such work includes, but is not limited to:
   1. Roof Penetrations.
   2. Any attachments to roofing system.
   3. Penetrations in Vapor Barriers.
   4. Exterior Insulation and Finish Systems (EIFS).

END OF SECTION 260100

SECTION 260120 - ELECTRICAL SUBMITTALS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

1.2 GENERAL:

A. Submit for review by the Design Professional a schedule with engineering data of materials and equipment to be incorporated in the work.
   1. Submittals shall be supported by descriptive materials, i.e., catalog sheets, product data sheets, diagrams, performance curves and charts published by the manufacturer, to show conformance to Specifications and Plan requirements; model numbers alone shall not be acceptable.
   2. Data submitted for review shall contain all information to indicate compliance with Contract Documents. Complete electrical characteristics shall be provided for all equipment.
   3. Submittals for lighting fixtures shall include Photometric Data.
   4. The Design Professional reserves the rights to require samples of any equipment to be submitted for review.

B. Prepare submittals, including the necessary inter-division planning and coordination in accordance with the approved project schedule. Note that certain Division 26 submittals cannot be prepared until approved submittals are available from other Divisions of the work.

C. Submittal material shall be assembled and checked by the Division 26 superintendent.

D. All layout drawings shall be prepared under the supervision of, and checked by the Division 26 superintendent.

E. Hard Copy Submittals: Submittal data shall be placed in one or more hard-back 3-ring binders arranged and labeled according to specification section. Each binder shall contain a title page and table of contents. Provide separator tabs, and label by specification section. Make note in the table of contents, any drawings that accompany the submittal. Title page shall contain Project Name, Contractor's Name, Division 26 Superintendent's name, Suppliers and point of contact for each, and date. Except as otherwise indicated in other sections, submit 5 complete copies. Quantity indicated does not include copies required for regulatory agencies.

F. Electronic Submittals: All electronic submittal files shall be organized to match the bid documents for specification section and name. Each submittal file shall be complete for each specification section. Multiple partial submittals per specification section will be rejected. Make note in the table of contents, any drawings that accompany the submittal. Title page shall contain Project Name, Contractor's Name, Division 26 Superintendent's name, Suppliers and point of contact for each, and date.

G. The fault current calculation required by Section 262042-Panelboards shall be provided after service has been installed and inspected by the Authority Having Jurisdiction.

1.3 RESPONSE TO SUBMITTALS:

A. The contractor shall review all submittals prior to submitting to ensure compliance with the contract documents. Comments made by the Design Professional do not relieve the contractor from complying with the contract documents (drawings, specifications, and addenda). The Design Professional does not approve any submittals. The Design Professional only reviews and makes observations regarding the submittals.

B. The purpose of the submittals is to demonstrate to the Design Professional that the contractor understands the design concept and that he demonstrates his understanding by indicating which equipment and materials he intends to furnish and install. Any deviation from the contract documents shall be clearly stated on the submittal data. If not clearly stated, the submittal shall be marked “Revise and Resubmit”. Failure of the contractor to provide submittals during the submittal process shall make the contractor totally responsible for any and all changes to achieve compliance with the contract documents.

C. Shop drawings shall be evaluated by the Design Professional in accordance with the following classifications:
   1. **"No Exceptions Taken"**: No corrections, no marks. Items may be ordered.
   2. **"Make Corrections Noted"**: A few minor corrections. Items may be ordered as marked up without further resubmission.
   3. **"Revise and Resubmit"**: Minor correction. Item may be ordered at the Contractor's option. Contractor shall resubmit drawings with corrections noted.
   4. **"Rejected"**: Major corrections or not in accordance with the contract documents. No items shall be ordered. Contractor shall correct and resubmit drawings.

D. Whether resubmittals are required or not, all shop drawings shall be corrected for the record manuals specified in Section 26 0100.

1.4 SUBMITTAL GROUPING:

A. Submittals shall be made in no more than 2 groups.

B. All submittals for a given system shall be submitted at the same time. For example, wiring diagrams and other detailed layout information must be submitted with equipment data sheets.

C. Submittals that do not comply with these requirements or that are deemed by the Design Professional to be incorrect shall be returned without review. The Contractor shall bear the burden of any resulting delays.

1.5 EQUIPMENT AND MATERIALS REQUIRING SUBMITTALS:

A. Section 260100 - General Provisions
   1. Superintendent’s resume
   2. Electricians’ qualifications
   3. Letter from company furnishing the Emergency Power System stating that they comply

with the requirements set forth in Section 266011.
4. Letter from company furnishing the Lightning Protection System stating that they comply with the requirements set forth in Section 265000.
5. Test Schedules.

B. Section 260110 - Demolition
1. List of Materials to remain property of the Using Agency.

C. Section 260120 - Electrical Submittals
1. Equipment Layout Drawings
2. Attachment 1

D. Section 261010 - Raceway Systems
1. Raceways and Fittings
2. Wall Boxes and Covers
3. Ceiling Boxes and Covers
4. Pull Boxes
5. Troughs
6. Firestopping Materials and Installation Drawings
7. Corrosion Protection

E. Section 262010 - Wires and Cables
1. Conductors
2. Connectors
3. Splices

F. Section 262020 - Wiring Devices
1. Receptacles
2. GFCI Receptacles
3. Weather Resistant Rated GFCI Receptacles
4. Switches
5. Dimmers
6. Occupancy/Vacancy Sensors & switches
7. Occupancy/Vacancy Sensor layout drawings
8. Photo-sensors
9. Weatherproof Covers
10. Device Plates
11. Temporary Protective Covers

G. Section 262021 - Safety and Disconnect Switches
1. Safety Switches
2. Fuses (Including Current-Limitation Charts)
3. Motor Rated Switches
4. Equipment List
5. Arc Flash Warning Labels
6. Nameplates

H. Section 262030 - Lighting Fixtures
1. Lighting Fixtures
2. Ballasts
3. Lamps
4. Emergency Ballasts

I. Section 262042 - Panelboards
   1. Enclosures
   2. Dimensional Data
   3. Locks
   4. Directory
   5. Circuit Breakers
   6. Bussing Diagrams
   7. Metering
   8. Arc Flash Warning Labels
   9. Nameplates

J. Section 262080 - Electrical Grounding, 600V and Below
   1. Ground Rods
   2. Conductors
   3. Connectors
   4. Bonding Bushings
   5. Ground Rod Enclosures

K. Section 265000 - Lightning Protection System
   1. Lightning Protection System Components
   2. Layout drawing including all bonding of metal bodies
   3. Installation Details
   4. Letter from Roofing Contractor / Roof Supports and Penetrations
   5. Installer Qualifications
   6. Certification that system complies with U.L. Masterlabel requirements

L. Section 266011 - Emergency Power Systems
   1. Certification of site for service / warranty
   2. Compliance / Labels (including EPA emissions compliance letter)
   3. Maintenance Agreement
   4. Rating
   5. Engine
   6. Generator
   7. Controller
   8. Instrument Panel
   9. Mounting Base
   10. [Fuel Tank]
   11. Accessories
   12. Automatic Transfer Switch
   13. Automatic Transfer Switch Arc Flash Warning Label
   14. Automatic Transfer Switch Nameplate
   15. Generator Docking Stations

PART 2 – PRODUCTS

2.1 NOT APPLICABLE:

PART 3 - EXECUTION

3.1 MANUFACTURER'S DATA:

A. Include the manufacturer's comprehensive product data sheet and installation instructions.

B. Where operating ranges are shown, mark data to show portion of range required for project application.

C. Where pre-printed data sheet covers more than one distinct product-size, type, material, trim, accessory group, or other variations, delete or mark-out portions of the pre-printed data which are not applicable.

3.2 EQUIPMENT LIST:

A. Where more than one type of a product is being used (i.e., starters, disconnects, breakers, etc.) provide a list with each submittal correlating the type and size of product to the load served.

3.3 TEST REPORTS:

A. Submit test reports which have been signed and dated by the firm performing the tests and prepare in the manner specified in the standard or regulation governing the tests procedure as indicated.

3.4 ELECTRICAL LAYOUT AND COORDINATION DRAWINGS:

A. Electrical Rooms: Provide layouts of all electrical rooms, using the dimensions of equipment actually furnished. Locate all ducts and piping entering or crossing these spaces.

B. Mechanical Rooms and Mechanical Equipment Yards: Provide layouts showing all mechanical equipment based on dimensions of the actual equipment provided. Show the location of all motor controls, disconnect switches, control power junction boxes and conduit stub-ups at equipment. Location of stub-ups shall be based on manufacturer's installation drawings.

C. Panel and Equipment Feeders, 60A or more: The routing of feeders is not shown on the drawings. Actual routing shall be determined by the contractor in accordance with the specifications and shall be coordinated with work by other trades. For feeders of 60A or higher rating, provide layout drawings showing proposed routes.

D. Lightning protection system layout drawings, as specified in Section 265000.

E. System specific drawings - Include the following:
   1. Floor plans:
      a. Show all system equipment, devices, and interconnecting cabling. Provide a legend to define all devices and cable runs.
   2. Details:
      a. Show the rough-in requirements and mounting height for every component Include

all requirements such as outlet box size/trim/alignment and raceway requirements.
b. Prepare in sufficient detail such that these drawings can be used to provide the required rough-in.

3. Point-to-point installation wiring diagrams of the entire system:
   a. Provide terminal diagram for every control panel.
   b. Provide wiring diagram for every device. Key these diagrams to the system diagrams.
   c. Provide wiring diagram depicting all interlocks of specific systems with other systems.
   d. Spare and unused terminals shall be marked as such. Indicate the size, type and color code of all conductors.
   e. The use of generic wiring diagrams is not acceptable. Wiring diagrams shall be prepared for this specific project.
4. Elevations:
   a. Provide an elevation drawing of the headend equipment / control panel / backboard, showing the location of all components.
   b. Indicate enclosure sizes and space available for future expansion.

F. Drawing Format:
1. Drawings shall be prepared at the following scales:
   a. Floor plans: 1/8" = 1'-0".
   b. Electrical Rooms: 1/4" = 1'-0".
   c. Mechanical Rooms / Equipment Yards: 1/4" = 1'-0".
   d. Feeder routes: 1/16 " = 1'-0".
   e. Lightning protection system layout drawings: 1/16 " = 1' - 0".

2. The scales defined above are for plan views. Device assembly drawings, wiring diagrams, etc. may be prepared “not to scale”.

3. Drawings shall be titled to define Project Name, Drawing subject, date prepared and designer’s name and seal. All revisions shall be marked and dated.

4. Drawings shall include all room names and numbers.

5. CAD-generated drawings are required. Upon written request, a .zip file containing the building floor plan(s) can be furnished to the contractor at a nominal cost, in AutoCAD 2020 format. By requesting these drawings, the contractor agrees to accept them “as is”. It will be the responsibility of the contractor to verify the drawings for accuracy and to make all changes necessary, at no additional cost to the Owner.

6. Submit only one copy of each drawing, in reproducible format. The Design Professional will mark review comments on the reproducible drawing so that the contractor can make as many copies as may be required.

3.5 ATTACHMENT NO. 1:

A. The intent of Attachment Number 1 is to ensure that the electrical requirements for equipment have been reviewed and coordinated by the Contractor. No electrical equipment shall be ordered, nor shall rough-in begin, before this coordination has taken place. This document shall be returned appropriately marked whether or not any changes are deemed to be necessary by the contractor.

ATTACHMENT NO. 1

SHOP DRAWING COORDINATION AFFIDAVIT

I, the Division 26 Superintendent, certify that I have reviewed the equipment shop drawings for electrically driven equipment and that the accompanying electrical shop drawings reflect the requirements of the actual equipment to be furnished for use on this project. The following deviations from design drawings were required to serve the furnished equipment:

ITEM	CKT. DESIG.	BKR.SIZE		CONDUIT/WIRE		DISC.SIZE		STARTER	
		New	Old	New	Old	New	Old	New	Old

NOTE: If no deviations are required please indicate by circling the appropriate answer above your signature.

PROJECT: _____ DEVIATIONS: Yes / No

COMPANY:_____

TITLE: _____ SIGNATURE: _____

TELEPHONE: _____DATE:_____

FAILURE TO PERFORM THE WORK REQUIRED BY THIS AFFIDAVIT, PRIOR TO ORDERING MATERIALS OR ROUGHING-IN, MAY RESULT IN IMPROPER CONNECTIONS BEING PROVIDED. THE EXPENSE OF CORRECTIVE MEASURES, IF REQUIRED, SHALL BE BORNE BY THE CONTRACTOR.

END OF SECTION 260120

SECTION 261010 - RACEWAY SYSTEMS AND SUPPORTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

1.2 SCOPE OF WORK:

A. The requirements of this section apply to all electrical raceway systems and supporting devices, installed under this contract, except for concrete encased duct banks. Electrical raceway system is defined to include, but not be limited to, all electrical raceways, boxes, fittings, and similar components necessary for a continuous pathway for the installation of cables or conductors. Supports are any devices or components used to support raceways or electrical equipment.

1.3 QUALITY ASSURANCE:

A. Submittals: Refer to Section 260120 for requirements.

PART 2 - PRODUCTS

2.1 ELECTRICAL METALLIC TUBING (EMT):

A. Uses permitted:
   1. Indoors concealed in walls or ceiling.
   2. Concealed in slabs above grade.
   3. Exposed horizontal runs installed at least 7' above finished floor.

2.2 INTERMEDIATE METAL CONDUIT (IMC) OR RIGID GALVANIZED STEEL CONDUIT (RGS):

A. Uses permitted:
   1. Indoors concealed or exposed.
   2. Transition from below grade nonmetallic raceway system to above grade metallic raceway system.
   3. Refrigerated spaces.
   4. Vertical drops serving equipment.

2.3 RIGID NON-METALLIC CONDUIT (SCHEDULE 40 PVC):

A. Uses permitted:
   1. Below grade installations.
   2. Grounding electrode conductor raceway.
   3. Lightning protection system down conductor raceway.

2.4 FLEXIBLE METAL CONDUIT:

A. Uses permitted:
   1. Final connection to lighting fixtures.
   2. Final connection to other than Division 23 equipment located in indoor, dry locations.

2.5 LIQUID-TIGHT FLEXIBLE METAL CONDUIT:

A. Uses permitted:
   1. Final connection to equipment in indoor or outdoor locations.

2.6 SLEEVES:

A. Conduit sleeves shall be RGS unless otherwise required by the through penetration firestop system selected.

B. Sleeves shall be minimum 1" and maximum 4" diameter, provided in quantities necessary to install cable systems specified in Divisions 23 and 27.

C. The contractor shall take special note that sleeve fill will be limited by the specific through penetration firestop system used. ***In no case shall the fill exceed 40%***.

2.7 CONNECTORS/COUPLINGS:

A. Connectors/couplings for use with EMT conduit shall be steel compression type, except that steel, set screw type will be acceptable for EMT conduits sizes 2-1/2" and larger.

B. Connectors/couplings for use with IMC and RGS conduit shall be threaded type.

C. All connectors shall be insulated throat type.

D. Locknuts shall be of the same material as connectors.

E. All fittings shall be raintight. Fittings encased in concrete shall be concrete-tight.

2.8 CONDUIT BODIES:

A. Provide galvanized steel or cast metal conduit bodies constructed with threaded conduit ends, removable cover, and corrosion resistant screws.

2.9 CEILING OUTLET BOXES:

A. Provide 4" octagon, galvanized steel interior outlet boxes constructed with stamped knockouts in back and sides and with threaded holes with screws for securing box covers or wiring devices.

B. Boxes used to support ceiling paddle fans shall be listed for the purpose.

2.10 WALL OUTLET BOXES:

A. Recessed:
   1. Boxes shall be galvanized steel constructed with stamped knockouts in back and sides and with threaded holes with screws for securing box covers or wiring devices.
   2. Minimum box size shall be 4" square by 1-1/2" deep.
   3. Boxes for GFCI outlets, Division 22, Division 23, and Division 27 devices and other locations deemed necessary, shall be 4-11/16" square by 2 1/8" deep.
   4. Boxes shall have square edge tile type covers.
   5. Where devices are ganged, use gang-type boxes with gang box covers.
   6. The use of gangable type outlet or switchboxes is not acceptable unless required by specific device manufacturer.
   7. Use masonry type boxes of equal or greater volume to those specified above, in masonry walls.

B. Surface:
   1. Use cast aluminum box with threaded hubs in conjunction with metallic conduit systems.

C. Special Conditions:
   1. Where box type specified herein conflicts with requirements of equipment to be installed, equipment manufacturer’s requirements shall govern.

2.11 INTERIOR PULL BOXES:

A. Provide galvanized sheet steel boxes without knockouts. Provide surface boxes with screw-held covers in unfinished areas. In finished areas, including storage rooms, provide recessed boxes with screw-held cover, finished to match panelboards.

2.12 WIRING TROUGHS:

A. Troughs shall be made of code gauge galvanized steel, without knockouts, and shall be suitable for surface mounting. Provide screw-held, removable front cover. Trough and cover shall be finished the same as panelboards. Dimensions shall be as indicated on the drawings. Provide knockouts as required.

2.13 SUPPORTS:

A. Supporting devices shall be the products of manufacturers’ specifically intended for supporting electrical raceways, devices, and equipment. Makeshift supports are not

acceptable. Where channel type supports are used, select complete assemblies based on the weight of the raceway(s) or equipment being supported.

B. The use of tie wire or tie wraps as a means of support for electrical raceways, devices and equipment is not permitted.

C. Plywood backboards shown in Communications Rooms or otherwise for the support of low-voltage cabling systems and/or mounting of equipment shall be fire resistant, Type AC rated. The plywood shall be painted with gray, fire resistant coating. Ensure that the plywood rating seal is left exposed after painting.

2.14 FIRESTOPPING:

A. A through-penetration firestop system shall be used to seal penetrations of electrical conduits and cables through fire-rated partitions per *NEC 300-21* and *NEC 800-3*. The firestop system shall be qualified by formal performance testing in accordance with *ASTM E-814*, or *UL 1479*.

B. The firestop system shall consist of a fire-rated caulk type substance and a high temperature fiber insulation. It shall be permanently flexible, waterproof, non-toxic, smoke and gas tight and have a high adhesion to all solids so damming is not required. Only metal conduit shall be used in conjunction with this system to penetrate fire rated partitions. Install in strict compliance with manufacturer's recommendations. *3M*, *Metacaulk* or *Nelson*.

C. **Submit installation drawings for conduit penetration, cable in metal sleeve penetration and blank metal sleeve penetration for each type of wall/floor construction encountered.**

D. Schedule a representative of the manufacturer to conduct a product demonstration / training session for each through-penetration firestop system to be used on this project. The session shall be held at the project site. Submit a letter to the Design Professional stating when the demonstration will be conducted.

PART 3 - EXECUTION

3.1 RACEWAY INSTALLATION - GENERAL:

A. Wherever possible, install horizontal raceway runs above water and drain piping. Give the right-of-way in confined spaces to piping which must slope for drainage and to larger HVAC duct work and similar services which are less conformable than electrical services. *However, ensure that all junction boxes and other points of access in raceway systems are located such that they are not rendered inaccessible.*

B. Complete the installation of electrical raceways before starting installation of cables within raceways.

C. All above grade conduits shall be routed parallel or perpendicular to the building structure.

D. **Raceways shall not be installed exposed in finished spaces or on the exterior of the**

building. Install concealed in walls, ceilings, below slab-on-grade or embedded in slabs above grade. *Where raceway system serves surface mounted* equipment (i.e., safety switch), mount equipment over recessed outlet box.

E. All exposed raceway systems shall be painted to match the surface to which it is attached. All components of the raceway system shall be painted, i.e., conduits, boxes, supports, etc. Painting is specified under other divisions of the work.

F. Provide 200 lb. nylon pull cord in all conduits installed for cable systems specified under Division 23 and Division 27; and where conduits will be left empty for future use. Cap open ends and mark location of opposite end with black indelible marker pen.

G. Seal the inside of all conduits entering the building from outside, whether they connect to enclosures or not.

H. Do not run raceways atop the roof deck, through stairwells or elevator shafts.

3.2 BELOW SLAB AND IN-SLAB INSTALLATIONS: (within the building footprint)

A. *Do not install conduits in slabs on-grade.* Raceways shall be routed under the first floor building slab. Conduits shall be routed such that the top of the conduit is a minimum of 6" below the slab.

B. All 90-degree elbows and all stub-ups through the floor slab for all size conduits shall be corrosion protected RGS or corrosion protected *IMC*.

C. Raceways in slabs above grade shall be totally embedded in the slab. They shall be placed above the lower reinforcing and below the upper reinforcing. The outer edge in no case shall be less than 1" from the surface of the slab. The corners of raceways at turnups into walls shall not be exposed at the wall/floor junction.

D. Raceways for Division 27 systems shall not be installed in or below slabs unless specifically indicated.

3.3 BELOW GRADE INSTALLATIONS: (Outside the Building Footprint)

A. Perform all excavating, trenching, and backfilling to install work of this project in accordance with applicable sections of Division 02 of the specifications and *ANSI C2.* Bottom of trenches shall be smooth and level to provide uniform bearing for conduits.

B. Secure conduits in trench to eliminate unnecessary curvature and to prevent movement of conduits while backfilling.

C. Maintain 6" vertical separation between conduits installed one above the other. Backfill and compact each layer separately. The minimum cover requirements specified herein shall be referenced to the uppermost layer of conduits.

D. Maintain minimum 12" horizontal and 6" vertical separation between conduits of different systems and between other underground utilities.

E. Do not backfill until installed electrical work has been tested and accepted, wherever testing is indicated.

F. Condition backfill material by either drying or adding water uniformly, to whatever extent may be necessary to facilitate compaction to the required densities. Do not backfill with frozen soil materials.

G. Backfill simultaneously on opposite sides of electrical work and compact simultaneously; do not dislocate the work from installed positions.

H. Backfill excavations in 8" high courses of backfill material, uniformly compacted to the following densities (percent of maximum density, ASTM Standard Proctor), using power-driven hand-operated compaction equipment.
   1. Lawn/Landscaped Areas: 90%
   2. Roadways: 95%
   3. Paved Area, Other than Roadways: 95%

I. Backfill to elevations matching adjacent grades, at the time of backfilling excavations for mechanical work.

J. 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 Design Professional.

K. Minimum cover requirements:
   1. Service entrance and feeder conduits, 600V and below: 24".

3.4 GRADE LEVEL PULL BOXES:

A. Top of boxes shall be set flush with finished grade and shall be aligned parallel or perpendicular to predominant site features (i.e., sidewalks, etc.)

B. The exact location of boxes shall be field determined based on existing conditions and coordination with other underground utilities.

C. Conduits shall enter boxes through field-made openings in the sides of box. Conduits shall not enter the bottom of box. Make and seal all openings in accordance with the box manufacturer’s recommendations.

D. Provide a 6" layer of crushed rocks beneath open-bottom type boxes.

3.5 MOISTURE PROTECTION:

A. Conduits entering refrigerated spaces - Provide sealing fitting at accessible location outside the refrigerated space. Seal raceway to prevent the entry of moisture.

B. Where conduits pass from a conditioned space to a non-conditioned space, apply insulating electrical putty inside conduit, at an accessible location, to prevent the entry of moisture.

C. Conduits and boxes installed in exterior walls shall not penetrate the vapor barrier.

D. Boxes installed on the building exterior shall have gasketed covers. All conduits entering box shall be sealed with insulating electrical putty.

3.6 CORROSION PROTECTION:

A. Corrosion protection for conduits passing through concrete slabs shall be by one of the following means:
   1. Field-wrap conduits with tape, using with a 50% overlay. Tape shall be premium 7-mil, flame retardant, weather resistant tape. Resists temperature and moisture for splicing. Meets requirements of *UL 510, HHI-595*, and *CSA 22.2*.
   2. Conduits shall have a factory-applied polyvinyl chloride, plastic resin, or epoxy coating.

B. All supporting materials installed exposed on the building exterior shall be hot-dipped galvanized after fabrication or provide an equivalent level of corrosion protection. Protect exterior raceway systems from damage while the building exterior is cleaned. Replace any portions of the system showing signs of rust at the time of final inspection.

3.7 GROUNDING:

A. Metallic raceway systems shall be made electrically continuous to provide a low impedance path to ground for faults, as required by the *NEC*.

3.8 RACEWAY BENDS:

A. Bend radius shall comply with the *NEC* and the requirements of the specific cabling system installed. For television and telephone service entrance conduits, consult with the local utility.

B. All field bends shall be made with a tool specifically intended for the purpose.

C. Tools using open flames are not acceptable for bending PVC conduit. Any section of conduit discolored or deformed in any way shall be cut out and replaced.

3.9 FLEXIBLE CONNECTIONS:

A. Final connections to light fixtures may be made using 3/8" diameter flexible metal conduit not exceeding 6’ in length.

B. 1/2" diameter flexible metallic conduit may be used to fish existing walls, within the limits of *NFPA 70*.

C. Final connections to motors and to other electrical equipment subject to movement and vibration shall be made using liquid-tight flexible metal conduit not more than 24" long.

3.10 SLEEVES:

A. Provide sleeves of the size and quantity required to install cabling systems specified under Division 23 and Division 27. Where multiple sleeves are required, install in a rectangular array.

B. Make and seal all penetrations to maintain fire rating of member penetrated. Pay particular attention to the annular space required around the inside and outside of the penetrating item. Sealing compounds shall be re-enterable type.

C. Coordinate the exact placement of sleeves with other trades to ensure they are readily accessible and are not obstructed by pipes, ductwork, etc.

D. Sleeves shall be flush with both sides of the member penetrated unless otherwise required by the through penetration firestop system selected.

3.11 RACEWAY LAYOUT:

A. Unless noted otherwise, the layout of all raceway systems is the responsibility of the Contractor.

B. Provide pull points as required by the *NEC* and ensure that all such points are readily accessible and not blocked by ducts, pipes, etc.

3.12 WALL OUTLET LAYOUT:

A. The location of devices shown on the drawings is schematic. Prior to roughing-in, review the architectural interior elevations and millwork shop drawings, to ensure that outlets will not be installed behind cabinets or otherwise inaccessible. Ensure that there is sufficient space from door jamb, cabinets, etc. to install without trimming device cover.

B. Outlets installed below countertops shall be centered in the knee space.

C. All outlets shall be installed vertically except where space above counter back splash and other features does not permit, and when installed in baseboards. In such cases, outlets shall be installed horizontally.

D. Maintain uniform spacing of outlets shown to be side-by-side on the plans. Spacing shall not exceed 2" in framed walls. For masonry walls, install outlets in adjacent cells.

E. Gang mount switches shown in the same location, unless noted otherwise. Provide metal barrier in boxes between switches, when switches are connected to opposite phases of systems exceeding 150V to ground.

F. Mark the branch circuit identification on the cover of all outlet boxes.

G. Provide separate outlet boxes and flexible final connections for fixtures provided with both normal and emergency power connections.

3.13 SUPPORTS:

A. Raceways:
   1. Support all components of the electrical raceway system using wood screws to wood; by toggle bolts on hollow masonry units; by concrete inserts or expansion bolts on concrete or brick; by machine screws, welded threaded studs, or spring-tension clamps on steel work.
   2. Support individual raceways with conduit straps or clips. Support multiple runs using trapeze-type hangers. Trapeze hangers shall consist of 1-1/2"x1-1/2" gage steel channels, 1/2" diameter threaded steel rods and conduit clamps. Attach rods to the building structure or to 1-1/2" x 1-1/2" gage steel channels span between adjacent structural members.
   3. Support conduits at distances required by the *National Electrical Code. Additional supports shall be provided at the points of tangency of all bends.*
   4. Joints in conduit systems shall coincide with point of support.
   5. Provide expansion joints in all raceway systems in either of the following conditions:
      a. In accordance with manufacturer's literature, based on length of run and temperature differential that will be encountered.
      b. When raceways cross expansion joints.

B. Outlet Boxes:
   1. Ceiling outlet boxes shall be supported by lightweight channel attached to structure with (2) 1/4" threaded rods and braced to prevent lateral movement. Boxes used to support ceiling paddle fans shall be listed for the purpose.
   2. Masonry walls:
      a. Install outlet boxes in sawcut openings.
      b. Outlet boxes shall be grouted in place, back and sides. There shall no reveals around the perimeter of the box.
   3. Framed walls:
      a. Non-rated walls - Outlet boxes shall be attached to intermediate horizontal supports between vertical framing members. *Do not attach boxes to vertical members*.
      b. Framed walls rated 1-hr or 2-hr, boxes 16 square inches or less - Compartmentalize each outlet box (top, bottom, and sides) using same material as wall framing. All penetrations in framing members shall be sealed. Where penetrations exceed 100 square inches per 100 square feet of wall space, install in accordance with subparagraph "c" below.
      c. Framed walls rated 1-hr or 2-hr, boxes exceeding 16 square inches - Compartmentalize boxes as specified above. Additionally, Boxes shall be covered back, top, bottom and all sides with drywall such that the rating is carried around the box. All penetrations in this envelope shall be sealed.
   4. Boxes shall not be installed in walls rated more than 2-hour.
   5. Do not install outlets back-to-back. Maintain 24" offset in rated walls and with no overlap in non-rated walls. Where groups of outlets are shown back-to-back, each group of outlets shall be shifted to accommodate the installation. *Exceptions: (1- Outlet boxes in non-rated masonry walls, may be installed back-to-back. Do not break webbing or connect boxes back-to-back. The use of thru-wall outlet boxes is not permitted. 2- The 24" offset may be eliminated in 1-hour and 2-hour walls when UL listed moldable putty is installed around box, in accordance with the UL Fire Resistance Directory.*)
   6. Outlet boxes mounted in STC rated walls shall be sealed in accordance with *Gypsum Association Document GA-600 Fire Resistance Design Manual, Sound Control*.

7. Cover of outlets installed flush mounted in walls shall be set back no more than 1/8" from face of wall.

3.14 ROUGH-IN FOR DIVISION 27 SYSTEMS AND USING AGENCY PROVIDED TELECOMMUNICATIONS SYSTEMS:

A. Provide all outlet and junction boxes, sleeves, and raceways to form an accessible pathway from each wall or floor mounted device, and ceiling mounted devices to the IDF or MDF or headend equipment location in which the cable terminates, as specified herein and as indicated on the drawings. Cable trays are specified in Section 261020.

B. Conduit sizes shall conform to the following:
   1. Voice / Data / Video outlet: 1"
   2. Voice / Data outlet: 1"
   3. Video outlet: 1"
   4. Fire alarm outlet: 3/4"
   5. Other: 3/4"

C. Raceways shall be labeled to the extent necessary to allow easy identification by the cable system installers.

D. Outlet box mounting height, cover type, and alignment shall be governed by Division 27.

E. Refer to Section 279010 for additional requirements. Pay particular attention to the requirement that the fire alarm system wiring shall be installed in a complete raceway system.

3.15 ROUGH-IN FOR DIVISION 23 CONTROL WIRING:

A. Provide outlet box and 3/4” conduit stubbed up to above accessible ceiling from each wall mounted device. Rough-in details shall be similar to that shown for Division 27 devices. Cabling support system above accessible ceilings for division 23 control wiring shall be supplied and installed by Division 23 contractor. In areas with exposed ceilings, such as mechanical rooms, provide complete conduit pathway to the associated control equipment.

3.16 ROUGH-IN FOR DIVISION 22 PLUMBING FIXTURE SENSORS:

A. Provide outlet boxes for sensors and transformers furnished with the plumbing fixtures. Provide 1/2" conduit from each sensor location to a point within 6" of transformer outlet box, and terminate with insulated throat bushing.

B. Provide wiring as described in the mechanical equipment connection schedule.

3.17 SPECIAL PROVISIONS FOR DEVICES INSTALLED IN MILLWORK:

A. The millwork shall be provided with openings to accommodate device outlet boxes.

B. Serve all “islands” from concealed stub up.

1. Power wiring within millwork may be flexible metallic conduit.
2. Low voltage cables for Division 27 systems are not required to be installed in raceway within the millwork as long as the cables are accessible.

3.18 ROUGH-IN AND CONNECTIONS FOR ELECTRONIC DOOR HARDWARE:

A. Provide raceways and 120V power connections as indicated on the drawings.

3.19 FIRESTOPPING:

A. Do not proceed with firestopping until the field demonstration has been conducted.

B. Seal all penetrations based on rating / element being penetrated. Penetrations in non-rated walls shall be rated 1–hour.

END OF SECTION 261010

SECTION 262010 - WIRES AND CABLES, 600V AND BELOW

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

1.2 SCOPE OF WORK:

A. The requirements of this section apply to the wire and cable work installed under this contract.

1.3 QUALITY ASSURANCE:

A. Acceptable Manufacturers: Provide wires and cables from manufacturers who have been in business for a minimum of five years.

B. Submittals: Refer to Section 260120 for requirements.

PART 2 - PRODUCTS

2.1 GENERAL:

A. Wires and cables manufactured more than 12 months prior to date of delivery to the site shall not be used.

B. Color Coding:
1. Color shall be **green** for grounding conductors and **green with yellow stripe** for isolated grounding conductors.
2. The color of the circuit conductors shall be as follows:

120/208 volt, 3-phase	Phase A - Black
	Phase B -Red
	Phase C - Blue
	Neutrals – White (with stripes as specified below)
277/480 volt, 3-phase:	Phase A - Brown
	Phase B - Orange
	Phase C - Yellow
	Neutrals – Gray (with stripes as specified below)

C. All conductors shall be 600V copper, with 75 C, THWN/THHN insulation. Minimum size shall be No. 12 AWG. Conductors within 3” of fixture ballasts shall be rated 90 C. Sizes up to No. 10 AWG may be stranded; sizes No. 8 AWG and larger shall be concentric-lay-stranded. All control conductors shall be concentric-lay-stranded.

D. Conductors used in flexible metal conduit and liquid-tight flexible metal conduit used for final connection to equipment shall be stranded.

PART 3 - EXECUTION

3.1 INSTALLATION GENERAL:

A. No more than (3) phase conductors, each of opposite phases for a three-phase WYE system, shall be combined in a single raceway without written permission from the Design Professional.

B. For each ungrounded conductor, provide a dedicated neutral conductor, with stripe color to match ungrounded conductor insulation color.

C. For each electrical connection/termination, provide a complete assembly of materials, including but not necessarily limited to, pressure connectors, terminals (lugs), electrical insulating tape, heat-shrinkable insulating tubing, cable ties, solderless wire nuts, and other materials necessary to complete splices and terminations. Torque all connections according to installation instructions.

D. Motor connections shall be made with compression connectors forming a bolted in-line or stub-type connection. Connections shall be insulated with *Raychem MCK* motor connection kit.

E. Splicing of feeder conductors shall not be acceptable, unless specifically indicated on the drawing. Where splicing of feeder conductors is indicated, splices shall be made using *Raychem RVS* splice kit and compression type butt splice

F. Numbers 10 and 12 AWG stranded conductors shall not be directly terminated to screw-type terminals. The use of *Stacon* type compression connectors is required.

G. All conductors shall be installed in raceways.

H. Make connections to wiring devices using "pigtails" within outlet boxes. *Direct connection (loop) to devices is not acceptable.*

3.2 DISTANCE LIMITATIONS FOR 20A BRANCH CIRCUITS:

A. All 120-volt, 20-amp branch circuits exceeding 90’ in length shall consist of No. 10 AWG circuit conductors. Increase conduit size accordingly.

B. All 277-volt, 20-amp branch circuits exceeding 150’ in length shall consist of No. 10 AWG circuit conductors. Increase conduit size accordingly.

END OF SECTION 262010

SECTION 262020 - WIRING DEVICES

PART 1 -GENERAL

1.1 RELATED DOCUMENTS:

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

1.2 SCOPE OF WORK:

A. The requirements of this section apply to all wiring devices installed under this contract.

1.3 QUALITY ASSURANCE:

A. Acceptable Manufacturers:
   1. Provide devices by manufacturers listed for each item.

B. Occupancy/Vacancy sensor catalog numbers and locations shown on plans and specifications are for representation purposes only. Exact models and mounting locations shall be provided by sensor manufacturer. System drawings including device layout, device type, and wiring details shall be submitted for review in shop drawing phase prior to ordering. **All sensors shall be dual technology.**

C. Submittals: Refer to Section 260120 for requirements.

PART 2 - PRODUCTS

2.1 GENERAL:

A. Provide factory-fabricated wiring devices, in type, color and electrical rating for the service indicated. Where type and grade are not indicated, provide proper selection as determined by Installer to fulfill the wiring requirements, and complying with *NEC* and *NEMA* standards for wiring devices.

B. Device colors shall be selected by the Design Professional on an area-by-area basis.

2.2 GENERAL USE RECEPTACLES:

A. Standard (Heavy-Duty Specification Grade): *Hubbell 5362*, *Arrow Hart/Eaton 5362*, or *Pass & Seymour 5362*.

B. Tamper Resistant (Heavy-Duty Specification Grade): *Hubbell 5362TR*, *Arrow Hart/Eaton TR5362*, or *Pass & Seymour TR5362*.

C. Ground-Fault Receptacles (Heavy-Duty Auto Grounding): *Hubbell GF20LA*, *Arrow Hart/Eaton SGF20*, or *Pass & Seymour 2095S*.

D. Receptacles shall be 2-pole, 3-wire, grounding type, rated 20A/125V.

E. Provide weather resistant receptacles in all outdoor locations.

2.3 SPECIAL PURPOSE RECEPTACLES:

A. Provide heavy-duty type of the *NEMA* configuration indicated on the drawings, as manufactured by *Hubbell*, *Arrow Hart*, or *Pass & Seymour*.

2.4 SWITCHES:

A. Toggle (Industrial Extra Heavy-Duty Specification Grade): *Hubbell HBL1221*, *Arrow Hart AH1221*, or *Pass & Seymour PS20AC1*. Provide single-pole, three-way and four-way switches as indicated. Catalog numbers listed herein are for single pole units. Other configurations shall be from the same product family.

B. Keyed: Key switches shall be rated same as toggle switches but shall have cylindrical locking mechanism. *Fork-type keys are not acceptable*. Provide [6] keys to the Owner at the time of final inspection.

C. Switches installed adjacent to dimmers shall be of the same type and style as dimmer.

D. Narrow-body switches for installation in door-jambs shall not be used.

E. Switches shall have ground screw.

2.5 LIGHTING DIGITAL ROOM CONTROLLERS:

1. Basis of Design Product: *WattStopper LMRC-210*. Other acceptable manufacturers include *Hubbell*, *Lithonia*, and *Greengate*.

2. Device shall have enough 0-10V dimming outputs as indicated on contract drawings for quantity of dimming zones of control.

3. Minimum Features Shall Include:
   a. Single-phase, multi-voltage 120/277VAC operation.
   b. Maximum 20A combined load per room controller.
   c. Class 2 dimming control signal 0-10VDC
   d. Class 2 output to digital lighting management (DLM) local network: 24VDC, up to 250mA across 4 RJ45 ports.
   e. DLM local network parameters: Category 5e cable and up to 48 communicating devices.
   f. UL listed.

2.6 WALL CONTROL STATIONS FOR USE WITH ROOM CONTROLLERS:

A. Basis of Design Product: *WattStopper LMSW-104* 4-Button Wall Switch with dimming control. Other acceptable manufacturer's include *Hubbell*, *Lithonia*, and *Greengate*.

B. Minimum Features Shall Include:
   1. On/Off and continuous dimming functionality.
   2. 4-Button arrangement shall be on/raise/lower/off.
   3. Connectivity with other digital lighting management control devices with free-topology Category 5e network cabling.
   4. Provide decorator style face plates in accordance with wiring device accessories specified in section 2.11.

2.7 OCCUPANCY/VACANCY SENSORS:

A. Corner Mounted: Dual technology (Ultrasonic & Infrared), ceiling or wall bracket mounted. Select based on size of space. Provide power pack and mounting hardware; suitable for switching 120 and/or 277 volt loads. *WattStopper DT-200* series, *Hubbell LODT* series, or equivalent by *Greengate* or *Sensor Switch*.

B. Ceiling Mounted: Dual technology (Ultrasonic & Infrared), ceiling mounted. Select based on size of space. Provide power pack and mounting hardware; suitable for switching 120 and/or 277 volt loads. *WattStopper DT-300* series, *Hubbell OMNIDT* series, or equivalent by *Cooper* or *Sensor Switch*.

C. Wall Mounted: Dual technology (Ultrasonic & Infrared), wall bracket mounted. Select based on size of space. Suitable for switching 120 and/or 277 volt loads. *WattStopper DW-100* series, *Hubbell LHMTS1* series, or equivalent by *Cooper* or *Sensor Switch*. Device shall be installed with the factory default manual-on mode.

D. Dimming Wall Switch Occupancy Sensors: Dual Technology *WattStopper DW-311* series, or equivalent suitable for switching 120- or 277-volt loads. Available switching schemes on device shall be Manual-ON, Auto-ON to 50%, 75%, and 100%. Default setting is to Manual-ON. Owner may request Auto-On to 50% function to be set after installation. Contractor shall be responsible for making this change to the operational setting.

E. The triggering of only one technology shall keep the fixtures on.

F. Power packs for sensors shall be rated for control of fractional horsepower motor loads in conjunction with the respective lighting load. Low-voltage multi-conductor cable between sensors and power packs shall be plenum rated, 22 AWG. Power pack shall have field selectable auto-on or manual-on mode. Basis of design: *WattStopper BZ-150*, or equivalent. ***Contractor shall set power pack function to manual-on for all spaces not defined as life safety egress by the Design Professional's Life Safety Plan.***

G. Provide low voltage momentary pushbutton switch(es) for manual control in configuration shown on plans. Multiple switching zones shall be grouped in the least number of multi-pushbutton switches possible.

H. Provide auxiliary contacts in sensors where shown on the project drawings, or as otherwise required for the functionality specified in the particular building space.

I. Daylight sensors shall be of the same manufacturer as lighting control power pack as to ensure compatibility. Daylight sensors intended for use with digital room management systems shall be fully compatible with other digital room management lighting control components (i.e., same manufacturer and series).

J. Dual technology occupancy sensors intended for use with digital room management systems shall be fully compatible with other digital room management lighting control components. Basis of design product: *WattStopper LMDC-100* (Ceiling Mounted) and *WattStopper LMDX-100* (Corner Mounted), or prior approved equals by list of accepted manufacturers in lighting digital room controller portion of this specification section.

2.8 WIRING DEVICE ACCESSORIES:

A. Wall Plates: Provide one piece wall plates for wiring devices, with ganging and cutouts as indicated. Provide blank plates for all unused outlet boxes. Provide with metal screws for securing plates to devices, screw heads colored to match finish of plate, and wall plates possessing the following additional construction features:

1. Material and Finish: Type 302 stainless steel in finished spaces and stamped steel in unfinished spaces.
2. Wall plates for surface raceway boxes shall be of the same width as the surface raceway boxes.
3. All plates shall be mid-size size.

B. Weatherproof Covers: All devices installed outdoors shall be provided with weather proof covers. Covers shall be *Intermatic* die-cast WP series (or equivalent), single or two gang type. The assembly shall be *UL* listed for wet locations, when in use.

PART 3 - EXECUTION

3.1 INSTALLATION OF WIRING DEVICES:

A. General:
1. Devices of the same type shown side-by-side shall be gang-mounted and installed under a common plate unless specifically noted.
2. Do not install receptacles within 6" of the edge of sinks.
3. Provide weatherproof covers for all devices installed outdoors.
4. All receptacles installed outdoors, all kitchen receptacles, and receptacles within 6’ of sinks and other interior receptacles specifically indicated shall be GFCI type.
5. All receptacles installed outdoors shall be weather resistant GFCI type.
6. Coordinate location of electric water cooler receptacles with cooler manufacturer’s recommendations.
7. All receptacles installed in patient care areas shall be hospital grade.
8. All receptacles installed in the following locations shall be tamper-resistant type:
   a. Dwelling units, dormitories, guest rooms and guest suites of hotels and motels.
   b. Child care facilities.
   c. Preschools and elementary education facilities.
   d. Business offices, corridors, waiting rooms and the like in clinics, medical and dental

offices and outpatient facilities.

e. Subsets of assembly occupancies described in *NEC 518.2* to include places of waiting transportation, gymnasiums, skating rinks, and auditoriums.

B. Connections:
   1. Make connections to side terminals only. Wrap side of device with two complete turns of 600V electrical tape, to cover the exposed terminals.
   2. See Section 262010 for conductor requirements.

C. Labeling:
   1. Provide engraved device plates where indicated. Use 1/8" high black letters.
   2. Device plates for receptacles in patient care areas shall have circuit designation engraved in 1/8" high black letters.
   3. Mark the branch circuit to which the device is connected on the back of each device plate, using an indelible marker pen.

3.2 DIMMERS:

A. In multi-circuit homeruns, provide separate neutrals for each circuit. Do not use a common neutral.

3.3 OCCUPANCY/VACANCY SENSORS:

A. Corner mounted sensors shall be ceiling bracket mounted where ceiling is present and no higher than 12’ AFF. Where space has no ceiling or ceiling is higher than 12’ AFF, the corner mounted sensor shall be mounted 10’ AFF on a manufacturer-supplied wall bracket.

B. Sensors shall be installed in locations shown on manufacturer submitted shop drawings.

C. Connect low voltage momentary switch(es) to sensor power-pack to achieve manual-on/automatic-off operation in the configuration shown on plans. Switch(es) shall allow manual-off operation as well.

D. Wall mounted sensors shall also be configured to operate manual-on/automatic-off, in configuration shown on plans.

E. Low-voltage sensor cable shall be supported by j-hooks attached to structural members, and shall be run at right angles with respect to building structure.

F. Adjust time-off delay to a minimum of fifteen minutes

G. Test all sensors to ensure that they are operating properly.

H. Prior to project closeout, the Manufacturer and/or his designated Representative shall test and adjust **ALL** occupancy sensors on a space-by-space basis. Adequate personnel shall be provided to perform this work in a timely fashion. Delay times shall be coordinated with the Owner’s Representative. Sensor sensitivities shall be adjusted as necessary for optimum performance and to minimize false activations from movement in adjacent spaces. If optimum performance of occupancy sensors cannot be achieved with installed device quantities and locations, adjustments to the quantity and/or location of the occupancy sensors

shall be performed at no additional cost to the Owner. Retest and adjust occupancy sensors as appropriate. At the conclusion of commissioning, the Manufacturer and/or his Designated Representative shall submit a comprehensive and detailed testing report as part of the as-built submittal package. Changes to the original manufacturer's layout submitted as part of the Division 26 submittal package shall be annotated on the as-built layout drawings.

3.4 TESTING:

A. Test all devices to ensure proper polarity and grounding.

3.5 PROTECTION:

A. If painting and other finish work occurs after device installation, protect device and conductors by installing and maintaining temporary cover:

END OF SECTION 262020

SECTION 262021 - SAFETY AND DISCONNECT SWITCHES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

1.2 SCOPE OF WORK:

A. The requirements of this section apply to all safety and disconnect switches installed under this contract.

1.3 QUALITY ASSURANCE:

A. Manufacturers: Provide products produced by one of the following (for each type of switch):
   1. General Electric Company
   2. Square D Company
   3. Cutler Hammer
   4. Siemens

B. Submittals: Refer to Section 260120 for requirements.

PART 2 - PRODUCTS

2.1 SAFETY AND DISCONNECT SWITCHES:

A. Switches shall be 600V heavy duty type, sheet steel enclosed safety switches, incorporating quick-break type switches, constructed so switch blades are visible in "OFF" position with the door open. Switches shall be equipped with operating handles which are an integral part of the enclosure base and whose positions are easily recognizable. Switches shall be pad-lockable in the "OFF" position. All current carrying parts shall be constructed of high-conductivity copper and silver-tungsten type switch contact. All switches shall be UL listed. Switches shall have engraved plastic nameplates indicating the load served, load rating and the branch circuit number.

   Example – (not actual disconnect on project): HP-1
   35.5A, 1ph, 208V
   Fed from HA-2

B. Switches shall be non-fused type unless indicated otherwise or unless required by the manufacturer of the driven equipment. Where fuses are required, provide fuses of the type recommended by the equipment manufacturer.

C. Where an equipment nameplate has a listed SSCR lower than the available fault current of the electrical system at the point of distribution from the panelboard serving that piece of equipment, The safety switch shall be fusible type installed with current-limiting time-delay fuses. *It is the responsibility of the electrical contractor to coordinate the peak and RMS let-through current of the actual fuse being installed to ensure the potential fault current is smaller than the listed SSCR value.*

D. **Nameplates shall be screwed and glued to the enclosure.**

E. Enclosures: NEMA 1 general purpose enclosures indoors, NEMA 3R enclosures where noted or shown on drawings or exposed to weather.

2.2 MOTOR RATED SWITCHES:

A. Switches shall be toggle-type, without overload protection, rated for the applied voltage and motor load.

B. Provide metallic coverplate that will allow the switch handle to be secured in either the ON or OFF position with a padlock.

C. Label same as specified for disconnect switches, except install label on wall adjacent to switch.

2.3 ARC FLASH WARNING LABELS:

A. All safety and disconnect switches shall have arc flash warning labels field affixed to their enclosures that comply with the requirements of NFPA 70 and NFPA 70E.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Coordinate safety and disconnect switch installation with surrounding equipment to provide clearance and workspace based on the voltage encountered, and to insure that the switch is within sight of the controller or driven equipment.

B. Group and lace conductors within enclosure with nylon tie straps.

C. **Location of safety switches shall be coordinated with the equipment installer.** Do not proceed with rough-in until location has been established.

D. All switches associated with outdoor equipment shall be located as close to the equipment as possible (when equipment is in a service yard, switches shall also be in the service yard) and mounted such that the top of the switch is no more than 3'-0" above grade. All switches associated with equipment mounted above a lay-in ceiling shall also be located above the lay-in ceiling.

3.2 SPARE PARTS:

A. Provide 6 spare fuses of each type used.

B. Equipment listed above shall be turned over to Owner.

END OF SECTION 262021

SECTION 262030 - LIGHTING FIXTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

1.2 DESCRIPTION:

A. This section of the specifications is applicable to all lighting fixtures and fixture accessories.

B. Fixtures shall be furnished with drivers installed.

1.3 QUALITY ASSURANCE:

A. Acceptable Manufacturer's:
   1. Lighting fixtures - see fixture schedule on drawings.

B. Submittals: Refer to Paragraph 3.05 and Section 260120.

PART 2 - PRODUCTS

2.1 LIGHTING FIXTURES:

A. Provide lighting fixture assemblies complete with all hardware and accessories needed to install and connect, as indicated on the drawings and this section of the specifications.

B. The Contractor shall select the voltage and frame type based on the use shown, on an area-by-area basis. These modifiers are not included in catalog numbers. (i.e. A given fixture may be required for use on more than one voltage. Determine voltage by circuit to which fixture is connected.)

C. Any fixtures that are defective or damaged shall be replaced with new. This includes, but is not limited to scratches, dents, inconsistent finishes, etc. The Design Professional's opinion shall be final in making the determination.

2.2 LED LAMPS AND FIXTURES:

A. General:
   1. LED lamps and driver shall have a 5-year warranty or longer.
   2. LED fixtures shall have minimum rated life of 50,000 hours or longer per LM 80 and LM 70 standards.
   3. Replacement lamps shall have minimum efficiency of 70 lm / W per LM 79 testing.

4. Integral LED lamps shall have minimum efficiency of 90 lm / W per LM 79 testing.
5. Refer to light fixture schedule on drawings for color temperature.
6. Provide minimum Color Rendering Index, CRI, of 80.

2.3 DRIVERS:

A. General:
   1. Provide the number of drivers in each fixture to achieve the switching operations indicated. Drivers shall serve only the LEDs within the same fixture; master / slave wiring is not acceptable. This does not preclude the sharing of drivers for fixtures installed in continuous rows.
   2. Drivers shall have a minimum starting temperature of 0 F and be rated for a maximum ambient temperature of 105 F.
   3. Drivers shall have a 5-year warranty and shall include replacement driver assembly and reasonable replacement labor costs.

2.4 EMERGENCY DRIVERS:

A. Fixtures shown to have integral backup power shall be provided with emergency type battery packs conforming to the following:
   1. LED Emergency drivers shall be *IOTA ILB-CP10* or equal by *Bodine*. LED emergency driver shall provide a minimum of 10W of power through constant power technology for 90 minutes. Driver shall have a 5-year warranty.

B. Emergency drivers shall be factory installed.

C. Drivers installed in fixtures located outdoors or unheated spaces shall be suitable for the ambient temperatures encountered.

2.5 FRAMES AND HOUSINGS:

A. Fixture catalog numbers indicate style of fixture required. Provide fixtures with proper frames for ceiling types indicated on the reflected ceiling plan.

B. Fixtures installed in inaccessible ceilings shall be *UL* approved for through wiring and all components shall be accessible from below.

2.6 PENDANT MOUNTED FIXTURES:

A. Provide fixtures of lengths indicated.

B. Provide all suspension assemblies, canopies and accessories required for complete installation.

C. Linear type fixtures shall be supported at all points with stainless steel aircraft cable or rigid stems, as indicated.
   1. General:
      a. Provide only one feed point per row of fixtures, unless separate emergency power connection is required.

b. Provide supports at every fixture junction and terminus and as stipulated by the manufacturer.

2. Aircraft cable:
   a. Provide manufacturer's stainless steel aircraft cable assembly with canopy, for the specific fixture series.
   b. Provide non-coiled cable securely attached to aircraft cable at feed points.
3. Rigid stems:
   a. Provide manufacturer's stem-canopy for the specific fixture series.

D. Circular type fixtures shall be provided with suspension assemblies specified for each fixture type.

E. Installation drawings shall be provided for each room, as specified in Section 260120. Show all points of support and feed locations.

F. Provide one pint of touch-up paint for each fixture type and color.

2.7 COLORS AND FINISHES:

A. The color / finish of all surface and pendant mounted fixtures and all suspension assemblies, canopies and accessories shall be selected by the Design Professional, from the manufacturer's premium color / finish group. Submittals shall include color charts of the colors / finishes available.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. General:
1. Do not use permanent fixtures to provide temporary construction lighting. No fixture shall be installed until the interior of the building is enclosed, conditioned, clean and free of dust.
2. Install lighting fixtures in accordance with the fixture manufacturer's written instructions
3. Fasten fixtures securely to the indicated structural support members of the building; and check to ensure that solid pendant fixtures are plumb.
4. Lay-in fixtures shall be supported independently of the suspended ceiling framing members by at least two tie wires located on opposite corners of each fixture.
5. Fixtures other than lay-in type shall be securely fastened in accordance with *NEC Article No. 410.36 (B)*.
6. Fixtures installed in rated ceilings shall comply with the *UL Fire Resistance Directory* for the ceiling design encountered.

B. Layout:
1. Locate fixtures as indicated on the reflected ceiling plans.

C. Recessed Fixtures:
1. It is anticipated that piping and ductwork systems will be installed prior to the installation of ceiling systems and lighting fixtures. Coordinate recess depth of fixtures, on an area-by-area basis, with other trades, to ensure that sufficient recess depth is maintained.
2. Maintain clearance from thermal insulation and combustible materials as required by the

NEC.

D. Pendant Mounted Fixtures:
   1. Install fixtures at the heights indicated on the reflected ceiling plans. Fixtures or rows of fixtures shall be true and level.
   2. Suspension assemblies shall be rigidly attached to the building structure. Suspension assemblies shall allow field adjustment of +/- 12".

E. Emergency fixtures:

   1. Where emergency fixtures with integral emergency drivers are shown to be switched, pull an unswitched phase conductor to emergency driver.
   2. Do not switch emergency fixtures connected to the emergency generator. Exception: Fixtures connected to dimming systems.
   3. Do not switch exit lights.

3.2 AIMING:

A. Aim adjustable fixtures to provide a uniform wash of the surface or area to be illuminated.

3.3 CLEANING:

A. Prior to final inspection, clean lighting fixtures in a manner recommended and approved by the manufacturer.

B. Replace any components that are damaged.

C. Specific attention is directed to the appearance of pendant mounted fixtures. Field touch-up of the finish will only be acceptable when:
   1. The level of damage to the finish does not require replacement of the product, in the sole opinion of the Design Professional.
      AND
   2. The Contractor ordered and took delivery of touch-up paint, as well as the manufacturer's recommendations on touch-up, at the time the product was ordered.
      AND
   3. The touch-up is acceptable to the Design Professional.

3.4 SPARE PARTS:

A. Provide 6 spare exit lights and 25' of associated raceway and conductors to connect to nearest un-switched lighting circuit. Spare signs shall be added in locations where the Authority Having Jurisdiction [State Fire Marshal] requires.

B. Provide 6 spare emergency drivers for linear fixtures. Spare drivers shall be installed in already placed fixtures where Authority Having Jurisdiction requires.

C. If spare equipment listed above are not needed for installation, turn over to Owner.

3.5 TESTING:

A. Test all fixtures for proper operation. Replace LEDs and drivers that are not working properly.

B. Test the emergency lighting system by opening the main circuit breaker serving the facility.
   1. Schedule the test with all trades to ensure the tests will not have adverse effects on other equipment and to make sure that other systems properly shut-down and restart.
   2. The test shall be conducted at night, in the presence of the Design Professional, Using Agency and State Fire Marshal.
   3. The assembled persons will walk the project to:
      a. Verify operation of equipment installed.
      b. Review lighting levels on an area-by-area basis.

END OF SECTION 262030

SECTION 262042 - PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

1.2 SCOPE OF WORK:

A. Provide panelboards as indicated on the drawings and as specified herein.

1.3 QUALITY ASSURANCE:

A. Manufacturers: Provide products by one of the following (for each type of panelboard and enclosure): *General Electric Company, Square D Co., Cutler Hammer, Siemens*.

B. Compliance / Labels:
   1. Equipment shall comply with the latest applicable standards of *NEMA PB-1* and *UL 67*.
   2. Where panelboards are used as service entrance equipment, they shall comply with all *NEC* and *UL* requirements for service entrance and a *UL* service entrance label shall be provided.

C. Submittals: Refer to Section 260120 for requirements.

PART 2 - PRODUCTS

2.1 ENCLOSURES:

A. Enclosure shall be constructed of code gauge steel constructed **without** knockouts. Provide manufacturer's standard light gray finish

B. Provide double hinged door with flush metal latch/lock on inner door. Inner door shall provide access to circuit breaker operating handles only, not to energized parts. Outer continuous piano hinged door shall be mounted to the panelboard box with factory screws and shall provide access to energized parts; metal latch/lock is not permissible on outer door. Both inner and outer doors shall open in same direction.

C. All locks shall be keyed alike.

D. Provide metal or *Lexan* interior circuit directory frame with card and clear plastic covering.

E. Panelboard enclosures shall be *NEMA 1* unless shown to be installed in damp or wet locations. In such locations, enclosures shall be *NEMA 3R* or *4X*.

2.2 CONSTRUCTION:

A. Provide dead-front safety type panelboards of either Power and Distribution type or Lighting and Appliance type as defined by the *NEC*.
   1. Power and Distribution type panelboards shall be a minimum of 32” wide by 9” deep and a maximum of 44” wide by 12" deep.
   2. Lighting and Appliance type panelboards shall be a maximum of 20” wide by 5-3/4” deep.

B. Panels shall be equipped with copper bus bars, **[**full-sized neutral bar**]**, **[**200% neutral bar**],** and an equipment ground bus. [Panels serving computer receptacles shall have a isolated ground bus in addition to the equipment ground bus.]

C. Each panel shall be equipped with main lugs or main breaker, as indicated.

D. Two section panels shall be through-feed type and shall be installed with cans abutting. *Cans and covers shall be of same size, for both sections.* Divide circuits as evenly between the two sections as possible.

E. Provide with laminated plastic nameplate engraved with name of panel, voltage, ampere rating/type fault current rating, date, and feeder origination. Nameplate shall be screwed and glued to panel. Nameplates shall be black in color with white lettering. Nameplates shall have beveled edges.

Example (not actual panel on project): Panelboard HA
277/480V, 3 phase, 4W
225A Main Lugs
14,000 AIC
Fed from SWBD
9/2019

2.3 CIRCUIT BREAKERS:

A. Provide bolt-in type, heavy duty, quick-make, quick-break, thermal, magnetic molded case circuit breakers. Multi-pole breakers shall be common trip, with a single handle.

B. Main circuit breakers shall be large frame type, individually mounted, connected directly to the bus. The use of back fed breakers is not acceptable.

C. Provisions for future breakers shall be fully bussed complete with all necessary mounting hardware.

D. Devices which achieve the level of fault protection indicated by means of "series" or "integrated" rating shall not be acceptable unless specifically indicated on the drawings.

E. Breakers serving HVAC equipment shall be HACR type.

F. Circuit breakers serving fire alarm equipment shall be provided with a lock tab, red in color.

G. Where the highest continuous current trip setting for which the actual overcurrent device installed in a circuit breaker is rated or can be adjusted is 1200 amps or higher,

provide an energy reducing maintenance switch with local status indicator.

2.4 BRANCH CIRCUIT IDENTIFICATION:

A. All panelboards shall have a legend permanently posted to their exterior frontal enclosure identifying phasing and the color scheme of all ungrounded conductors in accordance with *NFPA 70, Article 210.5*.

2.5 SPECIAL PROVISIONS FOR PANELBOARDS:

A. All breakers serving lighting loads shall be solenoid operated type. Breakers serving night lights, emergency battery packs and other non-lighting loads shall be standard type and shall not be controlled by this system.

B. The lighting loads in each panel shall be grouped

C. Provide factory representative start-up service.

D. Coordinate interface with EMCS, with Division 23 contractor.

2.6 SELECTIVE COORDINATION FOR EMERGENCY POWER SYSTEMS:

A. All emergency power system overcurrent devices shall be selectively coordinated with all supply-side overcurrent protective devices to comply with the requirements of *NFPA 70 Articles 700 and 701*.

B. The contractor shall furnish protective device coordination studies which shall be prepared by the equipment manufacturer. The studies shall be conducted under the supervision and approval of a Registered Professional Electrical Engineer or other qualified persons engaged primarily in the design, installation, or maintenance of electrical systems and skilled in performing and interpreting the power system studies. The Registered Professional Electrical Engineer or other qualified person shall be a full-time employee of the electrical power equipment manufacturer.

C. Protective Device Coordination Study:
   1. The results of the protective device coordination study shall be summarized in a final report and submitted with the shop drawings.
   2. The report shall include protective device time versus current coordination curves with associated one-line diagram identifying the plotted devices, tabulations of adjustable circuit breaker trip unit settings. Comments and recommendations for system improvements shall be provided where needed.
   3. Proposed protective device coordination time-current curves shall be graphically displayed on log-log scale paper.
   4. Include on each curve sheet a complete title and one-line diagram with legend identifying the specific portion of the system covered.
   5. Terminate device characteristic curves at a point reflecting maximum symmetrical or asymmetrical fault current to which device is exposed.
   6. Identify device associated with each curve by manufacturer type, function, and, if applicable, tap, time delay, and instantaneous settings recommended.

7. Provide adequate time margins between device characteristics such that selective operation is provided while providing proper protection.

D. All emergency power system and supply-side overcurrent protective devices to be selectively coordinated shall be adjustable trip type rather than thermal magnetic when required for coordination. Study results must be submitted and approved prior to ordering and installing any overcurrent protective devices.

E. Field Adjustment: Adjust protective device settings according to the recommended settings table provided by the coordination study.

2.7 WARNING LABELS:

A. All panelboards shall have arc flash warning labels field affixed to their enclosures that comply with the requirements of *NFPA 70* and *NFPA 70E*.

B. Where panelboards are used as service equipment, provide separate label to show the maximum available fault current. Label shall have blank fields to handwrite the calculated available fault current and the date calculated. After service is installed and ready to be inspected by the Authority Having Jurisdiction **[**Design Professional**]**, Contractor shall submit to the Electrical Engineer the fault calculation (at the service entrance only).

PART 3 - EXECUTION

3.1 GENERAL:

A. Provide circuit directory upon completion of work. Identify load served and location (by room name and number) assigned by user, not by room numbers on floor plans. Note spares and spaces as such. Create directory using electronic spreadsheet and print in 8-1/2"x11" format using as many pages as necessary. Fold and place in directory holder.

B. Do not splice conductors in panelboard enclosure.

C. Only one conductor shall be connected to each terminal or lug.

D. Connect circuits 1 and 2 to phase A; 3 and 4 to phase B; 5 and 6 to phase C., etc. Conductors shall be color coded in accordance with Section 262010.

E. Group and lace conductors within panel enclosure with nylon tie straps.

F. Each section of two section panels shall contain only those conductors which originate in that section. Do not use panel as a wireway.

3.2 GROUNDING:

A. Ground all panels in accordance with details on the drawings and Section 262080.

B. Do not bond neutral and equipment grounding conductors within panelboard unless panel is

used as service equipment or are a separately derived system.

3.3 ADJUST AND CLEAN:

A. Adjust operating mechanism for free mechanical movement.

B. Touch-up scratched or marred surfaces to match original finish.

C. Clean all debris from panel interiors.

D. Clearance and Workspace: Maintain workspace and clearances as required by the NEC for the voltage encountered. No pipes or ducts shall pass above the outline of the panelboard. It shall be the responsibility of this Contractor to make sure that other trades do not encroach on this space.

END OF SECTION 262042

SECTION 262080 - ELECTRICAL GROUNDING, 600V AND BELOW

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

1.2 DESCRIPTION OF WORK:

A. Provide grounding and bonding of systems and equipment as shown on the drawings, specified herein and as required by *Article 250* of the *NEC*.

B. The grounding electrode system shall consist of:
   1. Ground rods.
   2. Underground metal water supply pipe, outside the building.
   3. Concrete encased electrode

C. The following items shall be bonded to the grounding system:
   1. Structural steel frame of the building.
   2. Interior metal piping systems.
   3. Equipment enclosures.
   4. Device terminals.
   5. Equipment grounding conductors.
   6. Lightning protection system.

1.3 RELATED WORK:

A. Grounding and bonding for Lightning Protection Systems is specified in Section 265000.

1.4 QUALITY ASSURANCE:

A. Acceptable Manufacturers: Use products of manufacturer’s regularly engaged in the production of grounding systems products.

B. Standards: *IEEE Green Book - Grounding*.

C. Compliance / Labels: All materials shall be *UL* listed for grounding and bonding systems.

D. Submittals: Refer to Section 260120 for requirements.

PART 2 - PRODUCTS

2.1 GENERAL:

A. Where more than one type meets indicated requirements, selection is Installer's option. Where material or component is not otherwise indicated, provide products complying with *UL*, *NEC*, and established industry standards.

2.2 GROUND RODS:

A. Rods shall be 3/4" diameter x 10' long copper-clad steel.

2.3 CONDUCTORS:

A. Grounding Electrode conductors: Bare, stranded copper electrical grounding conductors, sized as shown. When no size is shown, select from *Table 250-66* of the *NEC*.

B. Bonding Jumper Braid: Copper braided type, sized for application.

C. Equipment Grounding conductors: Insulated, stranded copper electrical grounding conductors complying with Section 262010, sized as shown. When no size is shown, select from Table *250-122* of the *NEC*.

2.4 CONNECTORS:

A. Connectors to rod or reinforcing steel bar electrodes shall be exothermic weld type. The use of wire ties to make rebar continuous is not acceptable.

B. Connections to pipe electrodes shall be pressure or clamp type.

C. Connections to items specified to be bonded to the grounding system may be by any *UL* listed product suitable for the application.

2.5 CAUTION TAGS:

A. Tags shall be weatherproof, custom-printed plastic type, 3-1/4" wide x 5-5/8" high, with stainless steel eye and nylon self-locking tie.

B. Tags shall be two-sided and shall have yellow background with black letters. The word “CAUTION” shall be machine-printed in boldface type at the top, with the custom message machine-printed below.

C. Provide the number of tags required, plus six spares.

D. Tags shall be *Seton #12584*, or equivalent. (*Seton*: 1-800-243-6624)

PART 3 - EXECUTION

3.1 GENERAL:

A. Ensure that metal-to-metal contact is made between grounding connectors and painted or coated surfaces of equipment enclosures, piping systems, etc.

B. Where concrete penetration is necessary, non-metallic conduit shall be cast flush with the points of concrete entrance and exit so as to provide an opening for the ground wire and the opening shall be sealed with a suitable compound after installation of the ground wire.

C. Metallic raceway systems shall be made electrically continuous to provide a low impedance path to ground for faults, as required by the *NEC*.

3.2 GROUNDING ROD ELECTRODES:

A. Install ground rods in the approximate location shown. Drive (3), 10’ rods into the earth in a triangular pattern with the rods 10’ on center. Install rods such that the top of each rod is 8" below finished grade.

B. Install an enclosure for each ground rod, similar to a *Quasite* “*PC*” style, open bottom box, with nominal dimensions of 17" long x 11" wide x 12" deep. Box cover shall be locking type and have the logo “GROUND”.

C. The rod and exothermic connection to the grounding electrode conductor shall be accessible from within enclosure. Fill the lower 2" of enclosure with crushed rock. Top of enclosure shall be flush with finished grade.

D. Install boxes in accordance with the manufacturers’ instructions for the loading indicated. Note that full vehicular traffic rating requires the box to be encased in concrete and use of steel cover.

3.3 BUILDING PERIMETER GROUNDING ELECTRODE:

A. Make bottom rebar in concrete footing around the perimeter of the building electrically continuous. Ensure minimum of 2” of concrete encasement between earth and rebar. Ensure that the concrete footing is in direct contact with the earth. Where vapor barrier, insulation, films, or similar items are below footer, paragraph B below shall be followed instead.

3.4 UNDERGROUND METAL WATER PIPE ELECTRODE:

A. Make connection to “street” side of water meter.

B. Install braided type bonding jumper between “street” side and “house” side piping such that removal of water meter will not interrupt ground path.

C. The connection shall be accessible.

3.5 EQUIPMENT GROUNDING CONDUCTORS:

A. Install an equipment grounding conductor in all branch circuit and feeder raceways, sized in

accordance with *Article 250* of *NFPA 70*.

3.6 BONDING:

A. Bond the structural steel frame of the building to the service equipment ground bus. The connection shall be accessible.

B. Bond column anchor bolts of structural steel building to building perimeter grounding electrode no less than every 100'.

C. Multiple buildings present under one electric service shall be bonded.

D. Bond each dry type transformer to nearest accessible structural steel member if present. Otherwise to nearest metallic water pipe.

E. Bond interior metal piping systems to the service equipment ground bus. The connections shall be accessible.

F. Bond metallic equipment enclosures to a lug installed within the enclosure, which is connected to an equipment grounding conductor.

G. Bond standard device grounding terminals to metallic outlet box and to equipment grounding conductor.

H. Bond equipment grounding conductor to metallic boxes where splices are made.

3.7 BONDING BUSHINGS AND LOCKNUTS:

A. Bushings and locknuts shall be required:
   1. Service entrance conduit stub-ups. Interconnect with No. **1/0** AWG (bare) and bond to ground bus in the service equipment.
   2. When required by the *NEC* for voltages in excess of 250V. Bonding conductor shall be sized per the *NEC*.
   3. When terminating conduits in concentric or eccentric knockouts. Bonding conductor shall be sized per the *NEC*.
   4. For all connectors that are **not** *UL* listed as suitable for grounding.

B. Bushings shall be connected to the respective enclosure by an equipment grounding conductor sized in accordance with *Article 250* of the *NEC*.

3.8 LABELING:

A. Provide a waterproof "CAUTION" tag at the point of connection to each grounding electrode, which reads: "ELECTRICAL SYSTEM GROUNDING ELECTRODE - DO NOT REMOVE THIS CONNECTION. NOTIFY BUILDING MANAGEMENT IF DAMAGED OR DISCONNECTED."

B. Provide a "CAUTION" tag as specified above within the electrical service equipment where the grounding electrode conductor is terminated.

3.9 TESTING:

A. Upon completion of installation of electrical grounding system, test resistance of each ground rod installation using the "Fall of Potential" method. Ground resistance shall be measured in normally dry conditions not less than 48 hours after rainfall. Where tests show resistance to ground is over (25) ohms, take appropriate action to reduce resistance to (25) ohms or less by driving additional sections of ground rods and/or by chemically treating soil encircling ground rod; then retest to demonstrate compliance. Provide forms to record the data as the tests are conducted. Forms shall be signed by the person conducting the test.

END OF SECTION 262080

SECTION 266011 - EMERGENCY POWER SYSTEM - NATURAL GAS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

B. Refer to Section 262042 and 262043 for information on the required selective coordination for emergency power system overcurrent devices. The coordination study is a requirement of *NFPA 70 Articles 700 and 701*.

1.2 SCOPE OF WORK:

A. The Emergency Power Systems shall provide alternate AC power source for designated loads in the event there is an interruption of normal utility power. When required, the units shall automatically transfer the full rated load from the normal power source to the standby emergency generator. Upon return of normal power, the loads shall be automatically transferred back to the normal power source and the emergency generator shall automatically shut off, after a cool down period.

B. The extent of Emergency Power Systems (EPS) work is indicated by drawings and by the requirements of this Section. Provide a complete automatically operated electric generating set of the size, type and operating characteristics described hereinafter, completely installed, tested and operative. All equipment, labor, and materials necessary to accomplish this end shall be included, and the coordination of all required equipment and material shall be the responsibility of one manufacturer, who has an approved experience record in furnishing similar equipment.

1.3 QUALITY ASSURANCE:

A. Manufacturers: The following manufacturers are acceptable provided they meet all requirements of the specifications: *Onan/Cummings, MTU Onsite Energy (Detroit Diesel), Generac, Caterpillar.*

B. Geographic Location: The installation / service center shall be located within (75) miles.

C. Requirements:
1. The installation / service center shall be factory authorized and shall be certified in writing by the manufacturer as being responsible for installation and warranty work and shall be capable of performing work on the engine, generator, battery charger, fuel system, automatic transfer switch and all accessories which make up the complete emergency power system.
2. The installation / service center shall provide on-site service within (4) hours of receipt of service request.
3. The installation / service center shall maintain adequate levels of repair parts inventory.

D. Compliance / Labels:
   1. *NFPA 110-199__* for Type __, Class __, Level __ service. Where a conflict between this document and *NFPA 110* should arise, *NFPA 110* shall govern.
   2. Manufacturer Testing:
      a. Design prototype testing - Shall be performed on similar models of the unit furnished on this project.
      b. Final production testing of the engine/generator and automatic transfer switch - provide certified test reports.
      c. Field testing, by manufacturer's local representative.

1.4 SERVICE / MAINTENANCE AGREEMENT:

A. The ***engine / generator supplier*** shall provide a service / maintenance contract covering one year of operation, from the date of Substantial Completion. There shall be no deductible costs, or other costs, to the Owner for these services. All costs shall be included in the bid for this project. ***The agreement shall be made in the name of the Owner***. The service / maintenance agreement applies to the following items of equipment:
   1. Engine-Generator Set.
   2. Automatic Transfer Switch.

B. The ***Maintenance agreement*** shall include the following and shall include services per the equipment manufacturer's applicable instruction manual:
   1. Lube, oil, and filter change
   2. Fuel filter change
   3. Engine tune-up with parts
   4. Service/replace air cleaner
   5. Check coolant level
   6. Test anti-freeze and adj.
   7. Inspect cooling system hoses
   8. Service/replace belts as required
   9. Check engine heater operation
   10. Check generator set for fuel, oil, and coolant leaks
   11. Check air intakes and outlets
   12. Drain exhaust line
   13. Inspect silencer
   14. Check battery charger operation and charge rate
   15. Check battery electrolyte levels and specific gravity
   16. Emergency system operation with load applied for one hour period
   17. Frequency check/governor adj.
   18. Check transfer switch and accessory operation
   19. Check engine alternator charge rate
   20. Check engine-generator gauge and indicator operation
   21. Check generator set controller operation including shutdown functions and emergency stop
   22. Check generator output voltage and adjust as necessary

C. Maintenance shall be performed at intervals stated in equipment manufacturer's applicable instruction manuals except that the minimum service visits shall be four per year, and they shall be in Jan., Apr., July, and Oct.

D. Maintenance shall be performed near the middle of the month during the owners normal working hours. Arrangements will be made with the owner prior to each service call to secure access to the equipment.

E. The servicing agent will supply labor, supplies, parts and test equipment, as necessary to perform the service and preventative maintenance, at no additional cost.

F. ***The service agreement*** shall include labor, supplies and replacement parts to restore the system to operating condition, ***whether due to normal wear and tear or defects in workmanship or materials.*** Response to ***service*** calls shall be made within (4) hours.

G. Owner will maintain a regular recommended service procedure as recommended by the servicing agent. A record of these maintenance procedures will be maintained for reference.

H. The servicing agent shall maintain a complete service history and necessary drawings and service procedure data for reference in service of the equipment. The agreement does not include any expense to repair damage caused by abuse, accident, theft, acts of a third person, forces of nature, alteration of equipment, or improper operation. The servicing agent shall maintain a representative stock of replacement parts for the complete emergency system and a competent factory-trained service organization.

I. After each inspection, the owner will be furnished a written report detailing any conditions found and advising further service required, if any, to assure operating dependability of the equipment under contract.

1.5 COMPREHENSIVE WARRANTY:

A. The standby electric generating system components, complete genset and instrumentation panel shall be warranted by the manufacturer against defective materials and factory workmanship for a period of five (5) years. Such defective parts shall be repaired or replaced at the manufacturer's option, free of charge for parts, labor and travel. The warranty period shall commence when the standby power system is first placed into service. Multiple warranties for individual components (engine, alternator, controls, etc.) will not be acceptable. Satisfactory warranty documents must be provided. Also, in the judgment of the specifying authority, the manufacturer supplying the warranty for the complete system must have the necessary financial strength and technical expertise with all components supplied to provide adequate warranty support.

1.6 SUBMITTALS:

A. Refer to Section 26 0120 for requirements.

PART 2 - PRODUCTS

2.1 GENERAL:

A. The system shall have the following characteristics:
   1. 100 kva @ 0.8PF for Continuous Standby Service; based on use in outdoor.
   2. 3-phase, 4-W, 480/277 Volts.
   3. Provide monitoring and controls necessary to achieve the following sequence of operation:
      a. Transfer the emergency system load within the (10) second interval required by *NFPA 110*.
      b. After the emergency load has been stabilized, transfer the optional standby load. Time delay shall be field selectable, (1)-(5) minutes. Set for (1) minute.
      c. The emergency system loads shall take precedence over all other loads. An overload condition shall dump loads on the optional load standby system.

2.2 ENGINE:

A. General:
   1. 1800 RPM.
   2. Design: __- cylinder, __-cycle, water cooled, naturally aspirated.
   3. Bore: ___" Stroke: ___"
   4. Piston displacement: ___ cubic inches.
   5. Valves: __ per cylinder, single springs
   6. Crankshaft: Forged steel, counterweight-type.
   7. Connecting Rods: Forged steel with I-beam design.
   8. Compression ratio: _____
   9. Starting: 24V negative ground
   10. Cranking current: ___ amps at ambient temperature of 32 F.
   11. ___A battery charging alternator.
   12. Cylinder block: Cast Iron.
   13. 40A battery charging alternator.
   14. Fuel System: Fueled by natural gas and supplied with a unit-mounted electric solenoid fuel shut-off valve, flexible fuel line and secondary fuel pressure regulator.
   15. Isochronous governor capable of +0.25% steady-state frequency regulation.
   16. Air Cleaner: Dry element with restriction indicator.
   17. Lube Oil Capacity: 12 US Quarts, API CD 15W-40
   18. Lube Oil Filter: Single spin-on, full flow.
   19. Positive displacement, full pressure lubrication oil pump, cartridge oil filters, dipstick, and oil drain.
   20. Cooling system: High ambient 122 F unit mounted radiator, blower fan, water pump and thermostat.

2.3 GENERATOR:

A. Salient-pole, brushless, 12 lead reconnectible type; self-ventilated, drip proof housing; amortisseur rotor windings and skewed for smooth voltage waveform. *NEMA Class H* insulation with fungus-resistant epoxy varnish.

B. Brushless excitation system controlled by solid-state, anti-tracking voltage regulator capable of maintaining +/- 2% for any constant load from 0 to 100% of rating. Provide individual adjustments for voltage range, stability, and volts/hertz operations.

C. Voltage dip not to exceed 20% with one-second recovery within 2% of rated voltage, for one-step loads 0 to 90% of rating.

D. Shall sustain at least 250% rated current for minimum of 10 seconds, based on a 3-phase symmetrical fault.

E. Integral thermal-magnetic circuit breaker on output, coordinated not to trip under the conditions described above.

2.4 CONTROLLER:

A. Set-mounted, microprocessor-based, with vibration isolation. Modular construction to allow field replacement and for field testing without starting the generator. Controller shall include:
   1. Fused DC circuit.
   2. Complete two-wire start/stop control which shall operate on closure of remote contact device(s).
   3. Speed sensing and a second independent starter motor disengagement systems shall protect against starter engagement with a moving flywheel. Battery charging alternator voltage will not be acceptable for this purpose.
   4. The starting system shall be designed for restarting in the event of a false engine start, by permitting the engine to completely stop and then re-engage the starter.
   5. Cranking cycler with (15)-second ON and OFF cranking periods. Crank control shall provide at least two cranking periods. Each cranking attempts shall be separated by appropriate rest periods. A sensing device shall automatically disconnect the starting circuit when the engine has started. If the engine has not started at completion of the starting program, the over cranking signal shall so indicate. The engine starting controls shall be locked out and no further starting controls shall be locked out and no further starting attempts shall take place until the overcranking device has been manually reset. A selector switch shall be incorporated in the automatic engine start and stop controls. It shall include an "off" position that prevents manual or automatic starting of the engine; a "manual" or "hand crank" position that permits the engine to be started manually by the pushbutton on the control cabinet and an "automatic" position which readies the system for automatic start or stop on demand of the control system.
   6. Over crank protection designed to open the cranking circuit after (75) seconds if the engine fails to start.
   7. Circuitry to shut down the engine when signal for high coolant temperature, low oil pressure, or overspeed are received.
   8. Engine cooldown timer factory set at (5) minutes to permit unloaded running of the standby set after transfer of the load to normal.
   9. Three-position (Automatic-OFF-TEST) selector switch. In the TEST position, the engine shall start and run regardless of the position of the remote starting contacts. In the Automatic position, the engine shall start when contact in the remote-control circuit close and stop 5 minutes after this contacts open. In the OFF position, the engine shall not start even though the remote start contacts close. This position shall also provide for immediate shutdown in case of an emergency. Rest of any fault shall also be accomplished by putting the switch to OFF position.
   10. Indicating Lights to Signal:
      a. Auxiliary Pre-alarm (Yellow)
      b. Auxiliary Safety Shutdown (Red)
      c. Switch “OFF” (Flashing Red)

d. Over Crank (Red)
e. Emergency Stop (Red)
f. High Water Temperature (Red)
g. Over Speed (Red)
h. Low Oil Pressure (Red)
i. Battery Charger Fault (Red)
j. Low Battery Voltage (Red)
k. Low Fuel (Red)
l. System Ready (Green)
m. Anti-High-Water Temperature (Yellow)
n. Anti-Low-Oil Pressure (Yellow)
o. Low Coolant Temperature (Red)

11. Test button for indicating lights.
12. Alarm Horn with silencer switch per *NFPA 110*.
13. Terminals shall be provided for each signal listed above, plus additional terminals for common fault and common prealarm.
14. Generator controllers shall be monitored by the fire alarm system for the following conditions:
    a. Generator running
    b. Generator fault
    c. Generator switches in non-automatic position.

2.5 INSTRUMENT PANEL:

A. The instrument panel shall include:
1. Dual range voltmeter 3-1/2", 2% accuracy.
2. Dual range ammeter phase selector switch.
3. Voltmeter-ammeter phase selector switch.
4. Lights to indicate high or low meter scale.
5. Direct reading pointer-type frequency meter 3-1/2", .5% accuracy, 45 to 65 Hz scale.
6. Panel illuminating lights.
7. Battery charging voltmeter.
8. Coolant temperature gauge.
9. Oil pressure gauge.
10. Running time meter.
11. Voltage adjust rheostat.

2.6 MOUNTING BASE:

A. The engine-generator shall be skid-mounted on (2) iron "I" or "C" type channels. The design shall provide vibration isolation between the genset and the mounting base.

B. The frame design shall not inhibit easy access to the oil pan, after genset has been installed. Installations which require the use of a pump to drain the oil are not acceptable.

2.7 ACCESSORIES:

A. The following accessories shall be installed:

1. Block Heater, 120 Volt AC. Thermostatically controlled and sized to maintain engine coolant at 90 F (32 C) to meet the start-up requirements of *NFPA 110*, Level 1.
2. Generator strip heater, 120-volt, single-phase for high humidity applications.
3. Over voltage protection will shut down the unit after (1) second of 15% or more overvoltage. Note: Sensitive equipment may suffer damage in less than (1) second of an overvoltage condition. On-line equipment requiring faster shutdown should have its own overvoltage protection.
4. Weather housing, constructed of rugged steel, cleaned, phosphated, and electrocoat painted inside and out with rust inhibiting primer and exterior coat of the manufacturer's standard color. Provide hinged, double doors on each side to give easy access to the genset, and a rear door to allow access to the control panel. All door handles shall be key-lock type. Skid and floor design shall include a removable panel below the engine oil pan. All shelters shall come ready for job-installation. Top-mounted exhaust silencer with rain shield over the exhaust opening. Note: A 120-volt battery box heater shall be included.
5. Battery rack, battery cables, 12-volt batteries capable of delivering the required minimum cold-cranking amps required at 0 F.
6. 10-Ampere automatic float and equalize battery charger with +/- 1% constant voltage regulation from no load to full load over +/- 10% AC input line variation, current limited during engine cranking and short circuit conditions, temperature compensated for ambients from -40°C to +60°C, 5% accurate voltmeter and ammeter, fused, reverse polarity and transient protected. Provide alarm circuit board to meet the requirements of *NFPA 110* for low battery voltage, high battery voltage, and battery charger malfunction.
7. Gas-proof, seamless, stainless steel, flexible exhaust connection, and engine exhaust silencer rated for critical application. Exhaust noise shall be limited to (85) dBA as measured at 10' in a free-field environment.
8. 16-Light remote annunciator shall monitor all controller functions described in Paragraph 2.4.A.10 of the controller section, line power and generator power monitoring, and docking station power monitoring. An integral lamp test and horn silencer switch shall be included, as required to meet *NFPA 110*. [***Locate this annunciator adjacent to the fire alarm control panel***.] Provide all wiring between remote annunciator and generator set / docking station.

2.8 AUTOMATIC TRANSFER SWITCH:

A. The automatic transfer switch shall consist of a power transfer module and a control module, interconnected to provided complete automatic operation. Enclosure type shall be *NEMA 1*. The automatic transfer switch shall be mechanically held and electrically operated by a single solenoid mechanism energized from the source to which the load is to be transferred. The switch shall be rated for continuous duty and be inherently double throw***. The switch shall be open transition (break before make) and be mechanically interlocked to ensure only one of two possible positions - normal or emergency.*** The automatic transfer switch shall be suitable for use with and supplied by the manufacturer of the standby generator to be furnished for this project. The switch shall be 4-pole, rated for use on a 480Y/277, 3-phase, 4-wire system. *Withstand rating shall be at least the same as the interrupting rating as the feeder breaker on the normal power input.* Basis of design: *ASCO Series 300*.

B. **Provide parallel automatic transfer switches for life safety loads. Provide kirk keyed operation for transfer switches and breakers in the generator.**

C. Automatic transfer switches utilizing components of molded-case circuit breakers, contactors, or parts thereof which have not been intended for continuous duty or repetitive load transfer switching are not acceptable.

D. All main contacts shall be of silver composition. The operating transfer time in either direction shall not exceed one-sixth (1/6) of a second.

E. The control module shall be supplied with a protective cover and be mounted separately from the transfer switch for ease of maintenance. The interconnecting wiring harness shall include a disconnect plug to disconnect all wires including both sources of control power for routine maintenance.

F. Sensing and control logic shall be solid-state and mounted on plug-in printed circuit boards. Printed circuit boards shall be keyed to prevent incorrect installation. Interfacing relays shall be industrial control grade plug-in type with dust covers.

G. All standard control features shall be contained in this control module and will be equal to *ASCO Group G* for 3-phase service. This group contains the following:
   1. Voltage and Frequency Sensing
   2. Time Delays
   3. Engine Control Contacts
   4. Test Switch
   5. Indicators

H. Provide the following accessories:
   1. Engine generator exercising timer with toggle switch to select load, no-load operation. Adjustable in (15)-minute increments. Factory set at (20) minutes minimum each week unless otherwise specified. Equivalent to *ASCO 11BE*.
   2. Switched neutral transfer contact.

I. Inspection of all contacts (movable and stationary) shall be possible from the front of the switch without disassembly of operating linkages and without disconnections of power conductors. A manual operating handle shall be provided for maintenance purposes.

J. The automatic transfer switch shall conform to the requirements of *NEMA Standard ICS2-447* and *Underwriters Laboratories UL 1008*.

K. The complete automatic transfer switch shall be tested as to ensure proper operation of the individual components and correct overall sequence of operation and to ensure that the operating transfer time, voltage, frequency, and time delay settings are in compliance with the specification requirements. Submittals for approval shall include wiring diagrams, dimensional data, and complete description of operation.

L. The transfer switch shall be furnished with an operator's manual providing installation and operating instructions.

2.9 GENERATOR DOCKING STATION

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

TRYSTAR, or prior approved equal.

B. Docking station shall include *16 Series Camlok* panel mounts for use as connection to Portable Generator.

C. Entire package must be listed to *ETL* or *UL 1008 Standards*. *UL* listing of individual components is not acceptable.

D. Enclosures:
   1. *NEMA 3R* rain-tight, 304 GA aluminum enclosure
      a. Pad-lockable front door shall include a hinged access plate at the bottom for entry of cables from portable generator or portable load bank. *NEMA 3R* integrity shall be maintained with access plate open for cable entry.
      b. Front and side through a front access panel shall be accessible for maintenance.
      c. Top, side, and bottom through a front access panel shall be accessible for permanent cabling.
   2. Finishes:
      a. Paint after fabrication. Powder coated *Hammertone Gray*.

E. Phase, Neutral, and Ground Buses:
   1. Material: Silver-plated Copper
   2. Equipment Ground Bus: bonded to box.
   3. Isolated Ground Bus: insulated from box.
   4. Ground Bus: 50% of phase size.
   5. Neutral Bus: Neutral bus rated 100 percent of phase bus.
   6. Round edges on bus.

F. Temporary generator connectors shall be *Camlok* style mounted on gland plate.
   1. *Camlok* shall be color coded according to system voltage
      a. A phase – Brown
      b. B phase – Orange
      c. C phase – Yellow
      d. N Neutral – White
      e. G Ground – Green

G. Temporary connectors shall include protective flip lids to prevent accidental contact.

H. Permanent connectors shall be broad range set-screw type, located behind an aluminum barrier.

I. Short Circuit & Withstand Rating shall be minimum 65KAIC unless otherwise indicated on drawings.

J. Voltage and Amperage:
   1. 60A, 480Y/277V for life safety branch.

K. Phase Rotation Monitor Device: Phase monitoring relay to be *Siemens 3U4512-1AR20* or equal.

L. 60A Breaker Disconnect:
   1. Must be *UL 489* Listed Breaker.

2. Breakers shall be removable for service and maintenance.
3. Breaker shall have a pair of NO/NC auxiliary contacts to connect back to permanent generator remote annunciator panel.

M. Additional accessories shall be included in submittal drawings as follows:
1. Two-Wire Auto Start
2. Battery Charger Receptacle 20A GFCI 125V
3. Block Heater Receptacle 30A L5-30 125V
4. Extra Depth for Bottom Conduit Access
5. *Kirk* Key Door Interlock

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Install genset on concrete pad whose dimensions exceed the weatherproof housing by at least six inches, all sides. Pad thickness shall be 12". Concrete shall be 2500 psi, reinforced with 8-gauge wire fabric. Anchor genset to concrete pad as recommended by the manufacturer.

B. Provide branch circuit wiring and necessary breakers for generator accessories, from panel ELBH.

C. Wall mount the automatic transfer switch where indicated.

D. Provide factory representative to conduct startup and testing. Testing shall comply with the requirements of *NFPA 110, paragraph 7.13, "Installation Acceptance"*. Provide resistive load bank to conduct the tests.

E. Upon completion of testing, the factory representative shall provide (8) hours of on-site training of the Owner's designated personnel.

F. All wiring and interconnections shall be in accordance with commercial electrical standards. Installation drawings and complete wiring diagrams shall be furnished to the Owner.

END OF SECTION 266011

SECTION 270100 - COMMUNICATIONS AND ALARM SYSTEMS GENERAL PROVISIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

1.2 IMPOSED REGULATIONS:

A. Applicable provisions of the State and Local Codes and of the following codes and standards are hereby imposed on a general basis for electrical work:
   1. *NEC, National Electrical Code (NFPA No. 70), with Georgia Amendments.*
   2. *Life Safety Code (NFPA No. 101), with Georgia Amendments.*
   3. *State of Georgia ADA Accessibility Guidelines for Building and Facilities.*
   4. *International Building Code, with Georgia Amendments.*
   5. *EIA/TIA Telecommunications Standards.*
   6. *National Fire Alarm Code (NFPA 72), with Georgia Amendments.*
   7. *U.L. Fire Resistance Directory.*
   8. *U.L. Electrical Construction Materials Directory.*
   9. *U.L. Electrical Appliance and Utilization Equipment Directory.*

1.3 DESCRIPTION OF WORK:

A. Provide all labor, materials, equipment and supervision to construct complete and operable communication and alarm systems as indicated on the drawings and specified herein. All materials and equipment used shall be new, undamaged and free from any defects.

B. Outlet boxes, raceway systems, cable trays, sleeves and line voltage power connections for Division 27 systems shall be provided under Division 26.

1.4 COORDINATION:

A. Coordinate work provided under this division of the specifications with work provided under other divisions of the specifications and work provided by the Using Agency, where applicable.

1.5 PROJECT STAFFING:

A. Superintendent:
   1. Provide a superintendent to plan, layout, supervise and coordinate the work by all organizations providing work under Division 27. The superintendent shall be at the job site at all times work is being performed.
   2. The superintendent shall have a minimum of (5) years' experience in projects of similar size and scope. The Superintendent shall have a State of Georgia **Unrestricted Low Voltage License (LV-U)**.

B. Organizations Furnishing and Installing Division 27 Systems: Division 27 systems are specified by the name of acceptable manufacturers. Each of the systems shall be furnished and installed by an organization that:
   1. is an authorized and certified representative of the manufacturer, for purchase, installation, and service of the specific system.
   2. has current State of Georgia low voltage license appropriate for the system(s) being installed.
   3. stocks replacement parts for the specific system.
   4. has systems technicians in their employ
   5. has cable installers in their employ
   6. has experience on projects of similar size and scope.
   7. has been in business for at least 3 years.
   8. can respond to emergency service calls within (4) hours and routine service calls within (24) hours.

C. Systems Technicians: The devices and equipment that make up each of the systems included in Division 27 shall be installed, started (where applicable) and tested by technicians in the employment of the organization furnishing the system. Technicians shall have at least one of the following:
   1. *NICET Level II Engineering Technician Certificate* AND manufacturer authorized training, for the specific system to be installed.
   2. State of Georgia LV-A, LV-T or LV-U license AND manufacturer authorized training, for the specific system to be installed.

D. Cable Installers: Cabling systems, including devices and terminations, for each of the systems included in Division 27, shall be installed, and tested by technicians in the employment of the organization furnishing the system. Technicians shall have State of Georgia LV-G license AND manufacturer authorized training, for the specific system to be installed.

E. Helpers: Persons who do not possess the qualifications described herein shall be considered helpers. Helpers may assist technicians or cable installers, but shall not be allowed to install devices, make equipment connections, or perform other work for which they are not qualified. Helpers shall not perform any work on the project, at any time, without supervision by the Technician.

F. Submit resumes for organizations, systems technicians and cable installers for review and approval by the Design Professional, prior to proceeding with any work on the project.

1.6 UTILITY CONNECTIONS:

A. The approximate point of origination for electric, telephone, fiber optic and television utilities is shown on the drawings. Confirm the location with the respective utility prior to ordering materials or beginning any trenching. The Contractor’s bid shall allow for the service point to be shifted by the utility 50' feet in any direction from that shown.

1.7 DIVISION 27 DRAWINGS:

A. Do not scale the drawings. Obtain all dimensions from the Design Professional's dimensioned drawings, field measurements and shop drawings.

B. Drawings are diagrammatic and indicate the general arrangement and connection of equipment and devices. The contractor shall review product data sheets, wiring diagrams, manufacturer's installation instructions, etc. and provide the connections required to place equipment into service.

C. Discrepancies shown on different drawings, between drawings and specifications or between documents and field conditions shall be brought to the attention of the Design Professional.

1.8 RECORD DOCUMENTS:

A. The superintendent shall maintain a white set (blue-line or black-line) of contract documents in clean, undamaged condition, for mark-up of actual installations which vary substantially from the work as shown. Mark-up whatever drawings are most capable of showing installed conditions accurately. These documents shall be used for no other purpose. As a minimum, record the following:
   1. Post all addenda prior to beginning work.
   2. Post all changes in the work.
   3. Scope of each change order (C.O.), noting C.O. number.

1.9 RECORD MANUALS:

A. Manufacturer's operation and maintenance manuals for each Division 27 system.

B. Shop drawings, revised to reflect all review comments, *supplemented with the installation instructions shipped with equipment.*

C. As-built copy of the master cabling plan in AutoCad 2020 format, on USB flash drive.

D. As-built copy of the system specific drawings in AutoCad 2020 format, on USB flash drive.

E. Submit record manuals in quantities and in the format prescribed in the Division 01 specifications, plus one copy for the Design Professional.

1.10 TRAINING OF OWNERS FORCES:

A. Train Owner's personnel on the operation and maintenance of the following systems:
   1. Fire Alarm System – (1) hours
   2. Television Distribution System – (1) hours
   3. CATV Distribution System – (1) hour
   4. CCTV System – (1) hours
   5. Tour of Facility – (8) hours

B. The "tour of facility" shall consist of a walk-thru of the entire facility. Demonstrate the operation of all devices, equipment and systems.

C. ***Training shall not be conducted until the final inspection of the work has been conducted by the Design Professional and all punch list items completed.***

D. As a minimum, the following materials shall be reviewed during the training session:

1. Owner's operation and maintenance manual.
2. Corrected shop drawings and as-built system drawings.
3. Hands-on demonstration of system features and operation.

E. Notify the Design Professional, in writing, (10) working days in advance of each training session. Include a detailed agenda for the system. No more than two systems shall be covered in one day. The purpose of this requirement is to allow the Design Professional and Using Agency time to schedule representatives to be present, and is subject to the approval of the Design Professional.

F. Training shall be conducted at the project site by authorized representatives of the system manufacturer and the Division 27 superintendent.

1.11 REVIEW OF THE WORK BY THE DESIGN PROFESSIONAL:

A. During the course of the project, the work will be reviewed by a representative of the Design Professional. Upon each visit, demonstrate that the record documents and shop drawing files are being kept current.

B. The Superintendent shall accompany the Design Professional on all reviews and shall provide all personnel, tools, ladders, etc. necessary to conduct the review.

C. Prior to reviewing of work in progress, or at the final inspection, the Contractor shall submit a letter describing the specific work to be reviewed, along with a punch-list of items that are incomplete or which require correction, based on observations made by the supervisor of the given trade. Reviews will not be scheduled until this information is submitted. The Contractor shall bear the burden of any resulting delays.

D. Construction review reports will be issued by the Design Professional for every review trip. Within five working days from the date of review, the Contractor shall submit a letter which addresses when corrections will be made for each deficiency in the report. Prior to subsequent review of the work, the Contractor shall submit a letter confirming that the work required by all comments on the report have been completed.

PART 2 - PRODUCTS

2.1 GENERAL:

A. Refer to the drawings and individual specification sections for requirements.

B. All equipment shall be suitable for the environment in which it is installed. Such considerations shall include, but not be limited to characteristics of this specific project such as wet/damp/dry locations, ambient temperature / humidity, spaces used as air plenums and hazardous locations. It shall be the responsibility of the contractor to review the contract documents and order equipment based on intended use.

2.2 MATERIALS:

A. All materials and equipment used shall be new, undamaged and free from any defects.

B. Provide materials and equipment that are *UL* listed, unless listing is unavailable.

C. All equipment of the same type or of the same product category shall be the product of a single manufacturer.

D. Where product is specified by catalog number, such specification is intended only to convey general characteristics. Actual product selection shall be based on catalog number, other references on the drawings / specifications and intended use.

2.3 ACCEPTABLE MANUFACTURERS:

A. Provide equipment and materials which are products of the manufacturers listed on the drawings and in the specifications. Requests for substitution of other manufacturers shall comply with Division 01 and the paragraph "B" below.

B. Requests for prior approval (i.e., before the bid opening) must contain all information listed for the specific item in Section 270120, including any applicable dimensioned layout drawings. Requests must be sent by mail or express delivery such that they are received in the Design Professional's office no later than (10) working days prior to the opening of bids. Requests that are incomplete or are sent by facsimile will not be reviewed.

2.4 SPECIAL REQUIREMENTS:

A. All software-based electronic equipment shall use the manufacturer's current software version as of the project bid date.

PART 3 - EXECUTION

3.1 ROLE OF THE SUPERINTENDENT:

A. The Division 27 Superintendent's duties shall include, but not be limited to the following:
1. Preparation of submittals.
2. Planning and layout of the work.
3. Coordination with other trades and the local utility companies.
4. Posting addenda and changes in the work to maintain the Record Drawings and to ensure that Division 27 personnel are working from up-to-date drawings and specifications.
5. Supervision of all Division 27 personnel.
6. Ongoing review of work in place to ensure compliance with the Contract Documents.
7. Conducting a review of the work in place and materials stored for the Design Professional's representative.
8. Administrative duties as required to fulfill the requirements of the General Conditions, Special Conditions and Division 01 specifications.
9. Training of the Owner's Forces.

3.2 PROTECTION OF THE WORK:

A. Protect the work during the course of construction. Do not install any equipment or materials

until the proper environmental conditions have been established.

B. Store materials in the manner recommended by the manufacturer until materials are installed. Materials rated for indoor use shall not be stored outdoors regardless of the packaging in which the materials are shipped.

C. Do not install cables until the building is dried-in. For the purposes of this specification "dried in" shall mean the roof has been installed, all exterior openings are covered and the interior of the building is dry. Tape ends of all conductors to protect from damage. Coil cables and hang from the building structure. Use care not to exceed cable bending radius. *Under no circumstances shall cables be laid out on the floor.*

D. ***Protect equipment and cables from being painted. Any equipment or cables that are painted shall be removed and replaced with new. Cleaning of paint from item is not an acceptable substitute.***

E. *Do not install devices, or equipment until spaces are broom clean and the building is conditioned.*

F. Install temporary protective covers over equipment enclosures, devices and similar items after interiors, conductors, devices, etc. are installed to protect the installation during finish work performed by others.

G. Clean all equipment, inside and out, upon completion of the work. Scratched or marred surfaces shall be touched-up with touch-up paint furnished by the equipment manufacturer.

H. Equipment or materials that are improperly stored or are installed before the proper environmental conditions are achieved will be removed and replaced with new, at no cost to the Owner. The Contractor shall bear all consequences from any resulting delays.

I. All equipment and materials that become damaged will be removed and replaced with new, at no additional cost to the Owner.

3.3 INTERFACE OF WORK WITH OTHER TRADES:

A. Where Division 27 work must adjoin, abut or be incorporated into work installed by other trades, engage the services of the other trade to interface the work. Under no circumstances shall the installer performing work under this Division of the specifications modify or alter work installed by others. Such work includes, but is not limited to:
   1. Roof Penetrations.
   2. Any attachments to roofing system.
   3. Penetrations in Vapor Barriers.
   4. Exterior Insulation and Finish Systems (EIFS).

END OF SECTION 270100

SECTION 270120 - COMMUNICATIONS AND ALARM SYSTEMS SUBMITTALS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

1.2 GENERAL:

A. Submit for review by the Design Professional, a schedule with engineering data of materials and equipment to be incorporated in the work.
   1. Submittals shall be supported by descriptive materials, i.e., catalog sheets, product data sheets, diagrams, performance curves and charts published by the manufacturer, to show conformance to Specifications and Plan requirements; model numbers alone shall not be acceptable.
   2. Data submitted for review shall contain all information to indicate compliance with Contract Documents. Complete characteristics shall be provided for all equipment.
   3. The Design Professional reserves the rights to require samples of any equipment to be submitted for review.

B. For each product group and type, provide a letter from the product manufacturer stating requirements for storing and handling at the job site prior to installing the product. The manufacturer shall specifically address acceptable temperature and relative humidity levels.

C. All submittals shall be prepared by the organization furnishing the system. Submittals shall be checked for compliance by the Division 27 superintendent prior to submission.

D. Hard Copy Submittals: Submittal data shall be placed in one or more hard-back 3-ring binders arranged and labeled according to specification section. Each binder shall contain a title page and table of contents. Provide separator tabs, and label by specification section. Make note in the table of contents, any drawings that accompany the submittal. Title page shall contain Project Name, Contractor's Name, Division 27 Superintendent's name, Suppliers and point of contact for each, and date. Except as otherwise indicated in other sections, submit 5 complete copies. Quantity indicated does not include copies required for regulatory agencies.

E. Electronic Submittals: All electronic submittal files shall be organized to match the bid documents for specification section and name. Each submittal file shall be complete for each specification section. Multiple partial submittals per specification section will be rejected. Make note in the table of contents, any drawings that accompany the submittal. Title page shall contain Project Name, Contractor's Name, Division 27 Superintendent's name, Suppliers and point of contact for each, and date.

1.3 RESPONSE TO SUBMITTALS:

A. Each item reviewed by the Design Professional will be marked with numerical review codes

that correspond to the following:

1. **"No Exceptions Taken"**: No corrections, no marks. Items may be ordered.
2. **"Make Corrections Noted"**: A few minor corrections. Items may be ordered as marked up without further resubmission.
3. **"Revise and Resubmit"**: Minor correction. Item may be ordered at the Contractor's option. Contractor shall resubmit drawings with corrections noted.
4. **"Rejected"**: Major corrections or not in accordance with the contract documents. No items shall be ordered. Contractor shall correct and resubmit drawings.

B. Whether resubmittals are required or not, all shop drawings shall be corrected for the record manuals specified in Section 270100.

1.4 SUBMITTAL GROUPING:

A. Submittals shall be made in the following groupings:
   1. Group 1
      a. Resumes and affidavits – 270120.
   2. Group 2
      a. Master cabling plan – 270120.
      b. Supports – 279010.
   3. Group 4
      a. Fire Alarm System – 271010.
      b. CCTV System – 275020.
      c. CATV System – 273010
   4. Group 5
      a. Premises Cabling Systems – 272010.

B. System specific drawings shall be submitted with the respective specification section.

C. Submittals that do not comply with these requirements or that are deemed by the Design Professional to be incorrect or incomplete shall be returned without review. The Contractor shall bear the burden of any resulting delays.

D. Resubmittals must be scheduled (2) weeks in advance with the Design Professional. Resubmittals must be accompanied by a letter from the Contractor, with a copy of the previous submittal report, stating the resubmittal has incorporated all comments made on the previous report. Resubmittals made without this information shall be returned without review. The Contractor shall bear the burden of any resulting delays.

1.5 TESTING / TRAINING SCHEDULES AND TEST RESULT SUBMITTALS:

A. Submittals shall be made for each occurrence. Each submittal shall include a cover letter with the Contractor’s letterhead.

1.6 EQUIPMENT AND MATERIALS REQUIRING SUBMITTALS:

A. Section 270100 - General Provisions - Communications and Alarm Systems
   1. Superintendent’s qualifications
   2. Installers’ qualifications (as applicable for each system)

B. Section 270120 - Communications and Alarm Systems Submittals
   1. Master Cabling Plan
   2. System specific rough-in details
   3. Attachment 1

C. Section 271010 - Intelligent Fire Alarm System
   1. Draft copy of *NFPA 72 Certification*
   2. Proof of Coordination with other trades.
   3. Fire Alarm Control Panel
   4. Remote annunciator / Remote trouble station
   5. Power Supplies
   6. Batteries
   7. Calculations - Power Supply, Battery Sizing, and Wire Sizing
   8. Voice Alarm Control Panel
   9. Pull Stations
   10. Audible and audible/visible signaling devices
   11. Door Holders
   12. Flow and Tamper Switches
   13. Monitor and control modules
   14. Detectors and detector bases / housings
   15. Cables
   16. System specific drawings, per 270120, 3.04.B, plus interlock diagrams which shall include, as a minimum:
       a. Air Handler shutdown.
       b. Interconnections to the electronic card entry / access system.
       c. Elevator Recall and emergency shutdown.

D. Section 272011 - Cable Plant Labeling
   1. Product data sheets for each type label.

E. Section 272010 – Premises Cabling Systems
   1. Category 6 jacks
   2. Category 6 cables, including certification
   3. Category 6 patch cords
   4. Multi-mode optical fiber back-bone cables
   5. Single-mode optical fiber back-bone cables
   6. Optical fiber terminators
   7. Multi-mode optical fiber patch cords
   8. Single-mode optical fiber patch cords
   9. Faceplates
   10. Rack mounted copper patch panels
   11. Rack mounted optical fiber patch panels
   12. 110-style punch down blocks
   13. Equipment racks
   14. Equipment cabinets
   15. System specific drawings, per 270120, 3.04.B

F. Section 273010 - CATV Distribution System
   1. Incoming signal strength measurement
   2. Signal loss calculations

3. Amplifiers
4. Processors
5. Modulators
6. Splitters
7. Combiners
8. Multiplexers
9. Tap-offs
10. Terminating Resistors
11. Attenuators
12. Distribution cables
13. Tap-off cables
14. Hookup cables
15. Monitors
16. System specific drawings, per 270120, 3.04.B

G. Section 275020 - CCTV System
1. Multiplexer
2. Multiport Controller
3. Cameras
4. VCR
5. Monitors
6. Cables
7. Equipment Cabinet
8. System specific drawings, per 270120, 3.04.B

H. Section 279010
1. Bridle rings.
2. Cable ties.

PART 2 – PRODUCTS NOT APPLICABLE

PART 3 - EXECUTION

3.1 MANUFACTURER'S DATA:

A. For each system component, include the manufacturer's comprehensive product data sheet and installation instructions. Where operating ranges are shown, mark data to show portion of range required for project application.

B. Provide manufacturer's product data sheet for each type of cable used. Include cross-section diagram of the cable assembly.

3.2 CALCULATIONS:

A. Provide calculations to substantiate the sizing of power supplies, transformers, backup batteries and similar items.

3.3 TEST REPORTS:

A. Submit test reports which have been signed and dated by the firm performing the tests and prepare in the manner specified in the standard or regulation governing the tests procedure as indicated.

3.4 LAYOUT AND COORDINATION DRAWINGS:

A. MASTER CABLING PLAN:
   1. Provide a master cabling plan that defines the pathways (horizontal and vertical) to be used for all cabling systems installed as part of this project. The approved pathways shall become the basis of the individual system cabling plans. The master cabling plan shall include the following:
      a. Pathways for backbone cable runs between the MDF and IDF locations.
      b. Pathways for workstation outlets.
      c. Pathways for specific system horizontal cables.
      d. Location, quantity and size of all sleeves through walls and floors, including the U.L. listed thru-penetration firestop system specifications for each type penetration.
      e. Location of bridle rings for all horizontal wiring.
   2. The master cabling plan shall be prepared in accordance with all the Division 27 specifications, *EIA/TIA sSandards* and the *BICSI Telecommunications Distribution Methods Manual*. The master cabling plan shall be developed and sealed by a designer with the *BICSI RCDD* registration for telecommunications systems cabling design.

B. System specific drawings - Include the following:
   1. Floor plans:
      a. Show all system equipment, devices, and interconnecting cabling. Cabling shall be consistent with the master cabling plan. Provide a legend to define all devices and cable runs.
      b. Show labels for each device and cable run. For addressable systems, show the point ID for each device.
   2. Details:
      a. Show the rough-in requirements and mounting height for every component. Include all requirements such as outlet box size/trim/alignment and raceway requirements.
      b. Prepare in sufficient detail such that these drawings can be used to provide the required rough-in.
   3. Point-to-point installation wiring diagrams of the entire system:
      a. Provide terminal diagram for every control panel, patch panels, interconnect center, etc.
      b. Provide wiring diagram for every device. Key these diagrams to the system diagrams.
      c. Provide wiring diagram depicting all interlocks of specific systems with other systems.
      d. Spare and unused terminals shall be marked as such. Indicate the size, type, and color code of all conductors.
      e. The use of generic wiring diagrams is not acceptable. Wiring diagrams shall be prepared for this specific project.
   4. Elevations:
      a. Provide an elevation drawing of the headend equipment / control panel / backboard showing the locations of all components.
      b. Indicate enclosure sizes and space available for future expansion.
      c. Backboard elevations shall show the layout of the various systems components

installed thereon.

C. System specific drawings are required for each Division 27 system.

D. Drawing Format:
   1. Drawings shall be prepared at the following scales:
      a. Floor plans: 1/16" = 1' - 0".
      b. Details: Not to scale.
      c. Wiring Diagrams: Not to scale.
      d. Elevations: 1/2" = 1' - 0".
   2. Drawings shall be titled to define Project Name, Drawing subject, date prepared and designer's name and seal. All revisions shall be marked and dated.
   3. Floor plan drawings shall include all room names and numbers.
   4. CAD-generated drawings are required. Upon written request, an email with a zip file attachment containing the building floor plan(s) can be furnished to the contractor. The file will be in AutoCAD 2019 format. By requesting these drawings, the contractor agrees to accept them "as is". It will be the responsibility of the contractor to verify the drawings for accuracy and to make all changes necessary, at no additional cost to the Owner.
   5. Submit only one copy of each drawing, in reproducible format. The Design Professional will mark review comments on the reproducible drawing so that the contractor can make as many copies as may be required.

3.5 ATTACHMENT NO. 1:

A. Shall be filled out and returned with shop drawings. List all firms that will be providing work under Division 27.

ATTACHMENT NO. 1

The purpose of this form is to identify all organizations that will provide the work of Division 27, and describe how the work will be divided.

ORGANIZATION:

SYSTEM TO BE INSTALLED: FIRE ALARM SYSTEM

SYSTEM MANUFACTURER:

ORGANIZATION:

SYSTEM TO BE INSTALLED: ELECTRONIC CARD ENTRY AND CONTROL SYSTEM

SYSTEM MANUFACTURER:

ORGANIZATION:

SYSTEM TO BE INSTALLED: CCTV SYSTEM

SYSTEM MANUFACTURER:

ORGANIZATION:

SYSTEM TO BE INSTALLED: VOICE / DATA / VIDEO CABLING SYSTEM

SYSTEM MANUFACTURERS:

ORGANIZATION:

SYSTEM TO BE INSTALLED: VIDEO HEADEND SYSTEM

SYSTEM MANUFACTURER:

Attach a letter from each organization stating that they acknowledge and will comply with the staffing requirements of Section 270100 and that the proposed subdivision of work of Division 27, among the organizations will not compromise the integrity of the systems and does not conflict with recommendations of the equipment manufacturer, or applicable codes.

END OF SECTION 270120

SECTION 271010 - INTELLIGENT FIRE ALARM SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

1.2 DESCRIPTION:

A. The work required under this section of the specifications consists of an analog, addressable fire and voice alarm system.

B. *This is a performance-based specification*. The system specified herein shall be designed by the manufacturer or an authorized representative of the manufacturer who is either a registered *Fire Protection Engineer* or a *NICET Certified Engineering Technologist*.

C. Work of this section requires coordination with the following trades:
   1. Duct work installer.
   2. Elevator installer.
   3. Electrical system installer.
   4. Fire water service installer.
   5. Sprinkler installer.
   6. Fire pump installer.
   7. Electronic card access and door hardware installer(s).
   8. Generator installer.

D. Proof of this coordination shall be submitted with the shop drawings.

1.3 QUALITY ASSURANCE:

A. All components shall be *UL Listed* for their intended use as part of the Intelligent Fire Alarm System. Non-listed equipment shall not be used.

B. No equipment shall be installed, nor auxiliary connections made that will inhibit proper operation or use of the system and its components, in accordance with the *UL* listings.

C. Acceptable manufacturers: *Notifier, Edwards EST, Simplex.*

D. Submittals: Refer to Section 270120 for requirements. A draft copy of the certification required by *NFPA 72* shall be submitted with the shop drawings. Fill-in as much information as possible. Submittals made without this information will be rejected.

1.4 COORDINATION:

A. Coordinate control, supervisory and auxiliary functions with work provided under other

Divisions.

1.5 PERFORMANCE CRITERIA:

A. When installed, the system shall comply with the requirements of the State of Georgia *ADA*, *NFPA 72*, and *NFPA 101*.

B. All *NFPA 72*. All fire alarm drawings **shall** use symbols described in *NFPA 170, Standard for Fire Safety and Emergency Symbols".*

C. *NFPA 170* is part of the Performance Criteria.

PART 2 - PRODUCTS

2.1 GENERAL:

A. All equipment, components and software shall be new and the manufacturer's current model. Beta versions are not acceptable.

B. Provide and activate all standard alarm, trouble, control, and supervisory functions. Provide special functions as specified herein.

2.2 FIRE ALARM CONTROL PANEL:

A. The fire alarm control panel shall comply with the manufacturer's standard design, materials, and components for an **intelligent** fire alarm system with **addressable** devices, plus the following accessories:

B. A digital communicator for transmitting alarm and trouble conditions over the telephone line to a central station receiver. Provide surge suppression on all telephone lines connecting to the digital communicator. The system shall be capable of transmitting alarms, supervisory and trouble signals to a 3rd party monitoring company. Coordinate with owner to determine which 3rd party monitoring company is being used. Device shall be provided with an IP/GSM Communicator. Provide (1) internet data drop adjacent to the control panel.

C. A dedicated supervisory service LED and a dedicated supervisory service acknowledge switch, for the building sprinkler system.

2.3 VOICE ALARM PANELS:

A. Provide voice alarm integral with the fire alarm panel.

B. Voice alarm feature shall be capable of transmitting automatic or manual messages to fire alarm speakers. However, panels shall be configured for automatic operation.

C. Provide remote microphones at locations shown on drawings.

2.4 DOCUMENTATION CABINET:

A. Provide documentation cabinet located at the fire alarm control panel. Documentation cabinet shall house all record documentation required by *NFPA 72*.

B. Label documentation cabinet “SYSTEM RECORD DOCUMENTS”.

2.5 REMOTE ANNUNCIATOR:

A. The annunciator panel shall be recess mounted at location noted on the drawings and shall have an LCD readout. Each alarm initiating device (pull station, smoke detector, duct detector, and sprinkler system flow switch) shall be identified on the readout.

2.6 POWER SUPPLIES:

A. Provide power supplies in the quantity and size required to operate the devices connected to the system. Do not load any power supply more than 75% of its rating.

B. Group devices of the same type to the same power supply.

C. Remote power supplies are permitted providing:
   1. Location is approved by the Design Professional.
   2. A separate 20A / 120V circuit is installed to operate each remote supply.
   3. Backup battery system is installed at the location of each remote power supply.

2.7 BACKUP BATTERY SYSTEM:

A. An automatic battery back-up and recharging system with voltmeter and ammeter for supporting the entire system for a period of (24) hours under normal conditions with (5) minutes of alarm time at the end of the (24)-hour period, shall be provided for the control panel and all remote power supplies.

A. Install batteries in a separate cabinet adjacent to the control panel / remote power supply.

2.8 SIGNALING LINE CIRCUITS:

A. Circuits shall be Class B, Style 4.

2.9 NOTIFICATION APPLIANCE CIRCUITS:

A. Circuits shall be Class B, Style Y.

2.10 SYSTEM OPERATION:

A. The system shall be designed, installed, and connected to receive and process signals in

accordance with *NFPA 72*.

B. Control Actions Upon Receipt of Fire Alarm Signal:
   1. Doors in fire walls, held open by magnetic devices, shall close, via interface with control module.
   2. All doors locked by the electronic card entry/control system shall be unlocked, via interface with control module. The electronic card entry/control system is being provided by the Owner. It shall be the responsibility of the contractor to meet with the Owner's designated representative and determine the requirements.
   3. Air handling units equipped with smoke detectors shall be de-energized, via interface with control module.
   4. Smoke dampers in duct work shall close, via interface with control module.
   5. The alarm activation of any elevator lobby, elevator shaft or elevator equipment room detector shall cause the elevator cabs to be recalled in accordance with *ASME A17.1*.
   6. The alarm activation of any heat detectors in the elevator shaft or elevator machine room shall cause shutdown of elevator power and lighting circuits as required by *ASME A17.1*.
   7. The activation of projected beam detectors shall initiate the actions described in the applicable sections of Division 23 for smoke removal.

C. Supervisory Functions:
   1. Sprinkler system flow and tamper switches per *NFPA 72*, via interface with monitor module.
   2. Fire service post indicator valve per *NFPA 72*, via interface with monitor module.
   3. Elevator sump pump oil monitoring system.
   4. Generator controllers shall be monitored by the fire alarm system, where provided, for the following conditions: generator running, generator fault, and generator switches in non-automatic position.

D. Auxiliary Functions:
   1. Upon receiving a signal from the electronic card entry/control system, release doors held open during the day, but closed and operated by card access at night, via interface with control module.

2.11 NON-ADDRESSABLE DEVICES:

A. Audible Alarm Indicating Appliances:
   1. Audible signals shall be manufacturer's standard horn or speaker, as indicated, and shall be suitable for surface mounting on the wall.
   2. Horns shall have field-selectable "standard" and "high" settings.
   3. Speakers shall have field-selectable settings of ¼, ½, 1, and 2 Watts.
   4. Enclosure shall be white.

B. Visual Alarm Indicating Appliances:
   1. Visual signals shall be manufacturer's standard, suitable for surface mounting on the wall.
   2. Devices shall have field-selectable candela settings of 15, 30, 75 or 100 cd.
   3. Enclosure shall be white. Lens shall be vandal resistant.

C. Audio/Visual Alarm Indicating Appliances:
   1. Combination audible / visible signals shall be manufacturers' standard, the same as defined for individual devices.

D. Thermal Detector Head:
   1. Detectors will be a combination rate-of-rise and fixed temperature (200 F) type, automatically restorable. These devices shall be used only in spaces where high ambient temperatures prohibit the use of addressable devices. Unless noted otherwise, each of these devices shall be used in conjunction with a monitor module, such that point identification is maintained.

E. Waterflow Switches:
   1. Flow switches are furnished and installed under Division 21 and connected under this Division.

F. Sprinkler Valve Tamper Switches:
   1. Tamper switches are furnished and installed under Division 21 and connected under this Division.

G. Post Indicator Valves:
   1. Post Indicator Valves are furnished and installed under Division 21 and connected under this Division.

2.12 ADDRESSABLE DEVICES:

A. Pull Stations:
   1. Pull stations shall contain electronics that communicate the station's status to the control panel over two wires. Station address shall be field-selectable.
   2. Stations shall be double-action type.
   3. Enclosure shall be red, high-impact, vandal-resistant type.
   4. Station address shall be field-selectable.

B. Thermal Detector Head:
   1. They will be combination rate-of-rise and fixed temperature (135 F) type, automatically restorable.
   2. Station address shall be field-selectable.

C. Smoke Sensors:
   1. Smoke sensors shall be of the photoelectric or ionization type and shall communicate actual smoke chamber values to the system control panel. Sensors installed in elevator shafts or pits shall be suitable for the environment.
   2. Sensors shall be low profile.
   3. Station address shall be field-selectable.
   4. Set points shall be field-selectable from the control panel.
   5. Sensor shall have integral test switch.
   6. Sensor heads shall be photoelectric or ionization type, as determined by the manufacturer to best suit the environment in which the device is to be installed.

D. Addressable Duct Smoke Detector:
   1. Addressable Duct Smoke Detectors shall be of the photoelectric type specified above, for mounting outside of the air stream.
   2. Provide housing to allow installation on the side of air duct.
   3. Provide sampling tubes.
   4. Provide and install an externally mounted addressable control module for each duct

mounted smoke detector shown on Division 23 plans and/or details and program system as necessary for required automatic shut-down.

5. For each duct detector location provide one remote indicator / test switch unit. The unit shall provide status of the detector (normal, alarm, and trouble). Flush mount in wall near entrance to room in which air unit is installed.

E. Addressable Monitor Modules:
   1. Addressable monitor modules shall provide point-monitoring capabilities of individual non-addressable devices. Provide a separate module for each such device.
   2. Locate within 3' of the device to be monitored.

F. Addressable Control Module:
   1. Addressable control modules shall be used to initiate control actions and supervise initiating functions. A separate control module shall be provided for each control point. Initiation of control functions from auxiliary contacts in devices is prohibited.
   2. Locate within 3' of the device to be controlled.
   3. If the power requirements of the device being controlled exceed the contact rating of control module, provide a general-purpose relay, controlled by the module, with the required contact rating to support the load.

G. Smoke Alarms [/ Carbon Monoxide Detectors]:
   1. Ceiling mounted addressable system smoke detector outside of sleeping rooms: Unit shall be connected to the overall building fire alarm system but shall only annunciate locally. Device shall be services by the fire alarm control panel for trouble signal. Provide standard frequency sounder base. Activation of any notification device within a single unit shall activate all notification devices in that unit. Device shall be programmed to initiate upon activation of general building alarm or local alarm in unit. ("CO" indicated on plans adjacent to the device symbol indicates combination smoke detector / carbon monoxide detector).
   2. Ceiling mounted addressable system smoke detector in sleeping rooms: Unit shall be connected to the overall building fire alarm system but shall only annunciate locally. Device shall be supervised by the fire alarm control panel for trouble signal. Provide low frequency 520 Hz sounder base. Activation of any notification device within a single unit shall activate all notification devices in that unit. Device shall be programmed to initiate upon activation of general building alarm or local alarm in unit. ("CO" indicated on plans adjacent to the device symbol indicates combination smoke detector / carbon monoxide detector).
   3. Ceiling mounted addressable system carbon monoxide detectors: Unit shall be connected to the overall building fire alarm system but shall only annunciate locally. Device shall be supervised by the fire alarm control panel for trouble signal. Provide standard frequency sounder base. Activation of any notification device within a single unit shall activate all notification devices within that unit. Device shall be programmed to initiate upon activation of general building alarm or local alarm in unit.

H. Addressable Carbon Monoxide Detector / Alarm:
   1. CO sensors shall communicate actual CO values to the system control panel.
   2. Sensors shall be low profile.
   3. Station address shall be field-selectable.
   4. Set points shall be field-selectable from the control panel.
   5. Sensor shall have integral test switch.
   6. Sensor shall be equipped with sounder base.

2.13 REMOTE COMMUNICATION DEVICES:

A. Provide active RS-232 port for connection of printer.

B. Provide remote LCD annunciator (non-control type) in location shown on plans.

PART 3 - EXECUTION

3.1 WIRING:

A. Refer to Section 279010, Wiring Methods for Communications Systems.

B. Label each piece of equipment and each cable, using *NFPA 72* requirements/ recommendations. Label each end of all cables. Labels shall be of same type as specified in Section 272011.

C. Provide all wiring required to make system operable, as specified. Leave 25% spare capacity on each circuit for the future addition of devices and appliances. Voltage drop calculations shall substantiate initial load and load that can be added.

D. Install wires and cables without splices. Make connections at terminal strips in cabinets or at equipment/device terminals.

3.2 CONDUCTORS:

A. Provide cable type construction, listed, and approved for fire alarm usage.

B. Cables shall comply with *NEC Article 760*, be red in color and be identified in all enclosures.

C. ***All cables shall be installed in a metallic conduit system***, in accordance with Section 261010. Minimum conduit size shall be 3/4". All junction boxes shall be painted red.

3.3 DEVICES:

A. The location of devices shown is approximate. The exact location of all devices shall be determined by the system designer.

B. It shall be the responsibility of the contractor to provide suitable mounts for the projected beam detectors, to guard against movement which would prevent nuisance alarms, to the greatest degree possible.

3.4 DISCONNECT LABELING:

A. The panel and circuit number serving the control panel shall be marked with an indelible marker pen on the inside door of the control panel.

3.5 NOTIFICATION APPLIANCES:

A. The sound level and light intensity setting of notification devices shall be determined by the system designer.

3.6 DUCT MOUNTED DETECTORS:

A. Refer to the Division 23 drawings for the quantity and location of duct mounted smoke detectors.

B. The duct work installer shall determine the method of mounting the detector housing and shall also provide an access door in the duct work on the side opposite of the detector, for inspection of the sampling tubes.

3.7 PRELIMINARY TESTS:

A. Upon completion of the installation, test the entire system for proper operation. Make all adjustments and corrections necessary. Retest until proper operation is achieved.

3.8 CUSTOMIZATION:

A. Schedule on-site meeting (allow a minimum of (4) hours) with Owner's designated representative and review system operation to:
   1. Determine custom labels.
   2. Customize software programming for initiation, notification, and control circuits.
   3. Review all adjustable features and determine setpoints.
   4. Determine access levels and assign passwords.
   5. Implement customization based on meeting with Owner. Document all settings and provide hard copy.

3.9 FINAL TEST:

A. After customizing system, perform an acceptance test of the system as required by *NFPA 72*. Upon completion of tests, print alarm history log to verify tests.

B. Upon successful completion of tests, provide written certification per *NFPA 72*. Submit form with record documents.

C. Review test results with Owner and Design Professional. Demonstrate system operation as directed.

D. Arrange final inspection with the Fire Marshal and Owner’s Insurance representative. Present copy of final test alarm log and *NFPA Certification* to each. Demonstrate operation of system as directed.

E. Any changes made to the system after or as a result of the test shall require re-acceptance

testing as required by *NFPA 72*.

3.10 SPARE PARTS:

A. Provide spare parts as follows:

1.	Sensor heads:	2 of each type
2.	Sensor bases:	2 of each type
3.	Manual stations:	1
4.	Notification appliances:	2 of each type
5.	Control and monitor modules:	2 of each type

B. Deliver in unopened factory cartons at time of training. Submit receipt, signed by Owner's representative.

END OF SECTION 271010

SECTION 272010 - PREMISES CABLING SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

1.2 DESCRIPTION:

A. The Contractor shall provide all labor and materials for the installation of the fiber optic and twisted pair data / telephone systems shown on drawings and specified herein.

B. The following work and/or equipment will be provided by the Using Agency:
   1. Network electronics.
   2. Computer stations.

1.3 STANDARDS:

A. *TIA-568-A Commercial Building Telecommunications Cabling Standard, with all ratified amendments.*

B. *TIA-569-A Commercial Building Standards for Telecommunications Pathways and Spaces, with all ratified amendments.*

C. *TIA-606 Administration Standard for the Telecommunications Infrastructure of Commercial Buildings.*

1.4 PERFORMANCE REQUIREMENTS:

A. The installed cable systems and components shall be subjected to and shall pass the following tests:
   1. Twisted pair: The twisted pair data and voice cabling systems shall be installed to achieve Category 6 rating.
   2. Fiber Optics: The installed fiber optic cabling system and components shall be subjected to and shall pass an attenuation test in accordance with *TIA FOTP-171*, and an *OTDR* test in accordance with *TIA 455-61*.

1.5 QUALITY ASSURANCE:

A. Acceptable Manufacturers – Connectivity components: *Commscope, Panduit, Ortronics, Leviton, Siemon.*

B. All materials furnished under this Section of the specifications shall be the product of the same manufacturer.

C. Acceptable Manufacturers - Cables and patch cords: Cables and patch cords shall be manufactured by the same company as that of the connectivity components or shall be companies with formal, documented partnerships. The end-to-end system (connectivity components, backbone cabling, horizontal cabling, patch cables, etc.) shall be the solution that will provide a 25-year warranty from the company/partnership. All products shall be tested and certified to achieve the performance levels specified, with the products of the component manufacturer selected.

D. Submittals: Refer to Section 270120 for requirements.

1.6 RELATED WORK:

A. Cabling for video jacks is specified under Section 273010.

PART 2 - PRODUCTS

2.1 DATA AND VOICE STATION JACKS:

A. General Data: Individual, RJ45, non-keyed, modular, 8-position, *TIA-T568B* configuration, with paired punch-down sequence, using compact 110 IDC terminations, certified Cat6. Jacks shall accept 23 AWG solid copper wire and must cut plenum rated insulation.

B. Color:
1. Data - Blue
2. Voice - White

2.2 FACEPLATES:

A. Wall or Pole Mounting:
1. Single gang, modular, molded plastic type, for use with snap in inserts.
2. Surface mounted over recessed wall box or power pole.
3. Faceplates shall have a label strip and a clear plastic cover at the top and bottom.
4. Faceplates shall be 6-position type.
5. Provide blank snap-in covers, same color as faceplate, for unused positions.
6. Color: Selected by the Design Professional. Submit color samples.

2.3 UNSHIELDED TWISTED PAIR HORIZONTAL CABLES:

A. Cables shall be suitable for use with the wiring methods specified in section 279010 and rated CMP for indoor use only.

B. Color: The color of the outer jacket shall be specific to the system served as follows:
1. Data: Blue
2. Voice: White

C. Cables shall be Category 6 rated and shall contain 4UTP, 100-ohm, 23 AWG, solid-copper

conductors with an outer jacket.

2.4 FIBER OPTIC DATA CABLES:

A. Multimode - Indoor Riser:
1. *Certified 62.5/125* complying with *ANSI TIA/EIA 568A*.
2. Tight buffer, breakout construction.
3. (12) strands per cable each with individual strength member and breakout jacket.
4. Fibrous central strength members.
5. Outer jacket with ripcord.
6. Type CMP.
7. Suitable for use with the wiring methods specified in section 279010.

2.5 TWISTED PAIR DATA PATCH PANELS:

A. General:
1. Aluminum construction with black anodized finish, suitable for mounting in 19" equipment rack
2. 48-port type; higher density panels are not permitted.
3. Jacks shall comply with 2.1 above.
4. Flame retardant.
5. Certified Category 6.
6. Label strips with clear plastic covers, front and rear, for all ports.
7. Rear cable management bracket.

2.6 FIBER OPTIC PATCH PANELS:

A. General:
1. Aluminum construction with black anodized finish, suitable for mounting in 19" equipment rack.
2. Adapter modules with small form factor LC type connectors as indicated.

B. Indoor Riser Cables:
1. IDF Rooms: 24-port type.
2. Small form factor LC type connectors.
3. Storage compartment with clear door.
4. Label strips with clear plastic covers, front and rear, for all ports.

2.7 TWISTED PAIR DATA PATCH CABLES:

A. Certified Category 6, stranded copper cable assembly.

B. Flame retardant.

C. Modular plug each end, with strain relief boot and latch guard.

D. Color: Selected by the Design Professional prior to ordering.

E. Quantities:
1. Provide (2) patch cables for every station jack, one for the station end and one for the IDF end.
2. Provide (6) patch cables for the telecommunications room, for the backbone.
3. Provide (24) spare patch cables.

F. Lengths:
1. For the purposes of the bid, assume that each patch cord will be 15' long. Actual lengths shall be determined by the Contractor, for each instance.
2. Do not order patch cords until construction has progressed sufficiently to make this determination. Submit list for Design Professional's approval.

2.8 FIBER OPTIC PATCH CABLES:

A. General:
1. Patch cables shall be duplex cables with pre-assembled LC connectors. Determine length of cables in the same manner specified for twisted pair patch cords.
2. Provide one duplex patch cable for every port pair in each connector panel, per room.
3. Patch cables shall be yellow in color.

2.9 FREESTANDING PATCH PANEL / DATA CABLE MANAGEMENT RACKS:

A. General:
1. Aluminum construction with black anodized finish, 19"W x 7'H.
2. 6"W x 7'H cable management channels, with covers, on each side; retaining clips to hold cables in place with cover removed.
3. Cable access slots in side rails and cable management channels.
4. Base rail with mounting holes.
5. Flame retardant.
6. Provide the following rack-mounted accessories as indicated on the drawings:
   a. Cable managers.
   b. Shelves - ventilated type.
   c. Power strips.
   d. Blank covers.

2.10 EQUIPMENT CABINETS AND TERMINAL HOUSINGS

A. Wall Mounted IDF Data Cabinets:
1. Mounting opening shall be 48" overall minimum. Size cabinet to accommodate terminations and required future clearances. The cabinet shall have adjustable front mounting rails. The front mounting rail shall be located 3" from the face of the front door.
2. Cabinets shall have front mounting angles which conform to the TIA mounting standard and a (19") equipment mounting face, 24" deep.
3. Cabinets shall have removable sides, full front, bottom louvered hinged door with lock. The cabinet shall have wall mounting hardware such that the cabinet mounts are accessible from the inside of the cabinet.
4. Cabinets shall have; a vertical mounted A/C power strip in back of cabinet, 2" from rear; a power cord (115V, 60 HZ, 15-amp) with switched and breakered power source and (4)

grounded receptacles. Cabinet opening shall be provided for power cable connection to exit cabinet.

5. The front door shall be a metal frame door area. The front door shall have be hinged, with lift out removable hinges, shall have magnetic latches and pull handle. The front door shall have a key lock. THE KEY LOCK SHALL BE KEYED THE SAME FOR ALL CABINETS LOCKS IN MDF AND IDF CABINETS.
6. Cabinet shall have (1) 50 CFM fan installed in the top.
7. Provide for grommeted cable entrance on top front of cabinet.
8. Unless otherwise noted on drawings, provide adjustable rear equipment rails for cabinets.
9. The cabinet's color shall be black.

B. Wall Mounted Telephone, Intercom, CATV Terminal Housings:
   1. Housings shall be used for cable terminations in the IDF rooms for telephone, intercom, and video cabling and in the MDF room for telephone and intercom cabling.
   2. Housings shall include lift-out door, metal distribution rings, plywood backboard, and hardware for mounting. The top and bottom assemblies shall be removable for expansion. See drawings for size.

C. Floor Mounted MDF Equipment Cabinets
   1. Cabinets shall be used for fiber optic cable terminations, intercom equipment and video distribution equipment in the MDF.
   2. Mounting opening shall be 70” overall. The cabinet shall have a adjustable front and back mounting rails. The front mounting rail shall be located 6" from the face of the front door, also allowing a minimum of 3" clearance for cables between the mounting rail and the cabinet frame.
   3. Equipment cabinets shall have front and rear mounting angles which conform to the TIA mounting standard and a 19" equipment mounting face 30” deep.
   4. Equipment cabinets shall have louvered top and bottoms, removable sides, full front - hinged door with lock. The cabinet for the MDF location shall have a locked hinged back door.
   5. Cabinets shall have; vertical mounted A/C power strip in back of cabinet, 2" from rear door hinge; a power cord (115V, 60 HZ, 15-amp) with switched and breakered power source and eight grounded receptacles. Cabinet opening shall be provided for power cable connection to exit cabinet.
   6. The front door shall be a metal frame with a smoked *Plexiglas* opening (video cabinets shall be clear *Plexiglas*) for 90% of the door area. The front door shall have be hinged, with lift-out removable hinges, shall have magnetic latches and pull handle. The front door shall have a key lock.
   7. Cabinet shall have (2) 50 CFM fans installed in the top.
   8. Unless otherwise noted on drawings, provide adjustable rear equipment rails for cabinets located in MDF.
   9. Cabinets shall be bolted to the floor.
   10. The cabinet's color shall be black.

2.11 BACKBOARDS:

A. Backboards are provided under Division 26 of the work.

PART 3 - EXECUTION

3.1 GENERAL:

A. Installation:
   1. Install Category 6 horizontal cabling from each station jack to the IDF room indicated.
   2. Install backbone cabling from each IDF room to the MDF room as indicated.
   3. Horizontal cabling shall be limited to 295’ in total length. Any cables with a length of over 250’ shall be marked on each end with red tape. Any cables requiring a length of 295’ or more shall be brought to the attention of the Design Professional prior to its installation.
   4. Refer to Section 279010 for wiring methods.
   5. Label all components and cables as specified in Section 272011.
   6. Cables shall be continuous in length and shall not be spliced.
   7. All cables shall be terminated.

3.2 CABLE INSTALLATION:

A. General:
   1. Pull cables continuous from point-to-point. Leave sufficient slack in both ends of cables to allow for routing of cables through cable management guides and to terminate.
   2. Prior to terminating cables, coil and secure to wall or rack. Under no circumstances shall cables come into contact with the floor.

B. Indoor:
   1. Maintain clearances of cabling systems from sources of interference in accordance with *TIA 569*.
   2. Adhere to the cable manufacturer’s written instructions regarding maximum pulling tension and minimum bending radius.
   3. Make a strain relief loop where station cables enter conduit drops to station outlet boxes.
   4. Leave 10' in all fiber strands, coiled in storage compartment of connect centers.
   5. Dress all cables in cables trays and equipment racks.

C. Outdoor:
   1. Leave 50' loop of cables within manholes.

3.3 CABLE TERMINATIONS:

A. Make terminations with tool kits specifically made for the purpose, in strict accordance with the manufacturer’s written instructions.

B. Provide strain relief at each termination.

3.4 TESTING:

A. Demonstrate that cable systems have been installed and labeled as specified.

END OF SECTION 272010

SECTION 272011 - CABLE PLANT LABELING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

1.2 GENERAL:

A. Provide labels for all cables, device faceplates, equipment and equipment ports, installed on this project, as specified herein.

B. Colors for cables and devices are specified in the respective system specification section.

C. Device plate numbers within a room or space shall be assigned based on the “plan” view of the room or space, starting on the left side of the “top” wall and proceeding around the room to the “right”, “bottom” and “left” walls. Any remaining devices (i.e. floor or column-mounted outlets in the middle of the room), shall be then counted from left-to-right, top-to-bottom.

1.3 QUALITY ASSURANCE:

A. Labeling materials described herein are the product of *Panduit*. Products of other cabling system manufacturers’ listed in Specification Section 272011, and complying with the requirements specified herein, are acceptable.

B. Submittals: Refer to Section 270120 for requirements. Labels shall be included on layout drawings.

1.4 SYSTEM IDENTIFICATION STRINGS:

A. Fiber Optic Data:
   1. Label cables, equipment ports and faceplates as detailed on the drawings.

B. Copper Data and Voice:
   1. Label cables, equipment ports and faceplates as detailed on the drawings.

C. Fire Alarm:
   1. Cable: Provide a label at each end of all cables and at any interim points of termination.
      FA-SLC-PL-01
      FA = Fire Alarm
      SLC = Signaling line circuit or NAC = Notification Appliance Circuit
      PL= Power limited circuit or NPL = Non-power limited circuit
      01 = Circuit number or loop number
   2. Device: Provide a label for each device.

ID-01-001

ID =Initiating Device, CD=Control Device, NA=Notification Appliance
01=Circuit number or loop number
001=Unique device point identification

D. Closed Circuit Television (CCTV):
   1. Cable (at headend)
      CCTV-01-110
      CCTV = CCTV System
      01 = Camera, sequentially numbered
      110 = Room number, closest to camera location
   2. Camera:
      CCTV-01
      CCTV = CCTV System
      01 = Camera, sequentially numbered

PART 2 - PRODUCTS

2.1 LABEL GENERATION:

A. Labels shall be made using labeling software and thermal transfer printer, purchased for this project by the Contractor.

B. The software shall be installed on, and the printer connected to, a computer designated by the Using Agency. The Contractor shall make all labels using this computer.

C. The labeling software license and the printer shall become the property of the Using Agency.

D. Provide ink / toner and sufficient label stock to print all labels for this project plus 100% spare, of each type. Provide a heat shrink tool for applying labels. Tool shall become the property of the Using Agency.

2.2 LABELS:

A. Cable labels shall be heat shrink type with clear protective cover. Select size and type based on individual cable characteristics. Use black letters on white background except for data / voice / IP cables that exceed the maximum design length. In such cases labels shall be red on white background.

B. Faceplate labels shall be adhesive-backed component label, compatible with label window in faceplate.

C. Equipment port labels shall be adhesive-backed component label, compatible with label area.

D. Equipment and device labels shall be adhesive-backed component label, affixed to the back side of item, or in an otherwise accessible but inconspicuous location.

E. Set lettering height for each type label to provide the largest font possible in the space

available. Boldface Arial font is preferred. However, labels shall be sized and formatted such that they can be read from a distance of 24".

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Cable labels defined herein shall not be applied until the cables have been terminated and trimmed. Provide temporary labels at the time of cable installation. Temporary labels shall have the same information as permanent labels.

B. Use extreme caution when applying heat shrink labels.

C. Schedule computer time, with the Using Agency, to generate the labels.

D. Apply cable labels within 2" of termination, or fan-out, such that the lettering is visible without twisting or bending the cable.

3.2 AS-BUILT LABEL REPORT:

A. This report is applicable to Data / IP / Voice cable systems only.

B. Prior to system acceptance, the Contractor shall update the system layout drawings specified in Section 270120, for all changes made during the installation.

END OF SECTION 272011

SECTION 273010 - CATV DISTRIBUTION SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

1.2 DESCRIPTION OF WORK:

A. Provide a complete, operational 550 MHZ CATV distribution systems as specified herein and as indicated on the drawings. The operational system will be from the MDF to the rooms. See system functional schematic. The head end is in the MDF, and (1) distribution cable is run to each IDF location where splitter taps are located. Each CATV Outlet has a separate cable run to the IDF room and terminated on a splitter.

B. Provide lightning arresters, combiners, splitters, tap-offs, attenuators, cables, room outlets and other components required to place the system in operation.

C. Electrical supports for the CATV Distribution System are being provided by the electrical contractor as by these specifications as required under this contract. The CATV contractor is required to coordinate and inform the electrical contractor of any electrical requirements.

D. It is the Contractor's responsibility to coordinate incoming signal characteristics with the CATV service provider and to provide all calculations necessary for rating of each piece of equipment. These calculations and system design drawings shall be submitted with all other shop drawings and system specific drawings as required in Section 270120.

1.3 SUBMITTALS:

A. Refer to Section 270120 for requirements.

1.4 QUALITY ASSURANCE:

A. Acceptable manufacturers: *Blonder-Tongue, Scientific Atlanta, Drake*.

B. Provide CATV system components which have been listed and labeled by *Underwriters Laboratories*.

C. Raceways, boxes, cabinets, and conduit shall comply with all applicable *UL*, *NEC*, and *NEMA* standards and requirements.

1.5 PERFORMANCE CRITERIA:

A. The signal-to-noise ratio of the system design shall not be less than 50 db.

B. The system design shall provide a minimum signal level of +9 dbmv and a maximum signal level of +15 dbmv at each outlet.

C. Balance channel levels to eliminate cross-channel interference.

D. Total end to end (MDF to Room outlet) shall have no more than a 40 dbmv attenuation loss.

E. The minimum signal to be received from the Rooms to the MDF and/or from any equipment in the MDF to the CATV channel processors and/or modulators shall have a minimum signal of +10dbmv.

F. The room monitors outlets shall receive a minimum of +10dbmv signal.

1.6 WARRANTY:

A. This Contractor shall deliver the work described herein in a first-class operating condition in every respect. This Contractor shall also warrant that the material and workmanship shall be entirely free from defects. This Contractor shall repair or replace, at no additional expense to the Owner, any material or workmanship in which defects may develop within (2) years after the date of final acceptance of the installation by the Owner.

PART 2 - PRODUCTS

2.1 GENERAL:

A. All equipment, whether housed in the MDF or IDF's shall be wall mounted.

B. The contractor shall provide and turn over all proof of purchase documents to the owner as per the requirements of the manufacturer's warranty to support possible future claims.

C. The warranty shall provide for repair or replace materials used is the wiring system should a claim be made by the owner.

2.2 DISTRIBUTION TRUNK AMPLIFIERS:

A. Distribution Trunk Amplifiers maybe required to meet the system performance. The distribution Amplifier shall accommodate plug-in attenuators, by-pass jumpers and cable equalizers as required. Amplifiers shall be capable of two-way operation to provide a sub-channel return path.

2.3 SPLITTERS & DISTRIBUTION COUPLERS:

A. Provide 2, 4, or 8-way as required, and shall be capable of passing 750 MHZ signal. Shall have a tap-to-tap isolation of 23 dbmv. The splitters/taps shall have changeable attenuations caps. Each splitter/tap attenuation loss shall be balanced and selected to meet the system performance specifications.

2.4 CABLE:

A. Cables shall conform to the following types:
   1. Distribution feeder cables shall be RG-11, 75-ohm, quad shield, plenum rated.
   2. RG-6/U Quad Shield from the IDF rooms to each TV jack. Hook-up cables from wall outlet to TV shall be RG-59.

B. Supply one 6' RG-59 hookup cable with "F" connectors for each room outlet in the system, plus (6) spares. Provide jumper cables with connectors to interconnect all the equipment shown in drawing details and schematics including NIC. equipment.

2.5 LIGHTNING ARRESTERS:

A. Arresters shall be of the type recommended by the distribution system manufacturer, to provide maximum protection of components.

2.6 TERMINATING RESISTORS:

A. Provide matching terminating resistors for all non-connected or terminated feeder cables.

2.7 ATTENUATORS:

A. Provide all necessary attenuators to achieve system performance as specified or to meet equipment requirements.

2.8 EQUIPMENT CABINETS AND CABLE TERMINATION HOUSINGS:

A. See Section 272010

2.9 VIDEO F CONNECTORS:

A. See Section 272010.

PART 3 - EXECUTION

3.1 INSPECTION:

A. Installer must examine areas and conditions under which CATV distribution system is to be installed and notify Design Professional in writing of conditions detrimental to proper completion of the work or operation of the system. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

3.2 INSTALLATION OF CATV DISTRIBUTION SYSTEM:

A. Install CATV system where shown, in accordance with equipment manufacturer's written instructions, in compliance with *National Electrical Code*, and with recognized industry practices, to ensure that CATV system complies with requirements and serves intended purposes.

B. Use extreme care in fishing and pulling-in coaxial cable to avoid damage to cable and shield. Appropriate fittings are to be used when it is necessary to extend a length of cable. All cable attached to electronic equipment, active or passive, is to be labeled to show function and location of the other end of the cable. All labels will be typed, printed, or made with a suitable labeling device, and securely fastened to the cable.

C. Refer to section 279010 for wiring methods.

D. Tap-offs shall be supported on both sides.

E. All devices for head end equipment shall be mounted on wall. All splitters/couplers and amplifiers, if required, shall be installed on the CATV backboard in at the MDF and IDF locations. All equipment in the IDF locations shall be mounted in backboards.

F. No equipment or devices shall be installed in hallways or above ceilings.

G. The system shall be planned and installed in a manner compatible with construction phasing such that portions of the system can be made operable to permit partial occupancy of the facility. Such provisions shall be indicated on the shop drawings.

3.3 TESTING:

A. Prior to acceptance of the system and occupancy of the building or by phased occupancy, the manufacturer’s representative shall demonstrate the operation of all system components in the presence of the Design Professional and the Owner's representative.

B. Upon completion of the system installation, it shall be the responsibility of the installer to demonstrate the necessary mixing and matching of all input signals and amplifier level controls to eliminate any co-channel, adjacent channel, and intermediation interferences.

C. Before the contract is considered completed, the Contractor must conduct an operating test for approval. The system must be demonstrated to operate in accordance with the requirements of the specifications. The test must be performed in the presence of an authorized representative of the Owner and Design Professional. The Contractor must furnish all equipment and personnel required for the test as follows:
   1. The contractor shall provide a video input device to generate a signal for each function illustrated on the drawings. Using a field strength meter, measure the signal level at any outlet in the system at random. The signal on each channel must read not less than +9 dbmv and no more than +15 dbmv. Connect a TV set to an outlet in the system at random. Picture and audio quality must be equal or superior to reception normally available in the area.
   2. The contractor shall provide a notebook with the following testing information for each CATV outlet location.
      a. Room number

b. Forward signal dbmv signal strength.
c. Measurements must be made at the output of the last amplifier in the system. With the normal levels in the system the field strength meter must be tuned to the picture carrier of each channel in turn and the reading noted. The input to the head end amplifier must then be terminated in (75) ohms. Read the field strength meter again in the absence of the signal and add a meter correction factor of (4) dB to the reading. The difference between the two readings will give the system's signal-to-noise ratio and must not be less than (50) dB; (43) dB where broadband amplifiers must be cascaded in the system to accomplish distribution.
d. Cross channel intermediation tests must be made by applying normal signals into all channels. No visible components of cross channel intermodulation must appear on the screen of a receiver tuned to any normal signal, and the receiver is at picture black level.
e. The contractor shall set up a test to demonstrate the low band reverse channel modulation and signal level. The contractor shall select the furthest end room from each IDF room and generate a 50 dbmv modulated test signal and measure the output at the receiver side of the amplifier n the M.F. room. The received signal shall not be less than +9 dbmv and not more than +15 dbmv.

D. Should such a demonstration of performance show that the Contractor has not properly balanced the system and that picture degradation is present, a second performance demonstration will be required.

E. Should a second performance demonstration fail, the Contractor agrees to correct the system deficiencies under the supervision of the owner's technical staff at no cost to the owner.

F. The burden of proof that the completed system meets or exceeds all general and specific requirements will fall on the Contractor as a condition of the original contract and final acceptance by the Owner.

3.4 TRAINING:

A. Refer to Section 270120 for requirements.

3.5 RECORD MANUALS:

A. Refer to Section 270120 for requirements.

END OF SECTION 273010

SECTION 279010 - WIRING METHODS FOR COMMUNICATIONS AND ALARM SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

1.2 DESCRIPTION:

A. The work required by this section of the specifications applies to all systems specified under Division 27 and the HVAC systems control cabling specified under Division 23.

B. Installation of outlet boxes, raceway systems, cable trays, backboards and sleeves is specified under Division 26. Intermediate cable supporting systems, for cables not installed in cable trays is specified in this Section of the work.

1.3 QUALITY ASSURANCE:

A. Submittals: Refer to Section 270120.

PART 2 - PRODUCTS

2.1 CABLE CHARACTERISTICS:

A. Wire size, shielding and insulation requirements for cables shall be determined by the system manufacturer for each system based on specific system requirements, the *National Electrical Code* and *EIA/TIA* standards.

B. Cables installed outdoors or run below grade shall be suitable for use in wet locations.

Exception: Cables installed within the building footprint, to serve outlets located in floor boxes. In such cases cables shall be installed in a 3/4" general purpose innerduct, all within a 1" conduit. The innerduct / cable assembly shall not be installed until the conduit system has been cleaned and air-dried.

C. All indoor cables shall be plenum-rated, type CMP. Cables penetrating floors shall be riser rated, type CMR in accordance with *Article 800* of the *NEC*.

D. Cable ties shall be *velcro* and plenum-rated type.

E. Bridle rings shall be tiered type, with a separate tier for each system cable, such as *CableCat* clips manufactured by *Caddy*. Provide wide-body saddles for each ring.

2.2 SURGE SUPPRESSION:

A. Provide surge protection for conductors in accordance with *NEC Article 800*, where conductors enter and exit buildings.

B. Provide surge protection for the 120V incoming power connections to all headend equipment.

PART 3 - EXECUTION

3.1 GENERAL:

A. Wiring methods shall comply with *Articles 725, 760, 800* and *810* of the *National Electrical Code* **for power-limited circuits,** and *EIA/TIA* standards, as applicable.

B. Cable systems, or portions of cable systems, shall be installed in a conduit system under the following conditions:
   1. When required by the *National Electrical Code*
   2. When required by the system manufacturer
   3. To prevent or eliminate interference from cables of one system to another or from outside sources to cable systems.
   4. Wiring concealed in walls
   5. Wiring run above inaccessible ceilings
   6. Cables penetrating walls and floors.
   7. Wiring run exposed on interior walls (i.e., unfinished spaces)
   8. Wiring run in finished spaces with no ceiling unless otherwise noted on the drawings.
   9. Wiring run below grade, both inside and outside of the building footprint.
   10. Indoors in spaces or outdoors and wiring run below grade shall be installed in raceways.
   11. All fire alarm system cables.

C. Unless specifically noted, required by the *National Electrical Code* or system manufacturer, wiring above accessible ceilings is not required to be installed in conduits.

3.2 MASTER CABLING PLAN:

A. The Contractor shall develop a Master Cabling Plan as defined in Section 270120. The approved plan shall become the basis of installation for all systems governed by this section of the work.

3.3 CABLE SYSTEM AND CONDUIT SYSTEM ROUTES:

A. Complete conduit system not required:
   1. Horizontal cables shall be routed in the cable tray systems installed under Division 26, and bridle rings installed under this Division of the work. Cable tray routes have been predefined but may be adjusted to suit the master cabling plan, subject to the Design Professional's approval. The location of bridle rings shall be field determined based on this specification.
   2. Vertical cable drops shall be installed in conduits installed under Division 26.
   3. Cables passing through walls and floors shall be installed in conduit sleeves installed

under Division 26. The sealing of all sleeves is also specified under Division 26.

B. Complete conduit system required:
   1. Cables shall be installed in a complete conduit system installed under Division 26.

3.4 INTERMEDIATE SUPPORTS:

A. Cables not installed in cable trays shall be supported by bridle rings installed under this Division of the work. Provide a separate tier for cables of each system. The location of bridle rings shall be determined by the contractor based on the approved Master Cabling Plan, required by Section 270120. is not shown. The Contractor shall develop the pathways based on these specifications.

B. Bridle rings shall be installed no more than 5 feet apart on straight runs and within 12" of all corners

C. Bridle rings shall be attached to the building structure. The installation of cables shall not inhibit the removal of accessible ceiling panels. This precludes using ceiling panels as a means of support. Do not support cables from conduit or piping systems.

D. Cables shall be run parallel or perpendicular to the building structure in all three planes. Cables shall be readily accessible.

E. Grouping and Securing: Group all cables of one system along entire length of run using cable ties installed every 2-1/2'. Secure cable groups to bridle rings/J-hooks using cable ties.

3.5 SEPARATION:

A. Maintain a minimum separation of 2" between cables of different systems. Make crossovers as recommended by each specific manufacturer.

B. Maintain clearance from sources of interference as outlined in *EIA/TIA* standards.

C. The use of common sleeves through walls and floor is acceptable as long as this installation does not degrade system operation.

END OF SECTION 279010

SECTION 31 0000 - EARTHWORK

PART 1 - GENERAL

1.1 PROJECT CONDITIONS

A. Visit the site to become thoroughly familiar with all existing conditions; review all previous drawings and specifications and previous technical reports prior to formulating Bid. Previous drawings, specifications and technical data are available for review at the Owner's and Architect's offices.

B. Subsurface Soil Data: Soil and subsurface investigations have been made at the project site and the results are contained in Geotechnical Reports and any supplements thereto and are available for review. These reports are for reference only and the convenience of the Contractor. The soil investigation data is not warranted to indicate actual conditions. The Owner and Architect do not assume responsibility for variations in kind, depth, quantity and condition of soils; they disclaim responsibility for accuracy, true location and extent of soils investigation that has been prepared by others; and they further disclaim responsibility for interpretation of that data by Contractors as in projecting soil bearing values, rock profiles, soil stability and presence, level and extent of underground water. The information was obtained for use in preparing the foundation and earthwork design concepts illustrated on the Drawings. However, the Contractor must draw his own conclusions from the data. No claim of extra compensation or extension of contract time on account of subsurface conditions inconsistent with the data except as provided elsewhere herein will be allowed.

C. The Contractor is responsible to coordinate "insitu" soils/geo-technical testing to be performed by the Owner's Geo-Technical Engineer in connection with Project Components.

D. At his own expense and prior to bidding, the Contractor may make any soil surveys and investigations he may feel necessary. Obtain authorization of Owner, through Architect, prior to start of boring or subsurface investigations.

E. Survey and establish all property lines, property monumentation, clearing boundaries, and existing grades and lay out grade stakes for structures and appurtenances. If any survey monumentation is disturbed or destroyed, replace in original position. If existing grades are at variance with Drawings, Contractor shall promptly notify Architect and receive instructions prior to proceeding any further with the work. Contractor shall be fully responsible for all conditions resulting from his failure to do so. Contractor shall utilize a Registered Land Surveyor currently registered to practice land surveying in the State of Georgia.

F. Upon becoming aware of subsurface or latent physically changed conditions differing from those disclosed by the subsurface investigation, shall promptly notify the Owner and Architect verbally to permit verification of the conditions, and follow immediately in writing, regarding the nature and extent of the differing conditions. No claim by Contractor for any conditions differing from those anticipated in the Drawings and Specifications and disclosed by the subsurface investigation shall be allowed, unless Contractor has so notified Owner, verbally and in writing, as required above, of such changed conditions.

G. Remove from the project all qualified and quantified unsuitable materials, including all forms of rock, debris, organic materials and poor soils. Dispose of unsuitable materials legally.

H. Contractor is solely responsible for all earth quantities and to render the finished grade elevations of the Project as indicated on the Drawings unless provided for otherwise in this Specification or as otherwise directed by Architect.

I. Provide traffic protection by means of suitable signs, barricades, lights and personnel in accordance with the latest edition of the Manual of Traffic Control Devices (MUTCD).

J. Comply with rules and regulations governing respective utilities.

K. Protect downstream properties from encroachment or damage from increased or concentrated storm water flows, erosion, sediment or pollutants.

PART 2 – PRODUCTS

N/A

PART 3 – EXECUTION

N/A

END OF SECTION 31 0000

SECTION 31 0100 - MAINTENANCE OF EARTHWORK

PART 1 - GENERAL

1.1 Contractor shall provide additional fill material, remove excess material, or redistribute materials as required, should grades be changed by erosion or other causes during course of construction; without additional cost to Owner.

PART 2 – PRODUCTS

N/A

PART 3 – EXECUTION

N/A

END OF SECTION 31 0100

SECTION 31 0513 - SOILS FOR EARTHWORK

PART 1 - GENERAL

1.1 TOPSOIL

A. Existing Topsoil found on-site or imported to the site, shall consist of local, fertile, friable, natural soil of loamy character; free of soil lumps in excess of four inches (4”) in greatest dimension, stones in excess of one inch (1") in greatest dimension, and roots in excess of one inch (1”) diameter or twelve inches (12") length; typical of Project locality, and containing no chemicals harmful to plant growth or human health.

1.2 UNSUITABLE SOIL

A. Unsuitable soil materials consists of soil materials not capable of being compacted to density specified; rock material, as defined in this Section, larger than three inches (3"), debris and organic material including muck, which is a wet organic material that cannot support a light crawler tractor type of equipment and requires removal by power shovels or draglines; or material otherwise identified and designated as unsuitable by the Geotechnical Engineer.

B. Soil material which is too wet to permit the specified compaction but is still suitable to be used in a structural capacity (once dried) based on the recommendations of the Geotechnical Engineer, shall be spread and permitted to dry in an area to be designated by the Architect. Contractor shall assist drying by discing, harrowing or pulverizing until the soil moisture content is reduced to the specified value.

1.3 ROCK

A. Rock consists of three (3) types: Rippable Weathered Rock, Mass Rock and Trench Rock. Rippable Weathered Rock is considered part of the work. Payment for Mass Rock and Trench Rock removal shall be based on the unit costs provided in the Contract. Rock quantities shall be qualified and quantified by the Geotechnical Engineer and verified by the Architect. Rock is further described as follows:
   1. Rippable Weathered Rock is defined as residual material having a volume greater than one (1) cubic yard that, in the opinion of the Geotechnical Engineer, can be effectively plowed, spaded, or removed with power driven excavating equipment having been first loosened with a track-mounted bulldozer equipped with a single-tooth ripper shank, having a minimum draw bar pull rated at not less than 56,000 pounds.
   2. Mass Rock and Trench Rock are defined as residual material having a volume greater than one (1) cubic yard or more for mass excavation or one-half (½) cubic yard for trench or pit excavation that cannot be removed by rock excavating equipment equivalent to the following in size and performance ratings, without systematic drilling, ram hammering, or blasting.
      a. Mass Rock - Mass Excavation: Late-model, track-mounted bulldozer equipped with a single-tooth ripper shank; rated at not less than 230-hp flywheel power and developing a minimum of 56,000-lbf pryout force; measured according to SAEJ-732 (Caterpillar D-8K, Caterpillar 977 front-end loader or equivalent).
      b. Trench Rock - Excavation of Trenches and Pits: Late-model, track-mounted hydraulic excavator; equipped with a 42-inch-wide, short-tip-radius rock bucket; rated at not less than 120-hp flywheel power with a bucket-curling force of not less than 25,700-lbf and

stick-crown force of not less than 18,700 lbf; measured according to SAEJ-1179 (Caterpillar Model 225 or equivalent).

3. Blasting is not to be employed for rock removal in this project without written permission of the Owner.

1.4 FILL

A. Fill material consists of local, clean, non-active, organic free subsoil; free of debris, roots, topsoil and frozen material and capable of being compacted to the density required.

B. Maximum size of rock fragments shall be equal to or less than three inches (3") in the greatest dimension.

C. In areas of massive fills or disposal pits, the Geotechnical Engineer shall determine the maximum size of rock.

D. Materials classified as SM, SP, ML, SC or CL are suitable for structural fill. Generally, residual soils in the local area are suitable for reuse as structural fill provided that they meet the following criteria and shall be well graded within the following limits:
   1. Common fill shall consist of mineral soil substantially free from organic materials, loam, wood, trash and other objectionable materials which may be compressible or which cannot be properly compacted. Common fill shall not contain stones larger than three (3") inches in the largest diameter and shall have a maximum of 75% passing the No. 40 sieve and a maximum of 20% passing No. 200 sieve. Common fill shall not contain granite blocks, broken concrete, masonry rubble or other similar materials. It shall have physical properties such that it can be readily spread and compacted during filling. Soil excavated from the structural areas and which meets the above requirements may be used in embankments.
   2. Screened gravel shall meet the requirements of Section 806.2.02 of the State of Georgia Department of Transportation Standard Specifications for Construction of Roads and Bridges, 1993 or latest Edition.
   3. Partially weathered rock or rock no larger than three (3") inches in any dimension.

E. Soil should exhibit a plasticity index of less than 30 and a dry unit weight of at least 90 pcf unless more stringent requirements are indicated in the Geotechnical Report, in which case the more stringent requirements are to be followed.

F. Residual material to be used as fill material shall be tested and approved by Geotechnical Engineer for degree of compaction specified for its intended use.

G. For fill soils to be imported, Contractor is responsible to provide samples of same for laboratory testing by the Geotechnical Engineer to determine their Standard Proctor.

H. Identify the location of any "borrow pits" so that the Geotechnical Engineer Contractor may inspect same to determine suitability of the general soils which Contractor intends to import to the Project site.

PART 2 – PRODUCTS

N/A

PART 3 – EXECUTION

N/A

END OF SECTION 310513

SECTION 31 0516 - AGGREGATES FOR EARTHWORK

PART 1 - GENERAL

1.1 GRAVEL

A. Stone for Gravel Fill shall meet the quality requirements of Section 800 of the State of Georgia Department of Transportation Standard Specifications for Construction of Roads and Bridges, 1993 or latest Edition.

B. Gravel fill consists of sound, durable rock, free from contaminating soils, sands or organic matter of any kind, graded so 100% passes the 1-½" sieve, 95-100% passes the 1 inch sieve, 25-60% passes the ½ inch sieve, 0-10% passes the No.4 sieve and 0-5% passes the No.8 sieve.

1.2 CRUSHED STONE (Crusher Run)

A. Stone for Crushed Stone is consistent with Section 800 of the State of Georgia Department of Transportation Standard Specifications for Construction of Roads and Bridges, 1993 or latest Edition.

B. Crushed stone consists of sound durable particles of crusher run rock, 100% passing a two (2") inch sieve, 97-100% passing a one and one-half (1½") inch sieve, 60-95% passing a ¾ inch sieve, 25-50% passing a No. 10 sieve, 10-35% passing a No. 60 sieve, and not more than 7- 15% passing a No. 200 sieve and free from unsuitable materials.

1.3 GRANULAR BEDDING

A. Stone for Granular Bedding is consistent with Section 800 of the State of Georgia Department of Transportation Standard Specifications for Construction of Roads and Bridges, 1993 or latest Edition.

B. Granular bedding and backfill material shall consist of a granular soil, sand, chert, crushed stone or mixture of these, all of which passes a 3/4 inch sieve, 80% passing a 3/8 inch sieve, 40% passing a No.4 sieve, 10% passing a No. 8 sieve, and not more than 5% passing a No. 16 sieve. Material shall be free of organic matter and debris.

1.4 RIP RAP

A. Stone for Rip Rap is consistent with Section 805 Rip Rap of the State of Georgia Department of Transportation Standard Specifications for Construction of Roads and Bridges, 1993 or latest Edition.

B. Stone Dumped Rip Rap shall be processed in such a manner as to produce a quarry run material including rock fines which meet the gradation for the following two (2) types:

Type 1: For severe drainage conditions the largest piece of material shall have a maximum approximate value of two cubic feet. At least 35% of the mass shall be comprised of pieces which weigh 125 pounds or more.

Type 3: For general use normal drainage conditions the largest pieces of material shall have a maximum approximate value of one (1) cubic foot. At least 35% of the mass shall be comprised of pieces which weigh fifteen (15) pounds or more.

The remainder of Types 1 or 3 shall be well-graded down to the finest sizes. Rock fines shall comprise a maximum of 10% of the total mass. Rock fines are defined as material passing a No. 4 sieve.

C. Rip Rap consists of sound, durable pieces of granite or other local inert stone material resistant to the action of air and water. Flat, slabby and shaley pieces are not acceptable, clean and essentially free of rock dust and fines. The material shall be processed such that the largest pieces have a volume of not more than two (2) cubic feet and not more than 10% of the total weight of rip rap shall consist of spalls passing a five (5) inch sieve.

1.5 GRADED AGGREGATE BASE

A. Stone for Graded Aggregate Base is consistent with Section 815 of the State of Georgia Department of Transportation Standard Specifications for Construction of Roads and Bridges, 1993 or latest Edition.

B. Graded Aggregate Base material consists of stone particles 100% passing a two inch sieve, 97-100% passing a 1½ inch sieve, 60-95% passing a ¾ inch sieve, 25-50% passing a No. 10 sieve, 10-35% passing a No. 60 sieve, and not more than 7-15% passing a No. 200 sieve and free from unsuitable materials.

PART 2 – PRODUCTS

N/A

PART 3 – EXECUTION

N/A

END OF SECTION 310516

SECTION 31 1100 - CLEARING AND GRUBBING

PART 1 - GENERAL

1.1 DEFINITIONS

A. Clearing is the removal of all vegetative obstructions which interfere with the construction. These items may include minor structures above and below existing grades and below finished grades identified on the Drawings, trees and their complete root systems, brush, other vegetative material in any condition (i.e. chipped, cut, wrenched, etc.) debris, fences and other such items except items indicated to be preserved on the Drawings.

B. Grubbing is the incidental removal of all roots and stumps from the ground larger than ¾" in diameter.

1.2 Set and maintain any Erosion, Sediment and Pollution Control measures.

A. Protect adjacent and downstream properties from soil erosion. Comply with all Erosion, Sediment and Pollution Control measures specified elsewhere and required by applicable codes and ordinances.

B. Locate and mark all utilities, power poles and utility appliances or structures. Verify the horizontal and vertical locations. Protect existing facilities, utilities and adjacent property. Erect Erosion, Sedimentation and Pollution Control Measures illustrated on the Drawings.

1.3 Set and maintain any Active or Passive Tree, Limits of Disturbance or Vegetation Protection Fencing prior to clearing operations in accordance with the Drawings.

A. Protect areas outside limits of construction from encroachment by construction personnel or equipment regardless of property ownership. Set wooden post and orange safety fencing warning signs and other protective measures and warn the public of ongoing construction activities at limits of and a reasonable distance from the construction. Access shall be by specific written permission or easement only.

B. Construct 4'-0" high wooden post and perforated orange vinyl fencing around individual or groups of trees and shrubs designated to be preserved on the Drawings. Barricades shall be located at the drip-line of trees. Protect tree root systems from damage due to construction materials, construction operations, compaction and erosion.

C. Do not perform any clearing or any other construction operations, including material lay down beyond the approximate limits of construction or inside the limits of Tree Save Areas illustrated on the Drawings without express written consent of the Architect. Do not disturb existing trees or terrain unless illustrated on the Drawings.

D. Protect finished paved, grassed or planted areas from construction operations and debris.

E. Clear only those areas in which construction or grading operations are required and includes all excavated, graded and filled areas.

F. Protect all other areas from any damage as a result of clearing operations.

G. Remove all cleared material from Project site and legally dispose of off-site.

H. Unless otherwise directed, grub all cleared areas:
   1. In fill areas where design grade levels for building, roads or paved areas are to be placed, grub to minimum depth of twelve (12") inches below the finished design grade level as indicated on the Drawings.
   2. In all areas of excavation for structures, grub to the depth of the proposed excavation or to the depth that allows the area to be free of debris, rock, organic and inorganic materials, and unsuitable soils that would otherwise prevent the soil from being compacted to the density as indicated on the Drawings and stated in the specifications herein.

1.4 WORK INCLUDES, but is not limited to

A. Clearing and Earthwork equipment movement shall be limited to areas designated on the Drawings.

B. Do not disturb the existing terrain or existing vegetation outside the designated work area(s).

C. Debris from clearing and/or grading operations (cleared vegetative matter, trees, root systems, remnant chipped material, stumps, etc.) shall be removed from the site, unless specifically directed otherwise by the Owner.

D. At the Owner's sole discretion finely chipped vegetative matter may be utilized as mulch for slope protection.

PART 2 – PRODUCTS

N/A

PART 3 – EXECUTION

N/A

END OF SECTION 31 1100

SECTION 31 1400 - EARTH STRIPPING AND STOCKPILING

PART 1 - GENERAL

1.1 Strip any topsoil to full depth encountered in areas indicated to be graded on the Drawings.

1.2 Stockpiling may recur as required to complete all construction operations. Work includes intermittent movement of Topsoil from one location of the Project site to another.

1.3 Prior to stockpiling topsoil, remove tree limbs, tree roots, rocks larger than one inch (1") and other deleterious materials from the topsoil and remove from the site.

1.4 Where trees are indicated to remain, stop topsoil stripping at the Critical Root Zone (CRZ). CRZ equals 1.5 feet per caliper inch from tree trunk at 4.5’ height above ground at trunk; up to 20 inches where CRZ is a 30’ radius from tree trunk.

1.5 TOPSOIL STOCKPILING

A. Strip topsoil from all areas to be graded.

B. Stockpiling may recur as required to complete all construction operations. Work includes intermittent movement of Topsoil from one location of the Project site to another.

C. Prior to stockpiling topsoil, remove tree limbs, tree roots, rocks larger than one inch (1") and other deleterious materials from the topsoil. Removed materials shall become the property of the Contractor and hauled off the site and legally disposed.

D. Where trees are indicated to remain, stop topsoil stripping at the Critical Root Zone (CRZ).

E. Stockpile topsoil in manner to drain without ponding, and to avoid loss of material through erosion by wind or water.

F. Do not export any topsoil off-site unless approved in writing by the Architect.

G. Re-distribute a minimum of four inch (4") deep layer of topsoil fine graded to finish contour elevations illustrated in non-paved or building areas.

PART 2 – PRODUCTS

N/A

PART 3 – EXECUTION

N/A

END OF SECTION 31 1400

SECTION 31 2000 - EARTH MOVING

PART 1 - GENERAL

1.1 FIELD QUALITY CONTROL

A. Notify the Architect a minimum of every five (5) days to report the progress of work under this section so field soil engineering and testing services occur be provided during site preparation, excavation, fill placement and foundation phases of the Project. Do not proceed with additional portions of work until results of previous phases have been verified.

B. Geotechnical Engineer will verify all existing fill, topsoil, soils containing organic matter and all other undesirable materials are removed and only engineered fill is placed and compacted as specified over suitable subgrade soils.

C. If, during progress of work, tests indicate compacted materials do not meet specifications, remove defective work, replace and retest at no cost to Owner.

D. Verify compacted fills have been tested to specification prior to proceeding with placement of surface materials.

E. Geotechnical Engineer will observe all “benching” operations as fill placement progress to the existing slopes.

F. Geotechnical Engineer will observe building foundation construction as directed by the Building Architect, and determine the adequacy of bearing surfaces prior to construction of foundations.

G. Geotechnical Engineer will make all tests of backfill materials to determine their suitability for compaction, and will observe the placing of backfill as directed by the Architect.

H. Geotechnical Engineer shall have the power of rejection of materials, equipment or operating procedures of the backfilling operation. Replace, rework or correct work which does not meet the Specifications as directed by Architect at no cost to Owner.

I. Notify the Geotechnical Engineer at least 24 hours prior to the time testing will be required.

J. Additional tests on completed fill may be authorized by the Owner. If such tests indicate failure to meet the Specifications, the costs of these tests and subsequent retests will be paid by the Contractor. Otherwise, the costs of these tests will be paid by the Owner.

K. In-place density tests shall be performed by the Geotechnical Engineer according to the following requirements:
   1. In the general building area, conduct one (1) test for every 2,500 square feet for each two (2') feet depth.
   2. At wall and trench backfill areas, conduct one (1) test for every 50 lineal feet for each two (2') feet depth.
   3. In all cases, a test is required within the top foot of fill.
   4. Sidewalks - One (1) test for each two (2') foot lift of each 5,000 sq. ft. of area.

5. General area fills - One (1) test for each two (2') foot lift of each 10,000 sq. ft. of area.

1.2 RECORD "AS-BUILT" SURVEY

A. Contractor shall employ the services of an independent Registered Land Surveyor (R.L.S.) for the "As-Built" Record Drawings. The R.L.S. will hold active licensure and registration in the State of Georgia.

B. Provide a detailed "As-Built" topographic and utility survey of sufficient detail and accuracy to verify compliance with contract provisions. The minimum requirements for the survey shall include:
   1. +/- 0.05' for building corners and line.
   2. +/- 0.10' for drainage and utility structures.
   3. +/- 0.10' for pavements, walks and other improvements.
   4. Grid: Maximum of 25' - 0" grid.
   5. Contour interval: Maximum 2' - 0".

C. Survey data shall be furnished to the Architect utilizing both printed, hard copy and electronic file formats.
   1. Provide requisite numbers of survey on 30" X 42" sheets; each sheet containing an original surveyor's seal and signature.
   2. Provide two each CD ROMs containing survey data on a CAD version which is fully compatible with AutoCAD version 2008.

D. Re-Survey Responsibility: Where results of required survey prove unsatisfactory and do not indicate consistency of related work with requirements of Contract Documents, then re-surveys are the responsibility of the General Contractor, regardless of whether the original survey was the General Contractor's responsibility. The topographic and utility survey performed by the General Contractor shall be by the same Surveyor and meet the same requirements as the original verification survey described above.

E. Architect's Responsibilities: Upon receipt of survey data, Architect shall review the grades, elevations, lines and inverts for consistency with the grading design concepts and contract provisions. Architect will notify Contractor of inconsistencies or apparent deficiencies noted.

PART 2 – PRODUCTS

N/A

PART 3 – EXECUTION

N/A

END OF SECTION 31 2000

SECTION 31 2200 - GRADING

PART 1 - GENERAL

1.1 Contractor to furnish all labor, materials, equipment and incidentals required to perform all excavation, backfill, fill and grading required to complete the work as illustrated on the Drawings and as specified herein.

1.2 Provide all necessary shoring, sheeting and bracing for the protection of work and safety of personnel. Engage a Georgia Registered Professional Engineer highly experienced in the design of such shoring and bracing systems and perform the design engineering for said shoring and bracing. Do not backfill or load walls and structural systems until said walls or systems are completely developed and structurally sound.

1.3 Contact the Utility Protection Center at 1-800-282-7411 not less than three (3) working days prior to earthwork operations.

1.4 Burning of debris on the Project site will not be permitted.

1.5 Dewatering and Drainage procedures are included in the scope of the work. Do not proceed with excavation until suitable dewatering has been provided, if necessary, and approved by the Architect. Contractor shall prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding project site and surrounding area. Do not allow areas for water to pond. Execute necessary measures to eliminate water ponding. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation. Submit Dewatering procedures for review to the Architect. Dewatering shall be included in the contract sum and shall be provided at no additional cost to the Owner.

1.6 Rough Grading work includes but is not limited to:

A. Cutting, filling and backfilling.

B. Rough Grade the site to create surfaces on the Project site within 0.2’-0.4’ of the grade elevations illustrated on the Drawings.

C. Furnish, place and compact any additional material necessary to bring existing grades to new grades.

D. Engineering and execution of shoring and bracing of any closely adjacent buildings and structures.

E. Engineering and Shop Drawings for alternate Grading schemes of any nature.

F. Excavation, removal and replacement of unsuitable soil materials as described herein.

G. Rock removal as described herein.

H. Furnish and provide all means, methods, labor, equipment and materials to complete the satisfactory construction of the Project.

I. Incidental topsoil stockpiling, excavation, redistribution and/or importation for re-spread.

1.7 EXCESS, UNSUITABLE AND INSUFFICIENT MATERIALS

A. Remove and legally dispose of excess and unsuitable materials from Project site unless otherwise directed by the Architect. Unsuitable material may be placed on-site if, and only if, approved in writing by the Architect or Owner prior to any on-site distribution as a deductive change order and then shall only be placed in non-structural fill areas of the Project site designated by the Architect.

B. Provide satisfactory fill material in areas where existing materials are insufficient or unsuitable for earthwork operations.

C. If, in the opinion of the Geotechnical Engineer, the material in its undisturbed natural condition at or below the final design grade indicated on the Drawings is unsuitable for its intended use; it shall be removed and replaced with suitable material.

D. Contractor shall remove and replace unsuitable materials at the unit rates in accordance with the Bid Form. In accordance with the provision of the Agreement, the Contractor may be directed by the Owner's Representative to remove and replace unsuitable materials on a lump sum or time and materials basis should applicable unit rates not exist or not apply to the nature of unsuitable material encountered to be removed.

1.8 GRADING AND FILLING AROUND TREES

A. Obtain a copy Jackson County's Buffer, Landscape, and Tree Ordinance; which is hereby made a part of these Specifications; and follow all pertinent guidelines regarding Grading and Filling operations at or near Tree Save Areas as illustrated on the Drawings.

B. Maintain existing grade within Critical Root Zone (CRZ) of trees unless otherwise indicated.

C. Where existing grade is above new finish grade illustrated around trees, hand excavate within drip line to new grade. Cut exposed roots approximately three (3") inches below elevation of new finish grade. Employ a tree surgeon to recommend procedures such as pruning of branches and stimulation of root growth. Provide subsequent maintenance during the contract period as recommended and long range maintenance procedures to be followed after completion of construction operations.

D. Raising Grades (Where not supporting structures or pavements.)
   1. Clear plant materials to be removed and lightly grub areas to be filled. Light grubbing includes removal of stems, leaves and forest duff; while limiting damage to subsurface roots to the greatest extent practical.
   2. Where existing grade is four (4") inches or less below elevation of finish grade shown, provide fill using stockpiled topsoil. Use topsoil as specified. Place topsoil in single layer and do not compact.
   3. Where existing grade is more than four (4") but less than eight (8") inches below elevation of finish grade shown, place a layer of drainage fill on existing grade prior to placing

topsoil. Place fill against trunks of trees to an elevation of approximately two (2") inches above finish grade and extending not less than eighteen (18") inches from tree trunk on all sides. For balance of area within drip line perimeter, place drainage fill to an elevation four (4") inches below finish grade and complete fill with a four (4") inch layer of topsoil. Do not compact stone or topsoil layers.

4. Where finished grade is to be raised more than 8” within the drip line of trees to be preserved, place a (6”) inch minimum layer of drainage fill (graded aggregate) on existing grade prior to placing fill material. Do not compact drainage layer. Place compacted fill over drainage fill to (4”) inches from finished grade. Place (4”) inches topsoil over compacted fill to achieve finished grade. Do not compact topsoil.

1.9 FINE GRADING WORK INCLUDES BUT IS NOT LIMITED TO

A. Finish Grading of site to create surfaces on the Project site within 0.1’ of grade elevations illustrated on the Drawings.

B. Final placement of topsoil and fine grading of same.

C. Fine grading of all areas to provide a smooth contoured surface with positive drainage away from all structures and other use areas such that there are no areas of ponding. All areas to have positive drainage as illustrated on the Drawings.

1.10 QUALITY CRITERIA

A. Perform work in a manner consistent with applicable codes and ordinances and with requirements of authorities having jurisdiction. Make work under this Section consistent with:
   1. Applicable OSHA rules and regulations.
   2. Latest edition of the Jackson County Development Regulations.
   3. Goals, criteria and standards are conformed to the NPDES-GAR Permit 100001 as administered by the Georgia Environmental Protection Division.

B. Employ a Georgia Registered Professional Engineer or Georgia Registered Land Surveyor experienced in reading architectural and engineering drawings, using measuring devices and tape, and skilled in the use of surveying equipment necessary to perform construction layout surveying and establishing benchmarks and monuments required for all the work illustrated on the Drawings.

C. Earthwork monitoring and testing shall be performed by a Georgia Registered Geotechnical Engineer, selected and paid for by the Owner.

D. Make all excavation, backfilling and compaction consistent with the following Reference Standard Designations by the American Society for Testing Materials (ASTM), or as otherwise noted on the Drawings:
   1. ASTM C136-76-Sieve or Screen Analysis of Fine and Coarse Aggregates.
   2. ASTM D1556-64 (1974)-Density of Soil in Place by Sand-Cone Method.
   3. ASTM D698-Standard Proctor Compaction Test.
   4. ASTM D2167 (1972)-Density of Soil in Place by Rubber Balloon Method.

5. ASTM D2487-69 (1975)-Classification of Soils for Engineering Purposes.
6. ASTM D2922-78-Density of Soil and Soil Aggregate in Place by Nuclear Methods.
7. ASTM D2937-71-Density of the Soil in Place by Drive-Cylinder Method.

1.11 NOTIFICATION

A. Notify Architect 24 hours prior to commencing any earthwork operations such as clearing, grubbing, cutting (excavation), filling (backfilling or embankment).

B. Notify all utility providers prior to commencement of Earthwork operations.

C. Prevent interruption of utility service possible when utility lines which are to be removed, relocated and or severed are encountered.

1.12 SUBMITTALS

A. Submit detailed Shop Drawings and schematic diagrams as necessary to graphically describe all Shoring and Bracing procedures. Include calculations and schedules. Illustrate sequencing of all Shoring and Bracing.

B. Submit detailed time schedule of all Earthwork operations to the Landscape Architect/Engineer for review prior to commencing work.

PART 2 – PRODUCTS

N/A

PART 3 – EXECUTION

N/A

END OF SECTION 31 2200

SECTION 31 2216 - FINE GRADING

PART 1 - GENERAL

1.1 Finish grade disturbed areas, with a minimum four (4") inch depth of topsoil, in smooth, uniformly leveled, crowned, or contoured slopes between all new elevation surface points to existing, undisturbed grade elevations.

1.2 Grade areas adjacent to buildings for positive drainage to storm drainage structures and prevent ponding. Finish grades shall be within one tenth of a foot (0.1') of indicated elevations.

1.3 The Drawings indicate the levels, slopes and contours of finished grade elevations for the entire site. Slight modifications as determined by the Architect may be required. Contractor shall make these modifications without extra cost to Owner.

1.4 Where compacted areas are disturbed by construction operations, scarify surface, reshape and compact to required density.

1.5 Redistribute stockpiled topsoil to uniform depth over graded areas and other areas to receive landscaping or grassing, in a four (4") inch minimum depth. In the event that stripped topsoil is not sufficient to render a four (4") inch minimum depth, import clean topsoil sufficient to render a minimum four (4") inch depth as part of the no additional cost.

1.6 Redistribute excess topsoil, subsoil from footing excavations, other soil matter and debris onto approved areas of the Owner's property at no additional cost to the Owner.

1.7 At completion of finish grading operation, entire site shall be ready for planting or grassing.

1.8 Where finish grading meets or abuts curbs, walks or similar pavements, upstream grades shall be slightly higher than pavements to permit drainage and prevent ponding behind curbs or walks.

1.9 Protect existing and newly graded surfaces from traffic and erosion and keep free of debris. Where graded or compacted surfaces are damaged by subsequent operations, return to proper grade and state of compaction.

1.10 CLEAN-UP

A. Do not place such debris on private property without written consent of the Architect and the Owner of such property.

B. Do not place debris or grubbed material around perimeter of site.

C. Remove all non-organic debris, trash, etc. from the site and dispose of in compliance with all applicable laws and regulations.

PART 2 – PRODUCTS

N/A

PART 3 – EXECUTION

N/A

END OF SECTION 31 2216

SECTION 31 2316 - EXCAVATION

PART 1 - GENERAL

1.1 Excavation shall be made to the design lines and levels illustrated on the Drawings or to such depths, whichever is greater, as further described elsewhere in this section and to such widths as will give suitable room for construction of the structures, for bracing and supporting, pumping and draining and inspection. The bottom of the excavations shall be rendered clean, firm, level and dry and in all respects acceptable to the Architect. Where changes in levels occur, provide vertical steps in horizontal runs.

1.2 Excavation and dewatering shall be accomplished by means and methods which preserve the undisturbed state of subsurface soils. Exposed subsurface shall be proof-rolled with at least two (2) passes of the Proof rolling equipment. Geotechnical Engineer may waive this requirement if, in his/her opinion, the subsurface will be rendered unsuitable by such compaction. Subsurface soils which become soft, loose, “quick”, or otherwise unsatisfactory for support of structures as a result of inadequate excavation, dewatering, proof-rolling, or other construction methods shall be removed and replaced by structural fill as required by Geotechnical Engineer at Contractor’s expense.

1.3 Dewatering shall be such as to prevent boiling or detrimental under-seepage at the base of the excavation as specified herein.

1.4 Contractor shall prepare subsurface areas for all structures unless otherwise illustrated on the Drawings or otherwise specified elsewhere in this Section.

A. Roughly level and proof roll these areas with a heavily loaded 20-30 ton dump truck making at least four (4) passes (two passes being perpendicular to the others).

B. Compact the top twelve inches (12”) of fill below subsurface to a minimum of 98 percent Standard Proctor (ASTM D698).

1.5 Excavation equipment shall be satisfactory for carrying out the work in accordance with the requirements specified. In no case shall the earth be ploughed, scraped, or dug with machinery so near to the finished design limits indicated on the Drawings as to result in excavation of, or disturbance of material below design limits. The last of the material loosened by mass excavation shall be removed with pick and shovel immediately prior to placement of concrete or the working mat.

1.6 When excavation for foundations has reached prescribed depths, the Geotechnical Engineer shall be notified and will inspect conditions. If materials and conditions are not satisfactory to the Geotechnical Engineer, the Geotechnical Engineer will issue instructions as to the procedures to resolve the issue(s) in question.

1.7 During final excavation to design limits as indicated on the Drawings, take whatever precautions are required to prevent disturbance and remolding. Material which has become softened and mixed with water shall be removed. Hand excavation of the final three (3”) inches to six (6”) inches will be required as necessary to obtain a satisfactory undisturbed bottom.

1.8 Over-excavation by Contractor beyond the design limits and depths required or indicated on the Drawings shall be replaced with lean concrete, compacted structural fill, crushed stone, or other materials as directed by the Architect at no additional expense or extension of the contract time.

1.9 If soil conditions permit, cut footing trenches to exact size of footing and omit forms. Notify Architect if earth of doubtful bearing is encountered. If adequate bearing is not encountered within eight (8") inches of depth illustrated on the Drawings, excavations shall be carried deeper upon written authorization and paid for as additional work in accordance with Contract Conditions.

1.10 If excavations are carried deeper than required by the Drawings or the specifications in error, the additional depth shall be filled with materials specified for footings or concrete of class specified for footing at no additional cost.

1.11 Protect excavations against cave-ins, ponding and freezing. When freezing can be anticipated prior to placing of concrete, protect excavations or delay carrying excavations to full depth until concrete can be placed.

1.12 Maintain excavations free of surface water. Provide pumps if required to drain excavations. Provide and maintain temporary drainage ditches as required.

1.13 Notify Geotechnical Engineer when footing excavations are complete. Geotechnical Engineer will perform appropriate density testing of the excavations prior to placing formwork, reinforcement steel, anchor bolts and concrete.

1.14 Contractor shall be fully responsible for all damage to any part of the site, building structures or other installations, caused by water.

1.15 Concrete should be placed the same day earth excavation is made. If it is necessary for excavations to remain open overnight, provisions should be made to prevent collection of surface run-off in the excavation.

PART 2 – PRODUCTS

N/A

PART 3 – EXECUTION

N/A

END OF SECTION 31 2316

SECTION 31 2316.26 - ROCK REMOVAL

PART 1 - GENERAL

1.1 If rock is encountered, clear away earth and expose materials. Notify Architect and receive written instructions prior to excavations. Measure and estimate extent of rock to be excavated. Geotechnical Engineer shall identify, qualify and verify in writing whether the material shall be classified as rock and shall confirm the extent and quantity of rock to be excavated.

1.2 Contractor shall remove rock in accordance with the following:

A. Remove rock to a depth of twelve (12") inches below proposed pavements and remove rock to a depth of six (6) inches below slab.

B. Thirty-six (36") inches on each side of and below footings of the proposed building walls.

C. Six inches (6") below and eight (8") inches to each side of conduits, ducts and pipes installed in Site utility trenches, with minimum width of thirty-six (36") inches.

D. Twelve (12") inches below finished grade in areas to receive landscaping, sodding and seeding.

1.3 Blasting is not to be employed for rock removal in this project without written permission from the Owner. The Contractor must notify the Owner's insurance company of intent prior to initiating blasting related activity. Engage skilled mechanics to perform blasting. Provide heavy mats to minimize concussion. Handle, store and use explosives in accordance with the "Manual of Accident Prevention in Construction of the Associated General Contractors of America, Inc.", latest edition, with amendments.

A. In the event blasting is deemed necessary and is approved; Contractor shall notify residents within ½ mile radius of the site of intent to conduct blasting operations and furnish all monitoring of existing structures within ½ mile radius as part of the Unit Price for rock excavation established in the Bid Form.

PART 2 – PRODUCTS

N/A

PART 3 – EXECUTION

N/A

END OF SECTION 31 2316.26

SECTION 31 2323 - FILL

PART 1 – GENERAL

1.1 Preparation of Surface to Receive Fill (Reference and follow the Geotechnical Engineer's recommendations in his report).

A. Remove vegetation, top soil, debris, unsuitable soil materials, obstructions and deleterious materials from ground surface prior to placement of fill. Break up (and periodically cut benches into) sloped surfaces steeper than one vertical to four horizontal so that fill material will bond with existing surface. Surfaces to receive fill material shall be inspected and approved by Geotechnical Engineer.

B. When existing ground surface has density less than that specified for particular area classification, break up the ground surface, pulverize, moisturize soil to optimum moisture content, and compact to required depth and percentage of maximum density.

C. Subgrade shall be proof-rolled with a 20 to 30 ton heavily loaded dump truck, scraper or similar rubber tired equipment in the presence of Geotechnical Engineer. Proof-rolling shall be performed in two mutually perpendicular directions, with at least two (2) passes in each direction. Areas which exhibit signs of instability that cannot be stabilized with further compaction, shall be undercut to a suitable grade and backfilled with structural fill.

1.2 Create an eight foot (8’) to ten foot (10’) wide bench for every fifteen vertical foot (15 VF) of fill placed. Insure stable interface between old fill and newly placed fill.

1.3 Place fill materials in layers not more than six inch (6”) loose depth. Before compaction, moisten or aerate each layer to provide optimum moisture content plus or minus 2%, or as specified in soils report. Reference compaction requirements of fill elsewhere in these specifications. Do not place backfill or fill material on muddy, frozen surfaces or surfaces containing any frost or ice. Compaction shall be tested by Geotechnical Engineer.

1.4 No soil found on the site or transported to the site which is contaminated with material containing asbestos, PCB's, radon, gasoline, fuel oil or other fossil fuels shall be used for fill, backfill, or planting topsoil. Any contaminated soil found on the site shall be removed and disposed of in a manner approved by the appropriate regulatory agencies.

PART 2 – PRODUCTS

N/A

PART 3 – EXECUTION

N/A

END OF SECTION 31 2323

SECTION 31 2323.23 - COMPACTION

PART 1 - GENERAL

1.1 COMPACTION

A. Perform compaction of soil materials for fills using mechanical soil compaction equipment for type and size materials to be compacted. Hand compact materials in areas inaccessible to machinery.

B. Provide the percentages of specified compaction at the specified moisture content in the specified lifts as outlined in the Geotechnical Report. If no specification is given in said report, use the following as a minimum at 3% plus or minus of optimum moisture content placed in six (6") lifts:
   1. Provide 95% maximum dry density with top twelve (12") inches to 98% maximum dry density for fill under building slabs, extending beyond the building outlines a distance equal to twice the height of the fill beneath any edge of building. Fill should then slope not steeper than one vertical to two horizontal (2H:1V);
   2. Provide 95% maximum dry density with the top twelve (12") inches to 98% maximum dry density for fill under asphaltic pavements;
   3. Provide 95% maximum dry density Standard Proctor and top twelve (12") inches to 98% maximum dry density for fill under concrete footings, concrete sidewalks, concrete steps and concrete ramps and trench backfill;
   4. Provide 90% maximum dry density for all other non-paved fill material unless otherwise indicated.

C. Where subgrade or soil layer must be moisture conditioned before compacting, apply water to surface of subgrade or soil layer. Scarify and air dry soil material that is too wet to permit compaction to specified density.

D. Soil material that has been removed because it is too wet to permit compaction may be stockpiled or spread where directed by Geotechnical Engineer and permitted to dry. Assist drying by discing, harrowing or pulverizing, until moisture content is reduced to satisfactory value, as determined by moisture density relation tests. When accepted by the Geotechnical Engineer, soil material may be used in compacted backfill or fill.

E. Remove unsuitable material at the site for the proposed structures and paved areas from the existing grade. No water shall be allowed to accumulate in the excavation or on the subgrade soils during construction. Soils which will be exposed during construction are very sensitive to disturbances and strength degradation in the presence of excess moisture. They are also frost susceptible. The amount of time natural subgrade is exposed to the elements must be minimized in order to prevent possible subgrade degradation. Work must be completed such that excavation, inspection, undercutting, backfill and/or concrete mud matting can be accomplished expeditiously in a given area.

F. Contractor shall verify the bearing capacity prior to placing footings. If tests indicate less than assumed capacity, receive instructions from the Architect.

1.2 PROOFROLLING

A. After the site has been properly drained, and all organic surface soils have been removed, the site shall be inspected by Geotechnical Engineer and proofrolled at that time.

B. Proofrolling shall consist of several overlapping passes of heavily loaded 20-30 ton dump truck.

C. The purposes of the proofrolling will be to detect any areas where soft or unstable soils are present, as well as to improve the density of the loose near-surface soils.

D. Proofrolling shall be performed in the presence of the Geotechnical Engineer who can observe any areas where remedial action may be required.

E. Any soft or yielding areas shall be thoroughly undercut and replaced with well-compacted structural fill 95% Standard Proctor with the top twelve (12") inches compacted to 98% Standard Proctor Density or as specified by the Geotechnical Report.

F. The groundwater level should be maintained at a depth of at least two (2') feet below the depth of vibratory rolling operations. This work should be anticipated.

G. A minimum of four (4) complete overlapping passes shall be made in each of two perpendicular directions.

PART 2 – PRODUCTS

N/A

PART 3 – EXECUTION

N/A

END OF SECTION 31 2323.23

SECTION 31 2333 - TRENCHING AND BACKFILLING FOR UTILITIES

PART 1 - GENERAL

1.1 Excavation for all trenches required for the installation of pipes and ducts shall be made to the design levels indicated on the Drawings and in such a manner and to such widths as will give suitable room for laying the pipe or installing the ducts within the trenches, for bracing and supporting, and for pumping and drainage facilities. Bottoms of excavations shall be rendered firm and dry and in all respects acceptable to the Geotechnical Engineer. Bituminous pavement, when encountered, shall be cut with pneumatic chisels along smooth and straight lines before excavating. Saw-cutting is required on all asphaltic concrete.

1.2 Where pipe or ducts are to be laid in gravel or sand bedding or encased in concrete, the trench may be excavated by machinery to, or within 3" inches below the design level indicated on the Drawings provided existing earth sub grade in the bottom of the trench is not disturbed.

1.3 Where pipe or ducts are to be laid directly on the trench bottom, the lower part of the trenches shall not be excavated to the design level by machinery, the last of the material being excavated manually in such a manner that will give a flat bottom true to grade so that pipe or duct can be evenly supported on undisturbed material. Bell holes shall be made as required.

1.4 When excavation methods include the use of a steel trench box, comply with the following requirements:

A. When installing rigid pipe Reinforced Concrete Pipe (RCP), Ductile Iron Pipe (DIP), etc, any portion of the box extending below mid diameter of the pipe shall be raised above this point prior to moving the box ahead to install the next pipe. This is to prevent the separation of installed pipe joints due to movement of the box.

B. When installing flexible pipe (PVC, ABS solid wall, ABS truss, etc.), the bottom of the box shall not extend below mid diameter of the pipe. This is to prevent loss of soil between the box and the pipe bedding which could result in excessive deflection of the installed pipe.

1.5 Backfilling over ducts, pipes, conduits, etc. shall begin not less than three days after placing concrete encasement or until the test sample achieves prescribed strength of tested sample.

1.6 Where pipe is to be installed in fill of any type, fill shall be placed and compacted to the total depth required and then re-excavated for pipe installation.

1.7 As soon as practicable after the pipe has been laid and jointed, backfilling shall begin and thereafter is completed expeditiously. If required, as illustrated on the Drawings, screened gravel shall be placed around the pipe to its mid-diameter. As the screened gravel is placed, it shall be compacted by suitable tools. Compaction shall meet a minimum criterion of 98% Standard Proctor at or near its optimum moisture content (minus 2 to plus 3 percent).

1.8 For Aluminized Steel, Type 2 (AST2) and HDPE pipe for storm sewer system refer to Jackson

County Standards.

1.9 For Plastic (PVC) pipe for drainage systems or roof leaders grade trench bottom to uniform slope to provide a firm, unyielding bearing surface along the entire length of the barrel of the pipe. Continue backfilling with suitable soil in six (6") inch layers by hand, tamping material by hand operated tampers to a level eighteen (18") inches above top of pipe.

1.10 Form depressions for hubs and similar joints only in size as required for making joint.

1.11 In areas of rock excavation, and where needed in other areas, provide crushed stone bedding for all pipes.

1.12 Provide bedding over the full width of excavation to a minimum depth of six (6") inches under pipe.

1.13 Whenever the subsurface is unstable or too soft to provide a satisfactory pipe foundation for any pipe, undercut the trench as necessary and backfill with crushed stone. Compact and bring the material to proper grade to create a firm, unyielding foundation.

1.14 After the bedding, if required, has been placed to the mid-diameter of the pipe, select common fill shall be placed to a depth of twelve (12") inches over the top of the pipe. Material shall be thoroughly compacted by hand-tamping as placed with at least one man tamping for each man shoveling material into the trench. Compaction shall result in achieving a 95% Standard Proctor test at optimum moisture content.

1.15 Where pipes are laid in unpaved areas, the remainder of trench shall be filled with common fill in layers not to exceed twelve (12") inches and thoroughly compacted by rolling, ramming, or puddling sufficiently to prevent subsequent settling to 95% Standard Proctor at or near its optimum moisture content (minus 2 to plus 3%). Backfill shall be mounded three (3") inches minimum above the finish or existing grade or as directed by the Geotechnical Engineer. Wherever a loam or gravel surface exists prior to excavations, it shall be removed, conserved and replaced to the full original depth as part of the work under pipe items. In some areas it may be necessary to remove excess material during clean-up process, so that the ground may be restored to its original level and condition. If Contractor prefers not to store loam, gravel, or topsoil he/she shall replace it with material of equal quality and in equal quantity.

1.16 Where pipes are laid in streets, or other paved areas, the remainder of the trench above the bedding and up to a depth of twelve (12") inches below the bottom of the specified paving shall be backfilled with common fill in (6") inch (max.) layers thoroughly compacted by rolling or ramming to 98% Standard Proctor. The twelve (12") inch layer below the bottom of the specified paving shall be of Class A or B stone, compacted in six (6") inch layers to 98% modified Proctor.

1.17 Along the length of all pipeline and duct trenches, impervious dams or bulkheads of clay thirty-six (36") inch thicknesses or concrete twelve (12") inch thickness shall be constructed in the trench bottom at three-hundred (300') foot intervals or at manholes and structures, whichever is less, to obstruct the free flow of groundwater after construction is completed. Provide impervious dams at all points where a pipe trench enters an excavated area where a permanent under drain system is

installed.

1.18 Do not over-excavate. If specified trench widths are exceeded, Architect may require installation of stronger pipe or special installation procedures at no additional cost to Owner.

1.19 Water line trenches shall be excavated to avoid high points requiring the installation of vacuum and relief valves below the frost line.

1.20 Cutting and removing existing pavements where required shall be done in neat lines. As described in paragraph 1.1 above.

1.21 Do not backfill over utility lines which have not passed required testing or inspections, including the Geotechnical Engineer‘s inspection of the subsurface.

1.22 Contractor is to continue to backfill all trenches with suitable fill material in six (6”) inch lifts immediately after the pipe is laid or bedded as described in this section using suitable soils and adhering to the backfilled requirements of paved or unpaved areas. Compact trench backfill with portable compaction equipment.

1.23 If sufficient suitable excavated material is not available on site, provide sufficient and suitable borrow material for backfill.

1.24 Backfill from twelve (12”) inches above the pipe to finish grade shall be as follows:

A. Trenches in areas not to be paved may be backfilled and compacted by methods of Contractor’s choice. Compact backfill to 95% Standard Proctor Density. Refill the trench as often as required to maintain the design elevation at proper grade.

B. Trenches in areas to be paved and in areas beneath proposed structures shall be backfilled with granular material. Compact backfill to 98% Standard Proctor Density.

C. Compact backfill further, if necessary, by the use of compaction equipment as required. Refill settlement in trenches with acceptable materials and continue such maintenance until pavement placement is authorized by the Geotechnical Engineer.

1.25 Fill and backfill materials shall not be placed on frozen surfaces, or surfaces covered by snow or ice. Fill and backfill material shall be free of snow, ice and frozen earth.

1.26 UTILITY TRENCHES

A. Excavate trenches to a maximum width equal to pipe diameter plus 2'-0" for pipes 30" diameter and smaller; 2'-6" plus pipe diameter for pipe exceeding 30" diameter. Minimum excavation width shall be 3'-0". Do not over-excavate. If specified trench widths are exceeded, Architect may require installation of stronger pipe or special installation procedures at no additional cost.

B. The bottom of trenches, when in rock, shall be excavated a minimum of 6" below required bottom of pipe, refilled with fill material free of rock larger than 3" in any dimension, and compacted to bedding level to provide uniform bearing and support along the length of each

pipe section.

C. Pipe shall be carefully bedded in soil foundation.

D. Water line trenches shall be excavated to avoid high points requiring the installation of vacuum and relief valves below the frost line.

E. Cutting and removing existing pavements where required shall be done in neat lines.

F. Contractor shall backfill and compact trenches and/or underground cable installations by public utility companies in accordance with this section, as needed.

1.27 EXCAVATION EMBANKMENT AND BRACING

A. Contractor is responsible for all excavations. Protect all excavation embankments against collapse. Embankments over 5'-0" high shall be made at a slope not greater than 1½ horizontal to 1 vertical; or where the soil is very sandy or wet, the slope should not be greater than 2 horizontal to 1 vertical. Steeper slopes than those suggested herein may be employed when the work is under the supervision of a Registered Professional Engineer responsible for the design engineering of all shoring and bracing techniques required to accomplish the work and shall be employed by the Contractor.

B. Provide safe embankment slopes. All banks shall be temporarily supported and maintained secure until permanent support has been provided.

C. Where ditches or trenches are over 5'-0" deep cross bracing and shoring shall be provided to prevent collapse.

D. Provide bracing systems designed by a Registered Professional Engineer in the State of Georgia, experienced in such designs and acceptable to the Architect. The Drawings shall show the work and sequence in its entirety and be submitted to the Architect for approval prior to commencing work.

E. Prevent caving, or settlement of earth adjacent to excavations, and protect all persons as well as property. Shoring, brace work to meet the conditions in each particular case until construction has reached a point where backfill behind walls or ditches have been made and the need for shoring and bracing eliminated.

1.28 BEDDING

A. Conform to the following Specifications unless illustrated otherwise elsewhere in these documents
   1. For ductile iron, cast iron or plastic (SDR) pipe for water main or sanitary sewer system refer to Jackson County Standards.
   2. For Aluminized Steel Type 2 pipe (AST2), concrete pipe (RCP) or plastic (PVC) (HDPE) pipe for storm water drainage systems or roof leaders, grade trench bottom to a uniform slope to provide a firm, unyielding bearing surface along the entire length of the barrel of the pipe. Bed pipe in trenches on continuous soil foundation shaped to lowest one-fourth of

pipe profile, unless illustrated otherwise in these documents. Continue backfilling with suitable soil in (6”) inch layers by hand, tamping material by hand operated tampers to a level (18”) inches above top of pipe. Form depressions for hubs and similar joints only in size as required for making joint.

3. In areas of rock excavation, and where needed in other areas, provide crushed stone bedding for all pipes. Provide this bedding over the full width of the excavation to a minimum depth of six (6”) inches under the pipe.
4. Whenever the sub-grade is unstable or too soft to provide a satisfactory pipe foundation for any pipe, undercut the trench as necessary and backfill with crushed stone. Compact and bring the material to proper grade to create a firm, unyielding foundation.

1.29 TRENCH BACKFILLING

A. Do not backfill over utility lines which have not passed required testing or inspections including:
   1. Geotechnical Engineer inspection of subgrade.
   2. Inspections, testing and re-grading locations of subgrade utilities.

B. Backfill all trenches and excavations immediately after the pipe is laid using suitable soils:
   1. If sufficient suitable excavated material is not available on site, provide sufficient and suitable borrow material for backfill. See Paragraph 2.3 of this section.
   2. Backfill from (18”) inches above the pipe to grade shall be as follows
      a. Trenches in areas not to be paved may be backfilled and compacted by methods of Contractor's choice. Compact backfill to 90% Standard Proctor Density. Refill the trench as often as required to maintain the design elevation at the proper grade.
      b. Trenches in areas to be paved and in areas beneath proposed structures shall be backfilled with granular material. Compact backfill to 95% Standard Proctor Density with the top twelve (12") inches compacted to 98% Standard Proctor Density or as specified by the Geotechnical Report. Compact backfill further, if necessary, either by leaving the backfilled trench open to traffic while maintaining the surface or by the use of compaction equipment as required. Refill settlement in trenches with material acceptable to the Geotechnical Engineer and continue such maintenance until pavement placement is authorized by the Owner's Representative.

PART 2 – PRODUCTS

N/A

PART 3 – EXECUTION

N/A

END OF SECTION 31 2333

SECTION 31 2500 - EROSION AND SEDIMENTATION CONTROLS

PART 1 - GENERAL

1.1 SCOPE

A. Work described in this section includes the on-site containment of sediment transport, control of erosion and treatment of pollutants prior to, during and throughout all construction operations; establishment of permanent vegetative cover and continued maintenance of said measures in accordance with Paragraph. 1.8 - Maintenance of this section. Erosion, Sediment and Pollution Control is hereinafter referred to as ESPC.

B. Contractor is solely responsible for protection of downstream properties from encroachment or damage from soil erosion and/or the discharge of pollutants by water or air to any areas off the Project site.

C. All control measures illustrated on the Drawings are to be considered the minimum required; additional control measures will be added if determined to be needed by any on-site inspections. Provide same as required.

D. Contractor will be the "Operator" and will, together with the owner, the "Primary Permittee" as defined in the most current edition of Georgia EPD NPDES, GAR 100001 Permit (the Permit). The Contractor is responsible for filing the required Notice-of-Intent (NOI); for initial notification for the new facility construction site and all ESPC measures throughout construction and the filing of a Notice of Termination (NOT). Once one hundred percent (100%) permanent vegetative cover is established on all disturbed areas of the site. After the NOT is filed the Owner will take over responsibility of the Site.

E. All discharge monitoring shall be the responsibility of the Owner.

F. The State of Georgia, DNR, EPD, NPDES GAR 100001 Permit (the Permit) is hereby made a part of these Specifications by reference. As such Permit criteria are hereby made a part of Contractor's work.

G. The Contractor shall furnish and supply all means, methods, labor, equipment and materials necessary to complete satisfactory ESPC for the project.

1.2 SUBMITTALS

A. Schedule of Operations
   1. Submit schedule of exact dates operations including program for ESPC measures, maintenance of all said measures including control facilities, structures and devices and vegetative practices.

   2. Show anticipated starting and completion dates for land-disturbing activities including excavation, filling and rough grading, finished grading, construction of temporary and permanent control measures, and disposition of temporary erosion sediment and pollution control measures.

B. Proposed substitutions of products shall be submitted for approval not less than 30 days prior to anticipated installation date; and shall be evaluated based on product manufacture, appearance and performance. The Contractor will be responsible for submitting all documentation supporting proposed products. Acceptance or rejection of products offered as “Equivalent” for Substitution shall be at the sole discretion of the Owner.

C. Slopes 3:1 and steeper: Submit a sample, proposed installation methods and manufacturer’s cut sheet for erosion control blanket material such as:
   1. "Curlex II” with biodegradable FibreNet on both sides.
   2. BioD-StrawCoco with 30% coconut fiber matrix and natural biodegradable netting on both sides.
   3. “Tensar, North American Green BioNet SC150BN" erosion control blanket with biodegradable thread and 30% coconut fiber matrix.
   4. Other approved equal.

D. Slopes 3:1 and flatter: Submit a sample, proposed installation methods and manufacturer’s cut sheet for erosion control blanket material such as:
   1. “Curlex NetFree” 100% biodegradable erosion control blanket.
   2. “Tensar, North American Green BioNet S150BN" erosion control blanket with biodegradable thread.
   3. “Jute Mat” with a minimum weight of 14.7 oz. per sy.
   4. Other approved equal. Products with plastic/polypropylene netting are not to be used on potentially mowable slopes.

E. “Profile Flexterra (FGM)” or approved equivalent may be utilized in lieu of Erosion Control Blankets. Submit a drawing outlining mix specifications, application rates, and application methods for hydraulically applied “Profile Flexterra (FGM)”. Submit proof of applicators’ experience with use of product, demonstrating a minimum of three successful local applications of similar scope.

F. Submit a sample of the synthetic polymer such as “Siltstop” by Applied Polymer Systems or approved equivalent.

G. Submit a sample of Type C silt fence such as “Mirafi Filterweave 402" or approved equivalent.

1.3 PROJECT CONDITIONS

A. Visit the site and thoroughly familiarize himself with all existing condition and all previous drawings and specifications prior to formulating Bid.

B. Furnish and install all other ESPC control measures prior to or concurrent with any further land disturbance activity.

C. Maintain and continue to maintain all ESPC measures throughout all construction operations and all sequences of construction operations.

D. Schedule grading operations to allow permanent ESPC measures to be constructed in the same construction season.

E. Avoid or minimize exposure of soils to winter weather.

F. Maintain all controls until vegetative cover has been established.

G. Construct and maintain temporary control measures until such time as permanent measures are effective in control of erosion, sediment and pollution from the site.

H. Extent of measures shall be responsibility of Contractor.

I. Stop all erosion, sediment or pollution from leaving the site and encroaching on downstream or surrounding properties.

J. Temporary grassing shall be applied to all disturbed areas left idle for seventy two hours (72) per “Manual for Erosion and Sediment Control in Georgia”, latest edition published by the “Georgia Soil and Water Conservation Committee”.

L. Contractor is responsible for quantities of all control measures regardless as illustrated on the Drawings.

M. Extent of soil erosion control measures illustrated on the Drawings should be considered minimum.

1.4 QUALITY CRITERIA

A. Comply with "Manual for Erosion and Sediment Control in Georgia", latest edition published by the Georgia Soil and Water Conservation Committee." Contractor shall possess and keep a copy of the Manual on-site at all times.

B. Keep a log book on site documenting his inspection of all ESPC measures (minimum once/week and within 24 hrs of any storm event) and noting any corrections or modifications.

C. Reference the Drawings for any other procedural manuals, publications, permits or other field guidelines required for the Contractor to obtain, understand and utilize in the performance of his work. By reference of same, said materials are made a part of these Specifications. Keep a legible copy of said manuals, publications, permits or other guidelines onsite at all times.

D. Reference the State of Georgia EPD NPDES - GAR 100001 Permit and comply with all Quality Control criteria therein as it applies to the “Operator” of the Primary Permitted.

1.5 EXECUTION

A. Construct temporary sediment barriers of silt fence at all points where surface water flows from construction area bypassing temporary sediment traps if the area is subject to soil erosion; or as otherwise indicated on Drawings or as deemed necessary by the Architect and County Inspectors.

B. Install temporary sediment traps and temporary sediment basins in accordance with the location and details illustrated on the Drawings.

C. Continually remove accumulated sediment when they are one-third full of silt continually until permanent vegetative cover is established.

D. Install construction exit as indicated on Drawings. Maintain to prevent tracking and flow of mud onto public roads.

E. Construct diversion berms, dikes (2'-0" wide x 1'-6" tall) or ditches at the tops of all slopes or as otherwise indicated on the Drawings, to intercept storm water runoff from higher areas and to divert it from exposed slopes to a stabilized outlet.

F. Construct flexible down drains to convey concentration of storm water down the face of cut or fill slopes, or as otherwise indicated on the Drawings, to intercept storm water from higher to lower levels without causing slope erosion. Machine compact these elements and plant temporary seed until permanent vegetative cover can be established.

G. Maintain temporary barriers until permanent erosion control measures are established. Repair and replace barriers damaged or displaced by construction activity.

H. Contractor shall clean out and/or adjust temporary sediment basin(s)/facility elevations to specified depth throughout duration of Project after stabilization of all disturbed areas.

I. Compact embankment of sedimentation basin to minimum 95% Standard Proctor to the grade elevations illustrated on the Drawings.

1.6 SEDIMENTATION FACILITIES

A. Temporary sedimentation control measures shall be constructed concurrently with fine grading or partial fine grading of site and vegetative stabilization.

B. Direct surface water into completed portions of sedimentation facility.

C. Maintain temporary sediment traps around and at all drainage structures until permanent vegetative cover has been established to prevent washing of sediment into public storm sewer system.

D. Utilize “pigs-in-a-blanket” as temporary sediment traps at all completed or partially completed single wing, double wing catch basins, drop inlets and yard inlets on the site and at any existing basins and inlets adjoining the site that can be affected by sediment washing off the site.

E. Flush drainage lines between manholes and drainage structures as required during construction and after establishment of permanent erosion control measures to remove collected debris.

F. Install rip rap at all locations indicated on Drawings as soon as feasible.

G. Rip rap shall be reasonably well-graded granite stone sized from smallest to maximum size specified. Stones smaller than smallest size specified is not permitted. Control gradation of rip rap by visual inspection to assure thickness of rip rap conforms to contract document requirements.

H. Provide geo-textile filter fabric under rip rap.

I. After land disturbance operations of any kind, survey the sediment facility and determine that sediment volume that is available.

J. If specified volume is not available, disassemble control measures, excavate sediment from facility and install control measures.

K. Dispose of excavated sediment from facility, spread over slopes in accordance with contours illustrated on the Drawings and stabilize facility with permanent vegetation.

L. Prepare and submit a certified statement of correct sediment facility volume.

M. Do not dispose of any excavated sediment into any drainage way which might lead said material off-site onto adjacent downstream properties.

1.7 GROUND COVERS

A. Protect all exposed soils with mulching (temporary measure) and vegetative ground cover (permanent measure).

B. Install Erosion Control Blanket or Flexible Medium on all disturbed slopes having a finished grade of thirty three percent (33%) or greater (3:1) with vegetative cover. See (Submittals) 1.2 of this Section for Approved Products.

C. Install Erosion Control Blanket or Flexible Medium on all disturbed slopes having a finished grade of thirty-three (33%) percent or less (3:1) with vegetative cover. See (Submittals) 1.2 of this Section for Approved Products.

D. Ground cover consists of temporary seeding on all graded areas which will not receive final grading or permanent planting within three (3) days.

E. All grassing or planting operations shall include mulching as stabilization until ground cover by planting is effective.

F. Reseed as required until full vegetative coverage is established.

1.8 MAINTENANCE

A. Inspect all control elements after each rainfall event and a minimum of every two (2) weeks when no rainfall event(s) occur.

B. Clear all debris and accumulated sediment from behind barriers when half full so their functional capacity is not reduced during the construction period.

C. Repair and replace any and all damaged erosion and sedimentation control measures of any kind.

D. Maintain all erosion, sedimentation, pollution control measures for delivery of correct pond volume.

1.9 REMOVAL OF TEMPORARY EROSION CONTROL DEVICES

A. As soon as permanent vegetative cover is established, Contractor shall remove temporary devices, including sediment barriers, berms, silt traps and similar devices. Removal of

temporary devices may be accomplished in multiple phases as various areas of the site become stabilized, but must not take place without the approval of the Inspector, Engineer, and/or Architect.

B. Remove retrofit structure and clean out all accumulated silt and debris in sediment ponds and construct finished grades illustrated on the Drawings.

C. Remove all debris resulting from temporary erosion control from Project site.

D. Control dust from disturbed areas by means of mulching, irrigation, calcium chloride or other method subject to the Architect's review.

END OF SECTION 31 2500

SECTION 31 2514 - STABILIZATION MEASURES FOR EROSION AND SEDIMENTATION CONTROL

PART 1 - GENERAL

1.1 PRODUCTS

A. Submit proposed substitutions of products not less than 30 days prior to the anticipated installation date. Proposed substitutions shall be evaluated based on product construction, appearance and performance. The Contractor will be responsible for submitting all documentation supporting proposed products not less than 30 days prior to the intended installation date of the product. The acceptance or rejection of products offered as Equal or Substitution shall be at the sole discretion of the Owner.

B. Filter fabric for silt fences shall be a 36" high Georgia DOT approved pervious sheet of strong rot-proof synthetic polymer filaments non-calendered woven fabric constructed with monofilament yarns only with wire fence backing. Filter fabric shall be of type recommended by its manufacturer for the intended application. The filter fabric shall meet the requirements for Type “C” Fencing as per Section 171.02 of the Georgia DOT Standard Specifications 1993, or latest edition.

C. Filter Stone: Aggregate filter shall conform to following gradations:

% by Weight Passing Sieve Size	Square Mesh Sieve
(1)	3”
(2)	3/4 “
(3)	No. 4 0 – 20

Stone for Entrance Pad shall comply with ASTM D448 size #1 (1 ½” to 3 ½”)

D. Slopes 3:1 and steeper.
1. "Curlex II” with biodegradable FibreNet on both sides.
2. BioD-StrawCoco with 30% coconut fiber matrix and natural biodegradable netting on both sides.
3. “Tensar, North American Green BioNet SC150BN" erosion control blanket with biodegradable thread and 30% coconut fiber matrix.
4. Other approved equal.

E. Slopes 3:1 and flatter:
1. “Curlex NetFree” 100% biodegradable erosion control blanket.
2. “Tensar, North American Green BioNet S150BN" erosion control blanket with biodegradable thread.
3. “Jute Mat” with a minimum weight of 14.7 oz. per sy.
4. Other approved equal. Products with plastic/polypropylene netting are not to be used on potentially mowable slopes.

F. “Profile Flexterra (FGM)” or approved equivalent may be utilized in lieu of Erosion Control Blankets. Application rates to be determined based on conditions in area(s) where it’s to be

utilized. Approval is required.

G. Synthetic Polymers
   1. Contractor shall furnish, store on site and apply APS 600 Series Silt Stop, as manufactured by Applied Polymer Systems, Woodstock, Georgia (678) 494-5998 or approved equivalent on all disturbed, graded or exposed soil surfaces.
   2. Polymer shall be applied utilizing a hydro seeder mix of appropriate seed, fertilizer, lime and mulch for the same acre or without seed/fertilizer/lime/mulch mix.
   3. Follow all manufacturers' instructions and recommendations. Do not mechanically disturb treated areas after application. (This does not include foot traffic to install erosion control blanket).
   4. Contractor shall furnish, store and install a minimum 40 lbs. of APS 700 Series Silt Stop or approved equivalent erosion control polymer "dry" for incidental "touch-up" or point source erosion areas.
   5. Follow all manufacturers' instructions and recommendations for "dry" application. Do not mechanically disturb treated areas after application.

PART 2 – PRODUCTS

N/A

PART 3 – EXECUTION

N/A

END OF SECTION 31 2514

SECTION 32 1313 - CONCRETE PAVING

PART 1 - GENERAL

1.1 SCOPE

A. Work covered by this section consists of furnishing and installing Portland cement concrete for site improvements including, but not limited to, concrete curb and gutters, ramps, sidewalks, steps, retaining walls, and other miscellaneous site concrete and appurtenances.

B. Concrete curbs and gutters shall be standard “L” type with fiber expansion joints every fifty (50') feet and control joints every ten (10') feet. No steel reinforcing is required.

C. Concrete walks shall be a minimum four (4") inches thick and shall have a minimum slope of one (1") inch in eight (8') feet; or as otherwise illustrated on the Drawings. Slopes must be sufficient to avoid ponding of water on any walkway.

D. By submittal of his bid, the Contractor certifies that all means, methods, labor, equipment and materials to complete the satisfactory construction of the Project is included within the contract sum of his bid.

1.2 SUBMITTALS

A. Submit concrete design mix certified by the testing laboratory employed by the Contractor for the mix design based on cylinder check tests verifying the design mix. A submittal package for fibers, if used, must be incorporated with the concrete mix design(s) for approval by the Engineer. The following data must be in the submittal package; independent laboratory tests to ascertain the fibers meet or exceed specifications:
   1. Meets ASTM C-1116 Type III, 4.1.3, Standard Specification for Fiber-Reinforced Concrete.
   2. Meet ASTM C-1399 Test Method for determining Average Residual Strength of Fiber Reinforced Concrete, >45 psi.
   3. Certification that fiber meets all requirements stated in this specification.

B. Submit mill certification certifying that cement, sand, aggregate, reinforcing steel and joint materials comply with the requirements of this Specification.

C. Submit Shop Drawings for review prior to placement showing bending and placing details for steel reinforcing including bar sizes, spacing, bending and tagging identification. Shop drawings submitted after material is installed shall not be reviewed by the Landscape Architect/Engineer. Covering of steel for which shop drawings have not been reviewed is prohibited. Contractor shall assume total responsibility for steel reinforcing covered with concrete for which shop drawings have not been reviewed.

D. Submit manufacturers’ specifications and product data of proposed formwork ties.

E. Submit complete manufacturer's catalogue description of all joint materials and curing/sealing materials.

F. Submit delivery tickets for each load of ready-mixed concrete delivered showing the class and strength of concrete, pounds of cement per cubic yard, maximum size of coarse aggregate, the slump ordered, amount of admixture and time of batching.

G. Recycled Content: Submit invoices and documentation from the manufacturer of the amounts of post-consumer and post-industrial recycled content by weight for the following:
   1. Cementitious materials.
   2. Steel reinforcement and accessories.
   3. Aggregates.
   4. Any other products with recycled content.

H. Manufacturing Locations and Origins. Submit invoices and documentation showing manufacturing locations for each of the following products manufactured and sourced within a 500 mile radius of the building site.
   1. Cementitious materials.
   2. Aggregates.
   3. Fly ash.
   4. Steel reinforcement and accessories.
   5. Any other products manufactured and sourced within 500 miles of the building site.

I. Waste Management Plan; Submitted for approval prior to first concrete pour:
   1. Indicating designated locations or uses for excess concrete.
   2. Indicating designated location for cleaning out concrete trucks.

1.3 PROJECT CONDITIONS

A. In warm weather concrete placement will not be permitted when, in the opinion of Engineer, the sun, heat, wind, or limitations of facilities furnished by the Contractor prevent proper finishing and curing of the concrete in accordance with the requirements of these Specifications. Placing, curing and protection of cast in place concrete shall comply with the provisions of ACI 305R.

B. In cold weather, in addition to other requirements heat, protect and prepare the subgrade to produce a satisfactory subgrade entirely free from frost when the concrete is deposited. Concrete shall not be placed when the ambient temperature is below thirty-five (35) degrees Fahrenheit (2 degrees Centigrade), or when the concrete without special protection is likely to be subject to freezing temperature before final set has occurred usually at least seventy-two (72) hours. The placing, curing and protection of cast in place concrete shall comply with the provisions of ACI 306R.

C. Layout surveying shall be performed by a Georgia Registered Land Surveyor employed by the Contractor.

D. Survey and maintain all Project bench marks, monuments and other reference points, and if disturbed or destroyed they should be replaced by Registered Georgia Land Surveyor at no cost to the Owner.

E. Provide proper drainage during construction in a manner to prevent damage to the work, adjoining structures and adjoining and downstream property.

F. Patching parts of a section of work between joints shall not be permitted.

G. Remove and replace entire damaged sections when matching existing work.

1.4 QUALITY CRITERIA

A. Employ an independent testing laboratory, experienced and well qualified in the design of concrete mixtures and concrete testing to perform mix design services.

B. Testing laboratory shall design the proportions to be used prior to construction, for concrete mixtures to attain the unit compressive strengths specified and the workability or plasticity appropriate for the various conditions of concrete use and shall perform all services necessary for the design-of-mix and redesign where changes are made in the aggregates or in the plasticity or workability of the concrete.

C. Work and materials shall conform to the applicable requirements of Section 500.00 of "The Georgia Department of Transportation, Standard Specifications for Construction of Roads and Bridges", 1993 or the latest edition and any supplemental standards and specifications thereto.

D. Work shall be performed in accordance with ACI 301.

E. Design, engineering, construction and removal of concrete form work shall be the Contractor's responsibility. Except as specifically called for otherwise herein, all form work shall meet "ACI Standard Recommended Practice for Concrete Form work" (Latest Edition of ACI 347) as a minimum requirement.

F. Forms shall be constructed and reinforced to ensure that poured concrete is accurately placed to a tolerance of ⅛" in ten (10'-0") feet. Verify accuracy with a ten (10'-0") foot straight edge.

G. Cleaning, bending, placing and splicing reinforcement shall be in accordance with ACI 315 and ACI 318.

H. Reinforcement shall be tied in splices and intersections and shall be securely held in place with spacers, chairs or other acceptable supports at five (5'-0") foot on center maximum.

I. Reinforcement shall be free of loose or flaky rust, scale, dirt and ice at the time of concrete placement.

1.5 GUARANTEE

A. Contractor to provide Engineer a written guarantee that all work is of good quality, free from faults and defects and in conformance with these Specifications; and that if, within one (1) year after Final Payment, any Work or materials are found to be defective, Contractor will promptly, without cost to Owner, correct such defective work or materials.

1.6 BASE COURSE MATERIALS

A. Base course shall be constructed of structural fill or as otherwise illustrated on the Drawings and shall be compacted to 98% Standard Proctor Density.

1.7 CONCRETE

A. Concrete for combination concrete curb and gutter shall be “Class A”.

B. All other site concrete shall be minimum 3,000 psi concrete at twenty-eight (28) days unless noted otherwise, conforming to Section 32 3213 - Cast-In-Place Concrete - Site. Mix shall be in compliance with ASTM C94. All concrete shall be air-entrained with a minimum of forty- five (45) air. Use #57 size coarse aggregate.

C. Cement shall comply with ASTM C150 normal Type I specifications.

D. Aggregates shall comply with ASTM C33.

E. Concrete shall comply with ACI 318 and ACI 301. Adhere to all jurisdictional code requirements for reinforced concrete.

F. Ready mixed concrete shall comply with ASTM C94.

G. Water shall be clean and potable.

H. No additives shall be used without prior review of civil or structural engineer.

1.8 REINFORCING STEEL

A. Reinforcing bars and dowels shall be manufactured from new billet steel of domestic manufacture conforming to ASTM A615, Grade 60, deformed bars with an uncoated finish.

B. Welded wire fabric shall consist of deformed bars, furnished in flat sheets or coiled rolls with an uncoated finish, and shall conform to ASTM A-185.

C. Tie wire shall be 16 gauge annealed steel.

D. Spacers, chairs, bolsters, ties, and etc. shall conform to ACI 315.

E. Steel bars shall be fabricated as indicated on the Drawings and in accordance with ACI 315.

1.9 REINFORCING MATERIAL

A. Collated fibrillated polypropylene (CFP) fibrous bundles shall be used as reinforcement in concrete sidewalks.

B. Synthetic fibrous reinforcing material shall be 100% virgin polypropylene fibrillated fibers containing no reprocessed olefin materials and specifically manufactured to use as concrete reinforcement. Fibers shall be added at the rate of 1.50 lbs per cubic yard.

C. The fibers shall conform to ASTM C1116 and have a residual strength of no less than forty-five (45) psi.

D. Acceptable products shall include “Forta Econo-Net” as manufactured by Forta Corporation, “Procon F” by Nycon, Inc., “Fibermesh 300" by SI Concrete Systems. Similar products of other

manufactures shall be subject to Engineer's review.

1.10 JOINT MATERIALS

A. Expansion joint filler shall be non-extruding and resilient types conforming to AASHTO M-213 or M-153.

B. Poured joint sealer shall be a hot poured elastic type sealer intended for sealing joints in concrete pavements and shall conform to AASHTO -173.

C. Expansion joint filler for combination concrete curb and gutter shall be non-extruding bituminous treated fiberboard conforming to ASTM D 1751.

D. Expansion joint filler for concrete formwork shall be pre-molded ½" thick, impregnated asphalt fiber strips. Provide where expansion may cause damage.

1.11 CURING AND SEALING MATERIALS

A. Curing/sealing compound shall be water soluble emulsion type linseed oil base and conform to the requirements for Type 2 compound as specified in ASTM C 309, except that the requirements for the sag test and drying time shall not apply. Curing/sealing compound shall be "CS-309-25" as manufactured by W. R. Meadows, "Hydrozo Enviro-Seal 20" by Hydrozo, Inc., "Kure & Seal 1315" by NOX-CRETE, "Transguard 4000" by Armolan or approved equal.

1.12 FORM MATERIALS

A. Acceptable Form Materials
   1. Plywood shall be ⅝" thick mill oil impregnated, edge sealed exterior form type, grade BB-DFPA, concrete commercial standard 45-60 not previously used on any other project.
   2. For exposed surfaces # 1 lumber shall be T & G southern yellow pine S4S lined with minimum ¼" plywood conforming to federal specification LL-H-35.
   3. For unexposed surfaces, forms shall be the same as for exposed surfaces, except #2 lumber may be used.
   4. Metal forms are acceptable.
   5. Forms shall be built of sound lumber and any bevel strips for sign shall be placed as illustrated on the Drawings.

B. Joints shall be filled with bee's wax, a composition of tallow and cement or taped.

C. If any forms bulge or show deflection, which in the opinion of the Engineer exceeds the prescribed tolerances, the concrete shall be removed and the work rebuilt.

1.13 FORM TIES

A. Ties shall have a minimum working strength of 4,000 lbs.

B. Ties shall be adjustable in length to permit tightening.

C. Ties shall leave no larger than ⅞"diameter impression on finished surface.

D. Ties shall leave no metal within one (1") inch of finished surface when tie is removed.

E. Wire ties are not permitted.

1.14 FORM JOINTS

A. Construct expansion joints, control joints, construction joints and other joints as indicated on the Drawings. Acceptable key type steel formers shall include:
   1. Vulcan joints.
   2. Burke keyed Kold Joint Form.
   3. Dayton S-Grip-G-20.
   4. Or approved equivalent.

1.15 INSPECTION

A. Prior to placement of base material, installer shall inspect the site grading and ensure that the sub-grade has been properly placed and compacted, and is ready to receive the base material.

B. Installer shall also determine that all site drainage, piped site utilities, underground electrical and communications conduits have been installed, tested and accepted by the Engineer.

1.16 PREPARATION

A. Contractor shall submit to the Engineer for review all materials to be used in the base and pavements.

B. Contractor shall repair subgrade as necessary to provide uniform surfaces.

C. Spread base material and compact to 98% maximum density and within 1/8 inch of required grade.

D. Check field density with nuclear density device or other method acceptable to the Engineer.

E. Set forms on firm foundation true to grade and securely fastened in place.

F. No settlement or springing of forms under the finishing machine will be allowed.

G. Top face shall not vary from a true plane by more than 1/8 inch in ten (10') feet.

H. Vertical sides shall not vary from a true plane by more than 1/4 inch.

I. Clean and oil all forms prior to use.

J. Provide work bridges where necessary for finishing, straight edging, making corrections, etc. to surface after concrete has been screeded.

K. Bridges shall be rigidly constructed and easily moveable so that they will not come into contact with the concrete.

L. Check alignment and grade elevations of forms and obtain approval of preparation and

form work from Engineer prior to placement of concrete.

1.17 MIXING OF CONCRETE

A. All materials shall be measured and mixed in a machine. Mixing and transportation shall meet ASTM C94. The materials shall first be mixed dry and the water then added by measurement.

B. Mixing time shall begin when the water is added to the mix.

C. Water shall not be added to the mix at the job site except under the direction of the laboratory that designed the mix. The laboratory shall instruct that a fixed amount of cement shall be added to maintain the water/cement ratio if required. The mixer shall be turned fifty (50) revolutions after the addition of water.

D. A slump test shall be made of any concrete to which water has been added to ascertain that the slump does not exceed five (5") inches for regular mixes and six (6") inches for pump mixes.

E. A record shall be kept of any concrete to which water has been added and the record shall show the results of the slump test.

1.18 PLACING OF CONCRETE

A. Transport and place concrete in a manner to avoid segregation and in accordance with ACI 318 and ACI 304.

B. Concrete having attained initial set or having contained water more than one hour before final placement shall not be used.

C. Concrete shall not be dropped more than three (3') feet. Greater drops shall be handled with chutes.

D. Consolidate concrete by spading, vibrating, rodding or tamping. Work concrete around reinforcing, any inserts and into corners. Avoid objectionable segregation. Ensure concrete fills all voids in form work and fully contacts all surfaces. Take measures to prevent honeycombing. Excessive honeycombing shall be grounds for rejecting concrete work.

E. Construction joints shall be located as illustrated on the Drawings. All construction joints shall be filled with asphaltic filler after concrete is sufficiently cured, unless joints are specified to be treated otherwise.

F. Control joints on all concrete surfaces shall be located as indicated on the Drawings. Construction methods proposed for use other than those specified or indicated on the Drawings shall be subject to review by Engineer.

1.19 INSTALLATION OF CONCRETE APRONS/PADS/DRIVES

A. Place reinforcement in accordance with details illustrated on the Drawings. Concrete shall have minimum reinforcement as illustrated on Drawings. Transverse bars shall be supported by chairs capable of maintaining the steel in the proper portion during placement of concrete. Longitudinal bars shall be clipped to the transverse bars. Place and maintain bars within ½ inch of the vertical position and one inch of the horizontal position.

B. Thoroughly wet base without puddling prior to placing concrete.

C. Deposit concrete with a mechanical spreader uniformly over the full width and depth of the pavement. Concrete shall be continuous between transverse joints.

D. Vibrate the full width of concrete immediately behind the spreader with spud type vibrators at a frequency not less than 700 VPM. Vibration shall be sufficient to thoroughly consolidate the concrete along all forms but shall not continue long enough to cause puddling or an accumulation of grout on the surface.

E. Protect concrete from contamination with dirt or other debris from workmen's boots, etc.

F. Finish the surface with a power driven finishing machine equipped with at least two (2) oscillating type transverse strike- off screeds. Hand finishing shall be permitted only in areas of limited access where use of mechanical equipment is impractical, under emergency conditions or with the prior approval of the Engineer. Unless otherwise specified, the final finish and texture shall be fine broom finish using a push broom with stiff bristles, perpendicular to the path of travel.

G. Construct joints of the type and dimensions illustrated on the Drawings. Construct joints in a manner to prevent random or uncontrolled cracking. Should such cracking occur, remove and replace sufficient concrete to form a slab at least 10 ft. long unless directed otherwise by the Engineer.
   1. Form transverse expansion joints and fill with continuous joint filler. Provide at thirty (30') foot maximum spacing and at all edges that abut rigid structures or curbing.
   2. Tool (¼") inch wide construction joints with one (1") inch minimum depth at spacing illustrated on Drawings.
   3. After the final finish but before the concrete has taken its initial set, work the edges of pavement along each side of expansion joints, formed joints and construction joints with an approved tool and round to the radius specified. Produce a well-defined, continuous radius and a smooth, dense mortar finish. Do not unduly disturb the surface of the slab by tilting the tool during use. Eliminate tool marks appearing on the slab adjacent to joints. Remove all concrete on top of the joint filler. Test all joints with a straightedge before the concrete has set.

H. Immediately after completion of finishing operations and as soon as marring of concrete will not occur, the entire surface of newly placed concrete shall be covered and cured. The concrete shall not be left exposed for more than ½ hour during the curing period.

I. Provide sufficient covering material to cover and properly protect the last hour's pour against the effects of rain. This covering material may be burlap mats, waterproof paper or combined burlap and white polyethylene sheeting. Failure to provide sufficient cover materials or to adequately take care of curing requirements shall be cause for rejection of concreting installations.

J. When concrete is being placed and the air temperature may be expected to drop below 35 degrees F, a sufficient supply of straw, hay, grass, approved curing paper, or other blanketing material shall be provided along the work, and any time the temperature may be expected to reach the freezing point during the day or night, the material shall be spread over the pavement to a sufficient depth to prevent freezing of the concrete. Contractor shall be responsible for the

quality and strength of the concrete placed during cold weather and any concrete damaged by frost action shall be removed and replaced at the Contractor's expense.

K. As soon as the concrete has hardened sufficiently, the pavement surface will be tested by the Landscape Architect/Engineer with an approved 10-foot rolling straightedge capable of marking the deficient areas by suitable means. The rolling straightedge shall be furnished by Contractor.

L. Where the surface deviation in ten (10') feet exceeds 1/4 inch, the pavement shall be removed and replaced by, and at the expense of Contractor.

M. Unless otherwise provided, do not remove forms from freshly placed concrete until it has set for at least twelve (12) hours and then:
   1. Remove forms carefully to avoid damage to the pavement.
   2. After forms have been removed, cure the sides of the slab and fill minor honeycombed areas with mortar.
   3. Major honeycombed areas will be considered as defective work and shall be removed and replaced.
   4. When it is necessary to remove and replace a section of pavement, any remaining portion of the slab adjacent to the joints that is less than ten (10') feet in length shall also be removed and replaced.
   5. Inspect each joint for proper width, depth, alignment and preparation for sealing; before sealing is allowed.
   6. Pavement may be opened for traffic prior to sealing provided the joint forming device or insert has not been removed or sawed.
   7. When the insert is removed or sawed the pavement may be opened to traffic provided the joints are protected during the interval between sawing and sealing.
   8. Protection of the joints shall be accomplished by placement of a backup material immediately after sawing or removal of insert.
   9. Thoroughly clean joints immediately prior to sealing.
   10. Acid and/or pressure wash concrete prior to sealing if the concrete has been subject to traffic.
   11. Apply the sealant as soon as possible after the required curing of the concrete.
   12. Sealant shall be installed in strict accordance with manufacturers printed installation instructions.
   13. Traffic shall not be permitted while sealing and until after the sealant is cured.
   14. Pavement shall be closed to all traffic for sealing for a minimum of one (1) day.
   15. Joints shall be reasonably free of spalls, fractures, breaks and voids.
   16. Areas requiring repairs shall be chipped back to sound concrete and repaired with an acceptable non-shrinking patching system in accordance with the manufacturer's recommendations.
   17. Prepare and install joint sealants in accordance with the manufacturer's recommendations.
   18. The sealant shall be installed to a depth of 1/4 inch (± 1/8 inch) below the pavement surface or in accordance with the Drawings.

N. Protect the pavement and its appurtenances against both public traffic and traffic of Contractor's employees and agents.

O. Any damage to the pavement occurring prior to date of final completion shall be repaired or the pavement shall be replaced at no cost to Owner.

1.20 INSTALLATION OF SIDEWALKS

A. Place the 100% virgin polypropylene fibrillated fibers reinforcing material as illustrated in the Detail Drawings and the Manufacturers recommendations.

B. Excavate drain pockets for all weep holes and fill with coarse aggregate. Provide pipes, sleeves, or formed openings as Illustrated on the Drawings.

C. Place concrete in a manner to avoid segregation. Spread to the full width and depth of forms and bring to grade by screeding and straight edging.

D. Give sidewalks a fine broom finish using a push broom with stiff bristles, perpendicular to the path of travel with two (2") inch smooth trowel edges as illustrated on Drawings.

E. Final surface shall not vary from a true plane by more than (¼") inch in ten (10') feet.

F. Sloped paving may be either in horizontal or vertical courses but not a mixture.

G. Horizontal courses shall be three (3') feet to six (6') feet in width.

H. Provide vertical contraction or construction joints at thirty (30') foot intervals. Vertical contraction joints shall be 1/3 the thickness of the concrete.

I. Provide expansion joints for paved ditches at thirty (30') foot intervals and expansion joints where the ditch abuts a roadway or some other rigid structure.

J. Provide (¾") inch deep transverse grooves for sidewalks as illustrated on the Drawings, finished with a (¼") inch edging tool.

K. Provide one-half (½") inch wide pre-molded expansion joints shall be at fifty (50') foot intervals and at all curbs and rigid structures.

L. Fill expansion joints with pre-molded asphaltic joint filler and cut off any protruding material flush with the finished concrete.

M. Provide proper curing for the sidewalks using liquid curing/sealing compound.

N. Thoroughly clean all joints immediately prior to sealing and acid and/or pressure wash concrete prior to sealing as directed by Engineer.

O. Apply sealant as soon as possible after required curing period of concrete.

P. Prohibit traffic on sealed surfaces until sealer has cured.

Q. Provide sealer for all sidewalks and apply in accordance with manufacturer's recommendations.

1.21 INSTALLATION OF CONCRETE CURB AND GUTTER

A. Use metal forms unless otherwise specifically authorized by the Engineer, except that on curves having a radius of one-hundred, fifty (150') feet or less, wood forms may be used.

B. All forms shall be reviewed by Engineer.

C. Form setting
   1. Subgrade under forms shall be compact and cut true to grade, so that the forms will be firmly in contact with it for their entire length.
   2. Correct imperfections and variations of the grade in a manner satisfactory to the Engineer.
   3. Join each form section tightly by locked joints, free from play or movement in any direction.
   4. Check conformity to alignment and grade elevations illustrated on the Drawings and make necessary corrections prior to placing the concrete.
   5. Coat forms with oil each time they are used.

D. Form Removal
   1. Keep forms in place at least twelve (12) hours after concrete has been placed against them or for a longer period if so directed by the Engineer.
   2. Do not use crowbars or other heavy tools against green concrete in removing the forms.
   3. Clean forms well before re-oiling and reuse.

E. For finishing test the subgrade for elevation and density in advance of placing the concrete. Correct any discrepancies in accordance with the requirements for subgrade preparation.

F. Tamp and space the concrete so as to produce a dense concrete in which the mortar has been worked to the surface.

G. Strike off the concrete to the required cross-section and smooth the upper face of the gutter slab and the front face and top of the curb with a wood float.
   1. Use an edging tool on all exposed corners.
   2. When completed, surface of the curb and gutter shall be straight and true, and shall conform to the shape and dimensions illustrated on the Drawings.
   3. Remove face forms as soon as possible and finish the exposed surface with a first class wood float finish.
   4. Workmanship and appearance shall be of the highest quality.

H. Provide (¾") inch deep, (¼") inch wide construction joints for curbs and gutters at ten (10') foot intervals, and (½") expansion joints at fifty (50') foot intervals, at all tangent points, and at all rigid structures. Tool all exposed edges and joints to (¼") radius.

I. Fill expansion joints with pre-molded asphaltic joint filler and cut off any protruding material flush with the finished concrete.

1.22 INSTALLATION OF RETAINING WALLS

A. Design and engineering of the form work, as well as its construction shall be the responsibility of Contractor.

B. Construct forms to slopes, lines and dimensions indicated on the Drawings, plumb straight and sufficiently tight to prevent leakage.

C. Securely brace and shore forms to prevent displacement.

D. As necessary, provide access openings for cleaning and inspection prior to depositing concrete.

E. Do not coat forms with material that will stain or cause damaged to exposed concrete surfaces or to finish material applied directly to concrete.

F. Chamfer external corners of all exposed concrete as noted on the Drawings or as directed by the Engineer.

G. Provide for installation of any inserts, conduits, pipe sleeves, drains etc.

H. Allow sufficient time between form erection and placing of concrete for proper installation of any works by various trades.

I. Inside surface of wood board forms shall be soaked with clean water prior to placing of concrete.

J. Plywood or pressed wood forms, except as otherwise specified within shall be treated with an approved form oil or lacquer. Wipe off excess oil with rags leaving surface of forms just oily to touch. Do not oil forms where finish material is to be applied directly to concrete.

K. Steel reinforcement shall be protected by concrete cover as indicated on the Drawings.

L. Install any rebar reinforcing, size as indicated on the Drawings, at mid-height of the concrete slab on grade. Lap all joints 8" and extend rebar to within 3"of the sides and end of slabs.

M. Provide adequate notice to Engineer to provide sufficient opportunity for review of the placement of reinforcing steel before concrete is placed.

N. Remove forms in accordance with requirements outlined in ACI 318 in a manner to ensure complete safety of the retaining wall. Remove forms only after concrete has hardened sufficiently to avoid injury to surfaces. Minimum curing time prior to form removal shall be 24 hours. After removal of forms, notify the Engineer for review of newly stripped surfaces. Do not patch or touch up newly stripped surfaces until after review by the Engineer.

1.23 PROTECTION AND CURING

A. Protect and cure concrete as specified in the concrete standard ACI 301.

B. Apply curing compound in accordance with the manufacturers' recommendations.

1.24 PATCHING FORMED SURFACES

A. Do not patch or touch-up newly stripped surfaces until after review by the Engineer. Concrete which in the opinion of the Engineer, exhibits excessive defects shall be condemned and removed from the site at the Contractor's expense and replaced at no additional cost to the Owner.

B. All surfaces shall be patched to fill all the holes and correct minor honeycombing and other defects 1½"or less in any dimension the same working day the forms are removed. Concrete with larger defects shall be replaced at no additional cost to the Owner to the extent designated by the Engineer.

C. Wet the areas to be patched and thoroughly brush into the surface a grout coat of cement and sand following immediately with application of patching mortar.

D. Patching mortar shall be of a consistency similar to concrete mix except coarse aggregate shall be omitted.

E. Compact patching mortar into place and screed off leaving patch slightly higher than surrounding surface.

F. Allow patch to set until after initial shrinkage and then finish to match adjoining surface.

G. At the Contractor's option, a bonding agent may be used to bond patching material to concrete.

H. Unexposed surfaces shall have the rough edges and projections broken off.

I. All exposed exterior concrete, including curbs and gutters, exterior retaining walls, stairs, ramps exposed slab edges, etc., shall have a rubbed finish. After forms are removed, smooth out work joint and remove blemishes. Imperfections shall not exceed (1/16") inches in any dimension. While concrete is still slightly green, remove and repair projections, offsets and blemishes. Wet surface thoroughly and rub with cement or carborundum bricks and water until uniformly smooth.

1.25 INSTALLATION OF PEDESTRIAN HANDRAILS/GUARDRAILS

A. Contractor shall make field measures of sleeve locations prior to manufacture of pedestrian handrails and guardrails.
   1. All pedestrian handrail and guardrail posts shall be set in minimum eight (8") inches long galvanized pipe sleeves, or cored to a minimum eight (8") inches deep and anchored with "Porox" or equal.
   2. Posts shall be placed as illustrated on Drawings.
   3. Handrail to be mounted at twenty-five (25") inches and thirty-four (34") inches from pavement surface.
   4. Guardrail to be mounted at forty-two (42") inches from top of wall or pavement surface.
   5. Ends of handrail to be extended twelve (12") inches beyond limit of handicap ramp and extension shall be parallel with finished grade elevations at end of ramp.
   6. Guardrail to be used at all locations of walls where elevations of top of wall and finish grade differ more than 2'-6".

1.26 FIELD QUALITY CONTROL

A. Concrete testing shall be performed by a Testing Agency selected and paid for by the Owner. All costs related to tests which yield unacceptable values shall be borne by the Contractor. All costs related to any re-testing shall be borne by the Contractor.

B. Contractor will be responsible for notifying the Testing Agency twenty-four (24) hours prior to placing any concrete.

C. Contractor to provide a secure area for performing concrete tests and forming and storage of test specimens. Samples shall be procured in accordance with ASTM C172 and cylinders shall be made in accordance with ASTM C31. Samples shall be transported to a testing

laboratory

for curing and testing. All handling and testing of samples shall be in accordance with ASTM C-39.

D. Take job control sample specimens of the concrete in cylindrical containers at the point of deposit. The following tests are required as a minimum:
   1. Slump Tests - One (1) test per each twenty (20) cubic yards in accordance with ASTM C142-78.
   2. Compressive Tests - Four (4) cylinders for each test in accordance with ASTM C39-84. One (1) cylinder shall be broken at seven (7) days and two (2) shall be broken at twenty eight (28) days. An average of the twenty eight (28) day breaks shall be considered one (1) test.
   3. One (1) cylinder shall be held and broken at fifty-six (56) days only if test fails to meet specification.
   4. Air entrainment for applicable classes of concrete in accordance with ASTM C231.

E. FREQUENCY OF TESTING
   1. One (1) sampling consisting of four (4) cylinders, shall be made from each pouring operation and not less than one (1) sampling for each fifty (50) cubic yards of concrete poured each day. Take and cure samples in accordance with ASTM C-31.
   2. Cylinders shall be transported to a testing laboratory for curing and testing. Handle and test samples in accordance with ASTM C-39.
   3. Perform air entrainment tests for each set of cylinders of air entrained concrete.
   4. Perform unit weight tests in accordance with ASTM 567.

F. Take depth of slab measurements on pavement by probing the plastic concrete immediately behind the paver device. Take measurements at twenty (20') foot intervals and at three (3) points across the width of the concrete slab.

G. All concrete test reports shall include slump test, specific statement of where concrete is located in the structure, statement of number of yards of concrete emptied at test, total number yards of concrete in truck, air temperature and time.

H. Record results and forward to Owner, Engineer and Contractor. Make air and slump determination at a frequency sufficient to ensure concrete quality. Testing Agency shall notify the Engineer, Owner and Contractor if test reports indicate abnormalities.

1.27 PROCEDURES FOR TEST RESULTS

A. Results of the concrete tests shall be evaluated in accordance with Paragraph 17.2 of ACI Standard 301.

B. If evaluation of the compressive test indicates that the concrete has failed to meet the specified strength, core tests shall be made in the in-place concrete. The location and number of such tests shall be determined by the Geotechnical Engineer. Tests shall be paid for by Contractor.

C. If the core tests fail to verify the strength specified, the Engineer shall effect one of the following procedures:
   1. Have the Contractor remove and reconstruct that portion of the structure found to

be defective.

2. Accept concrete in-place and issue a change order as set forth in the General Conditions of Contract of these Specifications for a credit value to be agreed upon by the Owner, the General Contractor and the Engineer.

D. Concrete testing shall be back charged to the Contractor if specified strength is not obtained.

1.28 CLEANING

A. Portland cement concrete paving, curbs and sidewalks shall be acid washed and/or pressure washed at Substantial Completion by Contractor if required by the Engineer achieve the desired appearance.

PART 2 – PRODUCTS

N/A

PART 3 – EXECUTION

N/A

END OF SECTION 32 1313

SECTION 32 31 13

CHAIN LINK FENCES AND GATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Chain-link fences.
2. Gates: swing.

B. Related Sections:

1. Section 033000 "Cast-in-Place Concrete" for cast-in-place concrete post footings.

1.3 PERFORMANCE REQUIREMENTS

A. Lightning Protection System: Maximum grounding-resistance value of 25 ohms under normal dry conditions.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for chain-link fences and gates.

1. Fence and gate posts, rails, and fittings.
2. Chain-link fabric, reinforcements, and attachments.
3. Gates and hardware.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work. Show accessories, hardware, gate operation, and operational clearances.

C. Samples for Initial Selection: For components with factory-applied color finishes.

D. Samples for Verification: Prepared on Samples of size indicated below:

1. Polymer-Coated Components: In 6-inch lengths for components and on full-sized units for accessories.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency or factory-authorized service representative.

B. Product Certificates: For each type of chain-link fence, and gate, from manufacturer.

C. Product Test Reports: For framing strength according to ASTM F 1043.

D. Field quality-control reports.

E. Warranty: Sample of special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For the following to include in emergency, operation, and maintenance manuals:

1. Polymer finishes.
2. Gate hardware.

1.7 QUALITY ASSURANCE

A. Testing Agency Qualifications: For testing fence grounding. Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

B. Preinstallation Conference: Conduct conference at Project site.

1. Inspect and discuss equipment bases, and other preparatory work specified elsewhere.
2. Review coordination of interlocked equipment specified in this Section and elsewhere.
3. Review required testing, inspecting, and certifying procedures.

1.8 PROJECT CONDITIONS

A. Field Measurements: Verify layout information for chain-link fences and gates shown on Drawings in relation to property survey and existing structures. Verify dimensions by field measurements.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer or Installer agrees to repair or replace components of chain-link fences and gates that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Faulty operation of gate operators and controls.
b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

2. Warranty Period: Five years from date of Material Completion.

PART 2 - PRODUCTS

2.1 CHAIN-LINK FENCE FABRIC

A. General: Provide fabric in one-piece heights measured between top and bottom of outer edge of selvage knuckle or twist. Comply with CLFMI Product Manual and with requirements indicated below:

1. Fabric Height: As indicated on Drawings.
2. Steel Wire Fabric: Wire with a diameter of 0.120 inch

a. Mesh Size: 2 inches.
b. Aluminum-Coated Fabric: ASTM A 491, Type I, 0.40 oz./sq. ft..
c. Zinc-Coated Fabric: ASTM A 392, Type II, Class 1, 1.2 oz./sq. ft. with zinc coating applied before or after weaving.
d. Zn-5-Al-MM Aluminum-Mischmetal-Coated Fabric: ASTM F 1345, Type III, Class 1, 0.60 oz./sq. ft.
e. Polymer-Coated Fabric: ASTM F 668, Class 1 over aluminum, zinc, or Zn-5-Al-MM-alloy-coated steel wire.

1) Color: As selected by Architect from manufacturer's full range, complying with ASTM F 934.

f. Coat selvage ends of fabric that is metallic coated before the weaving process with manufacturer's standard clear protective coating.

3. Aluminum Wire Fabric: ASTM F 1183, with mill caustic-cleaned or etched finish, and wire diameter of 0.148 inch

a. Mesh Size: 2 inches.

4. Selvage: Knuckled at both selvages Twisted top and knuckled bottom.

2.2 FENCE FRAMING

A. Posts and Rails: Comply with ASTM F 1043 for framing, including rails, braces, and line; terminal; and corner posts. Provide members with minimum dimensions and wall thickness according to ASTM F 1043 or ASTM F 1083 based on the following:

1. Fence Height: As indicated on Drawings.
2. Light Industrial Strength: Material Group IC-L, round steel pipe, electric-resistance-welded pipe.

a. Line Post: 1.9 inches in diameter.
b. End, Corner and Pull Post: 2.375 inches.

3. Horizontal Framework Members: Intermediate, top, and bottom rails complying with ASTM F 1043.

a. Top Rail: 1.66 inches in diameter.

4. Brace Rails: Comply with ASTM F 1043.
5. Metallic Coating for Steel Framing:

    a. Type A, consisting of not less than minimum 2.0-oz./sq. ft. average zinc coating per ASTM A 123/A 123M or 4.0-oz./sq. ft. zinc coating per ASTM A 653/A 653M.
    b. Type B, zinc with organic overcoat, consisting of a minimum of 0.9 oz./sq. ft. of zinc after welding, a chromate conversion coating, and a clear, verifiable polymer film.
    c. External, Type B, zinc with organic overcoat, consisting of a minimum of 0.9 oz./sq. ft. of zinc after welding, a chromate conversion coating, and a clear, verifiable polymer film. Internal, Type D, consisting of 81 percent, not less than 0.3-mil- thick, zinc-pigmented coating.
    d. Type C, Zn-5-Al-MM alloy, consisting of not less than 1.8-oz./sq. ft. coating.
    e. Coatings: Any coating above.

6. Polymer coating over metallic coating.

    a. Color: As selected by Architect from manufacturer's full range, complying with ASTM F 934.

2.3 TENSION WIRE

A. Metallic-Coated Steel Wire: 0.177-inch- diameter, marcelled tension wire complying with ASTM A 817 and ASTM A 824, with the following metallic coating:

1. Type I, aluminum coated (aluminized).
2. Type II, zinc coated (galvanized) by hot-dip or electrolytic process, with the following minimum coating weight:

    a. Class 4: Not less than 1.2 oz./sq. ft. of uncoated wire surface.

3. Type III, Zn-5-Al-MM alloy with the following minimum coating weight:

    a. Class 60: Not less than 0.6 oz./sq. ft. of uncoated wire surface.

B. Polymer-Coated Steel Wire: 0.177-inch- diameter, tension wire complying with ASTM F 1664, Class 1 Class 2a or Class 2b over aluminum or zinc or Zn-5-Al-MM-alloy-coated steel wire.

1. Color: As selected by Architect from manufacturer's full range, complying with ASTM F 934.

C. Aluminum Wire: 0.192-inch- diameter tension wire, mill finished, complying with ASTM B 211, Alloy 6061-T94 with 50,000-psi minimum tensile strength.

2.4 SWING GATES

A. General: Comply with ASTM F 900 for gate posts and single or double swing gate types.

1. Gate Leaf Width: As indicated.
2. Gate Fabric Height: As indicated.

B. Pipe and Tubing:

1. Zinc-Coated Steel: Comply with ASTM F 1043 and ASTM F 1083; manufacturer's standard protective coating and finish.
2. Aluminum: Comply with ASTM B 429/B 429M; manufacturer's standard finish.
3. Gate Posts: Round tubular steel or aluminum.
4. Gate Frames and Bracing: Round tubular steel or aluminum.

C. Frame Corner Construction: Welded or assembled with corner fittings.

D. Hardware:

1. Hinges: 180-degree outward swing.
2. Latches permitting operation from both sides of gate with provision for padlocking accessible from both sides of gate.
3. Padlock and Chain:

2.5 FITTINGS

A. General: Comply with ASTM F 626.

B. Post Caps: Provide for each post.

1. Provide line post caps with loop to receive tension wire or top rail.

C. Rail and Brace Ends: For each gate, corner, pull, and end post.

D. Rail Fittings: Provide the following:

1. Top Rail Sleeves: Pressed-steel or round-steel tubing or Aluminum Alloy 6063 not less than 6 inches long.
2. Rail Clamps: Line and corner boulevard clamps for connecting intermediate and bottom rails in the fence line-to-line posts.

E. Tension and Brace Bands: Pressed steel or Aluminum Alloy 6063.

F. Tension Bars: Steel or Aluminum, length not less than 2 inches shorter than full height of chain-link fabric. Provide one bar for each gate and end post, and two for each corner and pull post, unless fabric is integrally woven into post.

G. Truss Rod Assemblies: Steel, hot-dip galvanized after threading or Mill-finished aluminum rod and turnbuckle or other means of adjustment.

H. Tie Wires, Clips, and Fasteners: According to ASTM F 626.

1. Standard Round Wire Ties: For attaching chain-link fabric to posts, rails, and frames, complying with the following:

a. Hot-Dip Galvanized Steel: 0.148-inch- diameter wire.
b. Aluminum: ASTM B 211; Alloy 1350-H19; 0.148-inch- diameter, mill-finished wire.

I. Finish:

1. Metallic Coating for Pressed Steel or Cast Iron: Not less than 1.2 oz. /sq. ft. zinc.

a. Polymer coating over metallic coating.

2. Aluminum: Mill finish.

2.6 GROUT AND ANCHORING CEMENT

A. Nonshrink, Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout, recommended in writing by manufacturer, for exterior applications.

B. Erosion-Resistant Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with potable water at Project site to create pourable anchoring, patching, and grouting compound. Provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended in writing by manufacturer, for exterior applications.

2.7 FENCE GROUNDING

A. Conductors: Bare, solid wire for No. 6 AWG and smaller; stranded wire for No. 4 AWG and larger.

1. Material above Finished Grade: Copper or Aluminum.
2. Material on or below Finished Grade: Copper.
3. Bonding Jumpers: Braided copper tape, 1 inch wide, woven of No. 30 AWG bare copper wire, terminated with copper ferrules.

B. Connectors and Grounding Rods: Comply with UL 467.

1. Connectors for Below-Grade Use: Exothermic welded type.
2. Grounding Rods: Copper-clad steel, 3/4 by 120 inches.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for a verified survey of property lines and legal boundaries, site clearing, earthwork, pavement work, and other conditions affecting performance of the Work.

1. Do not begin installation before final grading is completed unless otherwise permitted by design professional.

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

3.2 PREPARATION

A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

3.3 INSTALLATION, GENERAL

A. Install chain-link fencing to comply with ASTM F 567 and more stringent requirements indicated.

1. Install fencing on established boundary lines inside property line.

3.4 CHAIN-LINK FENCE INSTALLATION

A. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacings indicated, in firm, undisturbed soil.

B. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil.

1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
2. Concrete Fill: Place concrete around posts to dimensions indicated and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.

    a. Exposed Concrete: Extend 2 inches above grade; shape and smooth to shed water.

C. Terminal Posts: Locate terminal end, corner, and gate posts per ASTM F 567 and terminal pull posts at changes in horizontal or vertical alignment of 15 degrees or more.

D. Line Posts: Space line posts uniformly at 96 inches o.c.

E. Post Bracing and Intermediate Rails: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Diagonally brace terminal posts to adjacent line posts with truss rods and turnbuckles. Install braces at end and gate posts and at both sides of corner and pull posts.

1. Locate horizontal braces at midheight of fabric 72 inches or higher, on fences with top rail and at two-third fabric height on fences without top rail. Install so posts are plumb when diagonal rod is under proper tension.

F. Tension Wire: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Pull wire taut, without sags. Fasten fabric to tension wire with 0.120-inch- diameter hog rings of same material and finish as fabric wire, spaced a maximum of 24 inches o.c. Install tension wire in locations indicated before stretching fabric. Provide horizontal tension wire at the following locations:

1. Extended along top and bottom of fence fabric. Install top tension wire through post cap loops. Install bottom tension wire within 6 inches of bottom of fabric and tie to each post with not less than same diameter and type of wire.

G. Top Rail: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Run rail continuously through line post caps, bending to radius for curved runs and terminating into rail end attached to posts or post caps fabricated to receive rail at terminal posts. Provide expansion couplings as recommended in writing by fencing manufacturer.

H. Intermediate and Bottom Rails: Install and secure to posts with fittings.

I. Chain-Link Fabric: Apply fabric to outside of enclosing framework. Leave 1 inch between finish grade or surface and bottom selvage unless otherwise indicated. Pull fabric taut and tie to posts, rails, and tension wires. Anchor to framework so fabric remains under tension after pulling force is released.

J. Tension or Stretcher Bars: Thread through fabric and secure to end, corner, pull, and gate posts with tension bands spaced not more than 15 inches o.c.

K. Tie Wires: Use wire of proper length to firmly secure fabric to line posts and rails. Attach wire at one end to chain-link fabric, wrap wire around post a minimum of 180 degrees, and attach other end to chain-link fabric per ASTM F 626. Bend ends of wire to minimize hazard to individuals and clothing.

1. Maximum Spacing: Tie fabric to line posts at 12 inches o.c. and to braces at 24 inches o.c.

L. Fasteners: Install nuts for tension bands and carriage bolts on the side of the fence opposite the fabric side.

3.5 GATE INSTALLATION

A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach fabric as for fencing. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.

3.6 GROUNDING AND BONDING

A. Fence Grounding: Install at maximum intervals of 1500 feet except as follows:

1. Fences within 100 Feet of Buildings, Structures, Walkways, and Roadways: Ground at maximum intervals of 750 feet.

a. Gates and Other Fence Openings: Ground fence on each side of opening.

1) Bond metal gates to gate posts.
2) Bond across openings, with and without gates, except openings indicated as intentional fence discontinuities. Use No. 2 AWG wire and bury it at least 18 inches below finished grade.

B. Protection at Crossings of Overhead Electrical Power Lines: Ground fence at location of crossing and at a maximum distance of 150 feet on each side of crossing.

C. Fences Enclosing Electrical Power Distribution Equipment: Ground as required by IEEE C2 unless otherwise indicated.

D. Grounding Method: At each grounding location, drive a grounding rod vertically until the top is 6 inches below finished grade. Connect rod to fence with No. 6 AWG conductor. Connect conductor to each fence component at the grounding location, including the following:

1. Make grounding connections to each barbed wire strand with wire-to-wire connectors designed for this purpose.
2. Make grounding connections to each barbed tape coil with connectors designed for this purpose.

E. Bonding Method for Gates: Connect bonding jumper between gate post and gate frame.

F. Connections: Make connections to minimize possibility of galvanic action or electrolysis. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.

1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer in order of galvanic series.
2. Make connections with clean, bare metal at points of contact.
3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
4. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.
5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

G. Bonding to Lightning Protection System: If fence terminates at lightning-protected building or structure, ground the fence and bond the fence grounding conductor to lightning protection down conductor or lightning protection grounding conductor complying with NFPA 780.

3.7 FIELD QUALITY CONTROL

A. Grounding-Resistance Testing: Design Professional will engage a qualified testing agency to perform tests and inspections.

1. Grounding-Resistance Tests: Subject completed grounding system to a megger test at each grounding location. Measure grounding resistance no fewer than two full days after last trace of precipitation, without soil having been moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural grounding resistance. Perform tests by two-point method according to IEEE 81.
2. Excessive Grounding Resistance: If resistance to grounding exceeds specified value, notify Design Professional promptly. Include recommendations for reducing grounding resistance and a proposal to accomplish recommended work.
3. Report: Prepare test reports certified by a testing agency of grounding resistance at each test location. Include observations of weather and other phenomena that may affect test

results.

3.8 ADJUSTING

A. Gates: Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

B. Lubricate hardware and other moving parts.

3.9 DEMONSTRATION

A. Engage a factory-authorized service representative to train Using Agency's personnel to adjust, operate, and maintain chain-link fences and gates.

END OF SECTION

SECTION 32 3213 - CAST IN PLACE CONCRETE - SITE

PART 1 - GENERAL

1.1 SUBMITTALS

A. Submit concrete mix designs to Architect for all classes of concrete at least 15 days prior to start of concrete work required on this project. Mix designs shall identify proportions of all materials to be used, including admixtures. Submit test data to verify strengths.

B. Submit delivery tickets for each load of ready-mixed concrete delivered showing the class and strength of concrete, pounds of cement per cubic yard, maximum size of coarse aggregate, the slump ordered, amount of admixtures and time of batching.

1.2 QUALITY CRITERIA

A. Concrete shall comply with ACI 318 and ACI 301. Adhere to all jurisdictional code requirements for reinforced concrete.

B. Ready mixed concrete shall comply with ASTM C94.

C. All work shall comply with International Building Code 2006 Edition, with 2007, 2009 AND 2010 Georgia Amendments.

1.3 TESTING

A. Concrete testing shall be performed by a certified testing agency selected and paid for by the Owner. The Contractor will be responsible for notifying the testing agency 24 hours prior to placing concrete. Testing agency shall copy Architect, Owner and Contractor in all test reports and notify Architect by phone or fax if test reports indicate abnormalities.

B. Provide a secure area for the performing of concrete tests and forming and storage of test specimens. Samples shall be procured by the testing agency in accordance with ASTM C172 and cylinders shall be made and cured in accordance with ASTM C31.

C. The following tests are required as a minimum
   1. Slump tests (1 test per each 20 cubic yards) in accordance with ASTM C142.
   2. Compressive tests (4 cylinders for each test) in accordance with ASTM C39. One cylinder shall be broken at 7 days and two at 28 days. The average of the 28 day breaks shall be considered one test. One cylinder shall be held and broken at 56 days only if test fails to meet specification.
   3. Air entrainment for applicable classes of concrete in accordance with ASTM C231.
   4. Moisture tests on cured concrete prior to installation of finish flooring material. Concrete floors are to be adequately cured and dry, maximum moisture emission shall not exceed 3 pounds per 1000 square feet in 24 hours when done in accordance with the Rubber Flooring Manufacturer's Association Calcium Chloride Dome Test.
   5. Unit weight tests of lightweight concrete shall be in accordance with ASTM 567.
   6. Relative humidity shall be tested in accordance with ASTM F2170. The probe hole depth shall be 40% of slab thickness. Allow 72 hours after drilling probe hole prior to measuring

relative humidity.

D. Frequency
   1. Procure one set of compressive test specimens for each 100 cubic yards (or fraction thereof) for each class of concrete placed each day.
   2. Perform air entrainment tests for each set of cylinders of air entrained concrete.
   3. Perform unit weight tests in accordance with ASTM 567.

E. All concrete test reports shall include slump test, specific statement of where concrete is located in the structure, statement of number of yards of concrete emptied at test, total number yards of concrete in truck, air temperature, time.

F. All reviewed submittals shall be distributed to the following:
   1. Project Manager/General Contractor.
   2. Project Manager/Architect.
   3. Project Manager/Owner.
   4. General Contractor's Job Office.
   5. Structural Engineer.

1.4 PROCEDURES

A. The results of the concrete tests shall be evaluated in accordance with Paragraphs 17.2 of ACI Standard 301.

B. If the evaluation of the compressive test indicates that the concrete has failed to meet the specified strength, core tests shall be made in the in-place concrete. The location and number of such tests are to be determined by a laboratory approved by the Architect. Tests shall be paid for by the Contractor.

C. If the core tests fail to verify the strength specified, the Architect shall affect one of the following procedures
   1. Have the Contractor remove and reconstruct that portion of the structure found to be defective.
   2. Accept the concrete in place and issue a change order as set forth in the General Conditions of these Specifications for a credit value to be agreed upon by the Owner, the General Contractor and the Architect.

D. Concrete testing shall be back charged to the Contractor if specified strength is not obtained.

PART 2 - PRODUCTS

2.1 ADMIXTURES

A. Use no additives to prevent freezing. Exposed concrete shall be air entrained between 4.5% and 6% by volume. Admixtures for water reducing and enhancing handling and finishing shall be submitted for review before installation.

B. No flyash shall be substituted for cement content.

2.2 WATER

A. All water used in concrete shall be clean and potable.

2.3 READY-MIXED CONCRETE

A. Concrete mix shall be designed to achieve minimum 28 day strengths of:
   1. 4000 psi for Concrete Pavements
   2. 3000 psi for all sidewalks and Mechanical & Cooling Tower pad.
   3. See retaining wall drawings for concrete design mix at walls.

B. Slump for all grout shall be between 9 and 11 inches.

C. Maximum unit weight of lightweight concrete shall not exceed 120 PCF.

2.4 CURING COMPOUNDS

A. Interior concrete slabs which will serve as a substrate for any finish floor materials, including all hard tiles shall be cured with curing compound by one of the following manufactures:
   1. “1100 Clear” as manufactured by W. R. Meadows.
   2. “Resin Cure E” by Nox-Crete Products.
   3. “Aqua-Kure” by Lambert Corporation.
   4. Approved Equivalent.

   NOTE: Interior curing compounds should be dissipated or removed prior to installation of moisture sensitive finish floor materials. (Alternate Curing Procedure: Cover slab with waterproof paper, plastic sheets or a combination of the two for not less than three (3) days and not more than seven (7) days. Allow slab to dry for an amount of time per floor covering manufacturer’s recommendation but not less than 45 days under roof. Refer to ACI 302.2R-06 “Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials”.)

B. Exterior concrete walls shall be cured with one of the manufacturers listed below. Those exterior concrete surfaces which are proposed to receive a finish, such as paint, stucco, stain, etc., shall be acid etched in accordance with the curing compound manufacturer's recommendations no later than 24 hours prior to the finish material application.
   1. “CS-309-25” as manufactured by W. R. Meadows.
   2. “Enviroseal 20” as manufactured by Hydrozo, Inc.
   3. “Kure & Seal 1315” as manufactured by TK Products.
   4. Approved Equivalent.

PART 3 - EXECUTION

3.1 NOTIFICATION

A. Notify the Architect as far in advance as possible of each placement of concrete to permit review prior to installation.

3.2 PREPARATION

A. Ensure that concrete formwork and reinforcing are prepared in accordance with the drawings and/or related specifications at the time of concrete placement.

B. Earth forms for concrete shall be prepared as indicated on the drawings and/or related specification sections. Ensure that bearing surfaces are clean, well-graded soil material free of debris and organic material and compacted to prescribed bearing capacity.

C. Earth forms shall be damp, free of surface water, mud, frozen material, loose soil and debris.

3.3 MIXING

A. All materials shall be measured and mixed in a machine. Mixing and transporting shall meet ASTM C94. The materials shall first be mixed dry and the water then added by measurement.

B. Mixing time shall begin when the water is added to the mix.

C. Water shall not be added to the mix at the job site except under the direction of the laboratory that designed the mix. The laboratory shall instruct that a fixed amount of cement shall be added to maintain the water/cement ratio. The mixer shall be turned 50 revolutions after the addition of water.

D. A slump test shall be made of any concrete to which water has been added to ascertain that the slump does not exceed 5" for regular mixes and 6" for pump mixes.

E. A record shall be kept of any concrete to which water has been added and the record shall show the results of the slump test.

3.4 PLACING

A. Transport and place concrete in a manner to avoid segregation and in accordance with ACI 318 and ACI 304.

B. Concrete having attained initial set or having contained water more than one hour before final placement shall not be used.

C. Concrete shall not be dropped more than three feet. Greater drops shall be handled with chutes.

D. Consolidate concrete by spading, vibrating, rodding and tamping. Work concrete around reinforcing, inserts and into corners. Avoid objectionable segregation. Ensure concrete fills all voids in form work and fully contacts all surfaces. Take measures to prevent honeycombing. Excessive honeycombing shall be grounds for rejecting concrete work. Form slabs level unless otherwise indicated, to within 1/2" in 10'-0". Verify with a metal straight edge.

E. Construction joints shall be located only as reviewed by the Architect, Structural Engineer and as shown on the drawings. All construction joints shall be filled with elastomeric joint sealant concrete is sufficiently cured, unless such joints are specified to be treated otherwise.

F. Control joints on all concrete surfaces shall be located as indicated on the drawings. Construction methods proposed for use other than those specified in Division 3 or indicated on the working drawings shall be subject to review by the structural engineer.

G. Cold Weather
1. When temperatures are 40° F and falling water or aggregates, or both, shall be heated sufficiently to insure that the temperature of the concrete at the time of delivery shall be 55°

F or above.

2. The placing, curing and protection of the cast in place concrete shall comply with the provisions of ACI 306R.

H. Hot Weather

1. During hot weather conditions excessive concrete temperatures and water evaporation which could impair the strength or serviceability of the structure shall be prevented.
2. Production, delivery, placing, curing and testing of the cast in place concrete shall comply with the provisions of ACI 305R.

3.5 FINISHING

A. Slabs

1. Exposed exterior slabs shall receive a fine broom finish. Surfaces shall be rolled or tamped to force aggregate away from surface, screeded and then finished with wood floats or steel trowels. While concrete is still green, apply uniform light broom finish with stiff-bristled push broom perpendicular to direction of travel and tool control joints approximately(½") inch deep with radiused edges.

B. Formed Surfaces

1. Patching
   a. Do not patch or touch-up newly stripped surfaces until after review by the Architect. Concrete which, in the opinion of the Architect, exhibits excessive defects shall be condemned and removed from the site at the Contractor's expense and replaced at no additional cost to the owner.
   b. All surfaces shall be patched to fill all the holes and correct minor honeycombing and other defects 1 ½" or less in any dimension the same working day the forms are removed. Concrete with larger defects shall be replaced at no additional cost to the Owner to the extent designated by the Architect.
   c. Wet the areas to be patched and thoroughly brush into the surface a grout coat of cement and sand following immediately with application of patching mortar. Patching mortar shall be of a consistency similar to concrete mix except coarse aggregate shall be omitted. Compact patching mortar into place and screed off leaving patch slightly higher than surrounding surface. Allow patch to set until after initial shrinkage and then finish to match adjoining surfaces. At the Contractor's option, a bonding agent may be used to bond patching material to concrete if written permission is received by the Contractor from the Structural Engineer prior to its incorporation.
2. Unexposed surfaces shall have rough edges and projections broken off.
3. All interior and exterior concrete, including curbs, gutters, exterior retaining walls, stairs, ramps, exposed slab edges, etc. shall have a rubbed finish. After forms are removed, smooth out joint work and remove blemishes. Imperfections shall not exceed 1/16" in any dimension. While concrete is still slightly green, remove and repair projections, offsets and blemishes. Wet surface thoroughly and rub with cement or carborundum bricks and water until uniformly smooth.

3.6 PROTECTION AND CURING

A. Protect and cure concrete as specified in the concrete Standard ACI 301.

B. Apply curing compound in accordance with manufacturer's printed recommendations.
   1. Curing compound shall be applied uniformly in continuous operation by power sprayer or roller according to manufacturer's written instructions. Re-coat areas subject to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
   2. After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies in writing that curing compound will not interfere with bonding of floor coverings used on this Project.

END OF SECTION 32 3213

SECTION 32 9119.13 - TOPSOIL DESCRIPTION, PLACEMENT AND GRADING

PART 1 - GENERAL

1.1 Manually and/or mechanically apply four (4") inches minimum depth of clean topsoil in all disturbed areas.

1.2 Topsoil shall be stripped from areas to be cleared and grubbed on site; and/or provided from off-site locations.

1.3 Contractor shall furnish, at his expense, sufficient topsoil to properly install all work as required by the Drawings and Specifications.

PART 2 – PRODUCTS

2.1 TOPSOIL DESCRIPTION

A. Topsoil shall consist of natural, fertile, friable soil; possessing characteristics of representative productive soils in the vicinity. It shall not be excessively acid or alkaline nor contain toxic substances which may be harmful to plant growth.

B. Topsoil shall be without admixture of subsoil and shall be cleaned and reasonably free from clay, large lumps, stones, stumps, roots, debris or similar substances two (2") inches or more in diameter which may be a hindrance to fine grading or planting operations. No roots, stems or other solid organic material shall exceed 12" in length, regardless of diameter.

C. Topsoil shall contain a minimum of six (6%) percent organic matter. The acidity range shall be from 6.0 to 6.8, inclusive. The mechanical analysis of the soil shall be as follows:

Sieve Size	Percent Passing
1 inch mesh	99% - 100%
¼ inch mesh	97% - 99%
No. 100 mesh	40% - 60%
No. 200 mesh	20% - 40%

PART 3 – EXECUTION

3.1 TOPSOIL PLACEMENT

A. Top soil shall be placed in an even layer in all disturbed areas that are designated for planting and/or grassing.

B. Topsoil shall be spread smooth and lightly compacted to prevent uneven settlement. Compaction is not to exceed 85%. Overly compacted areas are to be loosened and fine graded.

C. Remove all debris, rocks and roots with any dimension greater than 1" from the surface. Remove all naturally formed soil clumps larger than 3" from the surface. Debris that becomes exposed after initial surface preparation shall be removed prior to substantial completion. No debris of sufficient quantity or size to hinder mowing operations shall be visible in any

grassed areas.

D. Rake smooth so as to provide positive drainage away from structures.

E. All depressions shall be filled and smoothed to provide positive drainage. Poorly drained areas are to be corrected prior to planting and/or grassing.

F. Protect all areas from contamination after topsoil has been placed. Contamination includes; construction materials, construction waste, equipment fluids and all other materials not included in the product description for topsoil.

END OF SECTION 32 9119.13

SECTION 33 0000 - UTILITIES

PART 1 - GENERAL

1.1 Contractor shall visit the site to become thoroughly familiar with all existing conditions; review all previous drawings and specifications and previous technical reports prior to formulating Bid. Previous drawings, specifications and technical data are available for review at the Owner's and Architects offices.

1.2 By submittal of his bid, the Contractor certifies that all means, methods, labor equipment and materials to complete the satisfactory construction of the project is included within the contract sum of his bid.

PART 2 – PRODUCTS

N/A

PART 3 – EXECUTION

N/A

END OF SECTION 33 0000

SECTION 33 1100 - WATER UTILITY DISTRIBUTION PIPING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work described in this section includes construction of a potable water, and fire protection distribution system as illustrated in the Drawings from an existing water line to points near the building where it is indicated for building plumbing to begin.

B. Work here implied and illustrated shall be performed by a Contractor qualified to perform such work as described in Jackson County and City of Jefferson and licensed by the State of Georgia. Provide Certification of Qualification to Architect.

C. Contractor is responsible as part of his contract for the completion, submittal and acquisition of any Jackson County and City of Jefferson Certification of Development Compliance or equivalent documentation in connection with all domestic water and fire service systems as may be required by Jackson County and City of Jefferson Department of Water Resources or the Georgia State Fire Marshall.

D. Fire lines shall comply with Jackson County and City of Jefferson Water System requirements and Jackson County and City of Jefferson prevailing adopted fire ordinances.

1.2 SUBMITTAL

A. Product Data: Submit for each type of piping material, prefabricated structure, and casting. Indicate product descriptions and installation procedures.

B. As-Built: Provide the Owner with two (2) “hard” reproducible copies and one (1) digital copy in an Auto Cad Release (Formats to be approved by City and County) of an "As-Built" Record Drawing of the water and fire protection system and all underground utilities showing the location of the water systems, as constructed, with dimensions of same illustrated relative to buildings, curb lines and the relative horizontal and vertical location of the water main system to any other underground utility in both plan and profile. The Contractor will furnish copies of the “As-Built” data to Jackson County and City of Jefferson Department of Water Resources for review and in a format acceptable to the Departments at no additional cost to the Owner.

C. Copies of all chlorination, bacteriological, pressure testing, meter, backflow preventer, vault and bypass testing; and all certifications related thereto. Provide copies of Jackson County and City of Jefferson release of any holds on C.O. or CDC for the Project.

D. Submit evidence to the Architect that the Contractor performing the Water Main System construction is a Jackson County and City of Jefferson Qualified Contractor.

1.3 QUALITY ASSURANCE

A. Requirements of regulatory agencies: Comply with applicable codes, ordinances, rules, regulations, and laws of local, municipal, state or federal authorities having jurisdiction.

B. Water distribution systems shall meet all requirements of Jackson County and City of Jefferson Department of Water Resources and shall be subject to review by their system inspectors.

C. Statement from the appropriate Governmental agencies shall be submitted which confirms that all testing and sterilization procedures in relation to installation of water main system are in compliance with the Jackson County and City of Jefferson Department of Water Resources requirements.

D. Reference in this Section to Jackson County and City of Jefferson Standards refers to the latest edition of any written guidelines or regulations for water system construction promulgated by Jackson County and City of Jefferson Department of Water Resources.

1.4 GUARANTEE

A. Guarantee the construction and workmanship of water distribution system for a period of one (1) year.

1.5 JOB CONDITIONS

A. Water distribution system(s) shall be coordinated with grading and paving operations as well as the adjustments and modifications of existing water and/or fire protection systems affected by or connected to the new construction.

B. Water mains shall be installed when subgrade is within six (6) inches of final grade, and prior to paving base installation.

C. Have all existing utilities marked and verify the horizontal and vertical location of all said utilities prior to commencement of construction operations.

D. Location of existing utilities illustrated on Drawings is approximate and may not indicate number, type, extent or accurate dimension of utility.

E. Contractor is solely responsible for any damages or injury incurred by damage or interruption of said existing utilities.

F. Contact the Utility Protection Center at 1-800-282-7411.

G. Costs incidental to complete water and fire distribution system(s), including cutting and patching of street, water main connections, casings etc. shall be included in the Contract Sum.

H. Coordinate all disconnections, testing or “shut downs” of existing systems to avoid interruptions of existing service. Notify the Engineer and Owner a minimum of ten (10) calendar days prior to any “shut down” or disconnection.

I. In no instance will the Contractor be compensated for “lost revenue” resulting from his inability to perform work for third parties because he did not finish his work on this Project within the specified Contract Time.

J. Final payment will not be paid until the Owner receives copies of approved testing and the approved Jackson County and City of Jefferson CDC.

PART 2 - PRODUCTS

2.1 PIPE

A. Fire Service line pipe material shall be new, unused Ductile Iron Pipe, Class 50 and shall be manufactured in accordance with ANSI A21.51 and shall comply with Jackson County and City of Jefferson Department of Water Resources requirements and comply with the prevailing adopted fire ordinance of Jackson County.

B. Domestic Water Service Pipe shall be new, unused Ductile Iron Pipe conforming to Jackson County and City of Jefferson Department of Water Resources Standards and Requirements. Cellular core pipe shall not be used.

C. Ductile Iron Pipe fittings shall be in accordance with AWWA C151/ANSI A21.51.

2.2 TRACER WIRE

A. Continuous or properly spliced No. 12 AWG solid plastic-coated copper wire - to be placed on any PVC water pipe from iron fitting to iron fitting.

2.3 PIPE JOINTS

A. Ductile Iron Pipe - Push on joint such as Tyton or approved equivalent with lubricant and vulcanized gaskets conforming to Jackson County and City of Jefferson Water Main Standards.

B. PVC Pipe - Push on type complying with ASTM 03139. The joints shall be designed to provide for the thermal expansion or contraction experienced. Gasket and lubricant shall conform to all requirements of AWWA C111-79 and ASTM F477.

2.4 FITTINGS

A. Fittings for ductile iron pipe and PVC pipe shall be cast or ductile iron, conforming to requirements of AWWA C110-77, fittings shall be cement mortar lined in accordance with AWWA C104-80, standard thickness. Joints shall conform to AWWA C111-79.

B. All fittings shall be mechanical joint unless otherwise specified on the Drawings.

C. Gaskets for any PVC pipe shall be plain rubber transition type compatible with the type of pipe used.

2.5 VALVES

A. Gate Valves: Iron Body Bronze - Mounted Gate Valves, All sizes as noted on drawings, inclusive. See Jackson County and City of Jefferson Standards for specifications. Check with Jackson County and City of Jefferson Department of Water Resources for direction of opening.

PART 3 - EXECUTION

3.1 GENERAL

A. Contractor installing water main pipe lines and accessories shall acquire all necessary permits from the Jackson County and City of Jefferson Department of Water Resources prior to performing any work on site, all costs to be included in the Contract Sum.

B. Contractor should note that he is responsible for the total construction of the precast reinforced concrete water vault, including all pipes, meters, valves etc. for the fire, domestic water and irrigation water inside the water vault.

C. Line and Grade: All pipe shall be laid and maintained to the required lines and grades; with fitting, valves, hydrants and appurtenances required at the required locations; and with joints centered and spigots home; and with all valve and hydrant stems plumb.

D. Protecting underground and surface structures: Temporary support, adequate protection and maintenance of all underground and surface utility structures, drains, sewers and other obstructions encountered in the progress of the work shall be furnished by the Contractor at his own expense.

E. Contact the Utility Protection Center at 1-800-282-7411 prior to commencement of any construction operations.

F. Sub-surface exploration: Whenever necessary to determine the location of existing pipes, valves, or other underground structures, the Contractor shall examine all available records and shall make all explorations and excavations for such purpose, all costs to be included in the Contract Sum.

3.2 LAYING PIPE

A. General
   1. Before lowering pipe into trenches, the bottom of the ditch shall be graded so that when pipe is in the ditch it will have a bearing for its entire length.
   2. Pipe shall be carefully examined for defects and the inside cleaned.
   3. After placing pipe in ditch, the bell gasket, and spigot shall be wiped free from all dirt, sand and foreign material.
   4. Gasket and spigot shall then have applied a film of lubricant.
   5. Plain ends of the pipe shall then be entered into the socket after which the pipe is forced into the socket until it makes contact with the bottom of the socket.

B. Trench water: At times when pipe laying is not in progress, the open ends of pipe shall be closed by acceptable means, and no trench water shall be permitted to enter the pipe.

C. Cutting pipe: Cutting of pipe for inserting valves, fittings or closure pieces shall be done in a neat and workmanlike manner without damage to the pipe.

D. Direction of laying: Unless otherwise directed, pipe shall be laid with bell ends facing in the direction of laying. For lines on an appreciable slope, bells shall face upgrade.

E. Permissible deflection: Wherever necessary to deflect pipe from a straight line, either in the vertical or horizontal plane, to avoid obstruction, to plumb stems, or where long radius curves

are permitted, the degree of deflection shall be as recommended by the manufacturer of the pipe.

F. Unsuitable conditions: No pipe shall be laid in water or when the trench conditions or weather is unsuitable for such work, except by permission of the Landscape Architect/Engineer.

3.3 MECHANICAL JOINTS

A. Mechanical joints shall be thoroughly bolted in accordance with the manufacturer's recommendations with Tee Head Bolts and bolts of high strength, heat-treated cast iron containing 0.50 copper or high strength low-allow steel having a minimum yield point strength of 40,000 pounds per square inch and an ultimate tensile strength of 70,000 pounds per square inch.

B. Gaskets and bolts and nuts shall conform to ANSI Specification A21.11.

C. Glands shall be of high strength cast iron.

D. Installation
   1. Successful operation of the mechanical joint specified requires that the spigot be centrally located in the bell and that adequate anchorage shall be provided where abrupt changes in direction and dead ends occur.
   2. Contact surfaces shall be brushed clean and lubricated with soapy water prior to installation.
   3. Joint bolts shall be tightened by the use of acceptable wrenches and to a tension recommended by the pipe manufacturer.
   4. When tightening bolts, it is essential that the gland be brought up toward the pipe flange evenly, maintaining approximately the same distance between the gland and the face of the flange at all points around the socket.
   5. This may be done by partially tightening the bottom bolt first, then the top bolt, next the bolts at either side and last, the remaining bolts.
   6. This cycle shall be repeated until all bolts are within the above range of torques.
   7. If effective sealing is not attained at the maximum torques indicated above, the joint shall be disassembled and reassembled after thorough cleaning.
   8. Overdressing of bolts to compensate for poor installation shall not be permitted.

3.4 SETTING APPURTENANCES

A. Valves and fittings: Gate valves, blow off/flushing valves and pipe fittings shall be set and jointed to new pipe in the manner previously specified for cleaning, laying and jointing pipe.

B. Valve boxes: Cast iron valve boxes shall be firmly supported; and maintained centered and plumb over the wrench nut of the gate valve, with box cover flush with the surface of the finished pavement or at such other level as may be directed on the Drawings.

3.5 ANCHORAGE OF BENDS, TEES, AND PLUGS

A. Limiting pipe diameter and degree of bend: Reaction or thrust backing shall be applied on all pipe lines at all tees, plugs caps and at bends deflecting eleven degrees or more, or movement shall be prevented by attaching suitable metal rods or straps.

B. Material for reaction backing
   1. Reaction, or thrust backing shall be of Class “A” Concrete, 3000 PSI at 28 days.
   2. Backing shall be placed between solid ground and the fitting to be anchored; the area of bearing on pipe and on ground in each instance shall be as illustrated on the Drawings.
   3. Backing shall, unless otherwise directed, be so placed that the pipe and fittings' joints will be accessible for repairs.

3.7 HYDROSTATIC TESTS

A. Pressure during test: After the pipe has been laid and partially backfilled as specified, all newly laid pipe, or any valved section of it, shall, unless otherwise specified, be subjected to hydrostatic pressure of 150 psi.

B. Duration of pressure test: The duration of each pressure test shall be at least four (4) hours.

C. Procedure
   1. Test shall conform with AWWA C600.
   2. Each section of pipe shall be slowly filled with water and the specified test pressure, measured at the lowest point of elevation, shall be applied by means of a pump connected to the pipe in a satisfactory manner.
   3. Pump, pipe connection gauges and all necessary apparatus shall be furnished by the Contractor.
   4. Test shall be applied to each valved section in order to check this leakage through all valves.
   5. Contractor shall notify and request Fire Marshal to monitor all pressure test and leakage test procedures.

D. Expelling air before test
   1. Before applying the specified test pressure, all air shall be expelled from the pipe.
   2. To accomplish this, taps shall be made, if necessary, at points of highest elevation, and afterwards tightly plugged.

E. Leakage defined: Leakage is defined as the quantity of water to be supplied into the newly laid pipe, or any valved section of it, necessary to maintain the specified leakage test pressure after the pipe has been filled with water and air expelled. Fire Marshal to monitor leakage test.

F. Permissible leakage: Suitable means shall be provided by the Contractor for determining the quantity of water lost by leakage under normal operating pressure. No pipe installation will be accepted until or unless this leakage is less than ten (10) US Gallons per 24 hours per thousand (1000') feet per inch nominal diameter. In calculating leakage, the Fire Marshal will make allowance for added joints in the pipe line above those that are incidental to normal unit lengths of pipe.

G. Variation from permissible leakage: Should any test of combined sections of pipe laid disclosed leakage per mile of pipe greater than that specified, or if individual sections show leakage greater than the specified limit, the Contractor shall, at their own expense, locate and repair the defective joints until the leakage is within the specified allowance.

H. Time for making test: Pipe may be subjected to hydrostatic pressure, inspected, and tested for leakage at any convenient time to Contractor, Landscape Architect/Engineer and Fire Marshal

after partial completion of backfill. The Contractor shall truck water as necessary to make the tests when each section is ready.

3.8 STERILIZATION

A. Before being placed in service, all new water main pipe lines and accessories shall be chlorinated.

B. Chlorinating equipment and materials, labor and supplies shall be furnished by the Contractor and included in the Contract Sum.

C. Prior to chlorination, all dirt and foreign matter shall be removed by a thorough flushing through the hydrants or by other acceptable means.

D. Each valved section of new laid pipe shall be flushed independently. That shall be done prior to the pressure test and may be done either before or after the trench has been backfilled.

E. Flushing, chlorinating and testing of water main pipe lines shall be in strict compliance with the Jackson County and City of Jefferson Department of Water Resources.

F. Sterilization procedure shall be in accordance with AWWA C601.
   1. Sterilization shall be accomplished by the application of clear water containing a minimum of 50 ppm of available chlorine.
   2. Chlorine bearing water shall remain in contact with the surfaces being sterilized for a period of not less than 24 hours.
   3. At the end of the contact period, the chlorine residual in all units and at extremities of pipelines shall be at least 25 ppm.
   4. Contractor shall arrange for the testing of treated water through the Landscape Architect/Engineer and Jackson County and City of Jefferson Department of Water Resources Testing Laboratory.

G. Chlorinating valves and hydrants: In the process of chlorinating water pipe, all valves or other appurtenances shall be operated while the pipeline is filled with the chlorinated agent.

H. Final flushing and test
   1. Following chlorination, all treated water shall be thoroughly flushed from the newly laid pipeline at its extremities until the replacement water throughout its length shall, upon test, be reviewed by Jackson County and City of Jefferson Department of Water Resources.
   2. Contractor shall be responsible for arranging for the test samples.

I. Repetition of procedure: Should the initial treatment prove ineffective, the chlorination procedure shall be repeated until confirmed tests indicate that water sampled conforms to the requirements previously stated.

END OF SECTION 33 1100

SECTION 33 3000 - SANITARY SEWERAGE UTILITIES

PART 1 - GENERAL

1.1 SCOPE

A. Work described in this section consists of constructing sanitary sewers and appurtenances as illustrated on the Drawings.

B. Work described in this section also consists of expediting television inspection and testing of the sanitary sewer system.

C. Work herein implied and illustrated shall be performed by a Contractor qualified to perform such work in Jackson County and City of Jefferson and licensed by the State of Georgia refer to Jackson County and City of Jefferson Department of Water Resources for detailed requirements. Provide Certification of Qualification to the Architect.

D. Complete, submit and secure a Jackson County and City of Jefferson Certificate of Development Compliance (CDC) from Jackson County and City of Jefferson Department of Water Resources in connection with the construction of the sanitary sewer system. This must be complete prior to the issuance of the Certificate of Occupancy.

E. Related Work Specified Elsewhere
1. Reference Division 31, Earthwork.
2. Reference Division 32, Exterior Improvements.
   a. Section 32 1216 Asphalt Paving.
   b. Section 32 1313 Concrete Paving.
   c. Section 32 1723 Pavement Markings.

1.2 SUBMITTALS

A. Product Data: Submit for each type of piping material, prefabricated structure, and casting. Indicate product descriptions and installation procedures.

B. Furnish “As-Builts” Record Drawings of the Sanitary Sewer System (Refer to paragraph 3.15).
1. As-Builts: Contractor shall provide the Owner with two (2) “hard” reproducible copies and one (1) digital copy in an Auto Cad Release (Formats to be approved by Jackson County and City of Jefferson) of an “As-Builts” Record Drawing of the new Sanitary Sewer system and all underground utilities showing the location of the new sanitary sewer system, as constructed, with dimensions of same illustrated relative to buildings, curb lines and the relative horizontal and vertical location of the sanitary sewer system to any other underground utility in both plan and profile. The Sanitary Sewer System “As-Built” may be part of the Contractor’s responsibility in meeting the requirements for securing a Jackson County and City of Jefferson CDC. It is the Contractor’s responsibility to ascertain from Jackson County and City of Jefferson whether the sanitary sewer “lateral” system is required as part of the CDC.
2. This shall include on-site and any off-site sanitary sewer service.
3. Shall conform to latest edition of Jackson County and City of Jefferson Department of Water Resources “Sanitary Sewer Standards” and the Jackson County and City of Jefferson

Development Regulations in respect to the sanitary sewer system “As-Built” documentation.

4. Record Drawings and “As-Builts” must be consistent with the Design Concept in construction and in function.

1.3 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies: Comply with applicable codes, ordinances, rules, regulations, and laws of local, municipal, state, or federal authorities having jurisdiction.

B. Sanitary sewer construction is subject to review and acceptance by Jackson County and City of Jefferson , and shall meet their requirements and Specifications.

C. Sanitary Sewer systems shall meet all requirements of Jackson County and City of Jefferson Department of Water Resources and shall be subject to review by their system inspectors.

1.4 JOB CONDITIONS

A. Contractor should note that he is solely responsible for furnishing and installing the sanitary sewer system as illustrated on the Drawings and as specified herein.

B. Sanitary Sewer construction is to be coordinated with grading operations to avoid deep trench conditions in so far as possible and to minimize soil erosion and to maintain general public and worker safety.

C. In no instance will the Contractor be compensated for “lost revenue” resulting from his inability to perform work for third parties because he did not finish his work on this Project within the specified Contract Time.

D. Final payment will not be paid until the Owner receives copies of approved “As-Built(s)”and the approved Jackson County and City of Jefferson CDC.

PART 2 - PRODUCTS

2.1 PIPE

A. Polyvinyl Chloride Pipe, Schedule 40 pipe shall conform to ASTM D3034 SDR35 as indicated on the Drawings. Standard pipe lengths not greater than twenty (20) feet shall be used on all work. “Wye or Tee” fittings shall be utilized (saddles are prohibited). PVC pipe shall be jointed with a rubber gasket and shall conform to ASTM F477. PVC pipe shall not be jointed by solvent cement with which the pipe surfaces are fused together. Pipes and fittings shall be fully lined in accordance with ANSI A21.4. Install a #10 cooper wire the entire length of the pipe in the ditch with the pipe. Cellular core pipe shall not be used.

B. Ductile Iron Pipe shall conform to ANSI Standard Specification A21.51 as indicated on the Drawings. Unless otherwise indicated on the Drawings, pipe shall be minimum Class 350 or thickness Class 50 Pipe for eighteen (18) inch and smaller. Pipe exterior and fittings shall be fully coated with an approved bituminous seal coat in accordance with ANSI A21.4. Ductile iron pipe shall be of the bell and spigot type with push-on joints conforming to ANSI Specification A21.11 or shall be mechanical joint.

2.2 MANHOLES

A. Manholes shall be precast reinforced concrete construction made in conformance with ANSI/ASTM C478 *(Minimum inside diameter of 4 feet and 5-inch minimum wall thickness)*. Manholes shall consist of precast reinforced concrete riser sections, eccentric top section and a base section. Concrete shall have a minimum compressive strength of 3,000 psi when tested in accordance with ASTM C 39.

2.3 APPURTENANCES

A. Castings shall be grey cast iron conforming to ASTM A48.

B. Drainage fill shall be Size # 57 crushed stone meeting ASTM C33.

C. Concrete shall be Class A, 3,000 psi "High Early" Type.

PART 3 - EXECUTION

3.1 TRENCHING AND EXCAVATION

A. Ground shall be excavated in open trench to the width, depth and in the direction necessary for the proper construction of the Sanitary Sewer according to the Drawings.

B. Bottom of the trench shall be shaped so as to conform as nearly as possible to the outside of the pipe, particular care being taken to recess the bottom of the trench in such a manner as to relieve the bell of the pipe of all load.

C. Pipe sewers shall be built in a trench, the width of which at the top of the pile shall not exceed the external diameter of the bell of the pipe, plus twelve inches (12") each side, unless otherwise directed by the Landscape Architect/Engineer. In no case shall the width of the trench be less than twenty-four inches (24").

3.2 BACKFILLING

A. Trenches and excavation shall be backfilled immediately after the pipes are laid therein unless other protection for the pipe line is directed.

B. Backfilling material shall be selected and deposited with special reference to the future safety of the pipes.

C. Clean earth, sand or rock dust shall be solidly tamped about the pipe up to the level of six inches (6") above the top of the pipe, and shall be carefully deposited in uniform layers, each layer solidly tamped or rammed with proper tools so as not to disturb or injure the pipe line.

D. Mechanical means may be permitted for backfilling, provided the equipment meets the approval of the Landscape Architect/Engineer. The remainder of the backfilling of the trenches shall be faithfully rammed or tamped in layers not more than six inches (6") in depth, with either approved mechanical or hand tamps.

E. Compaction shall be as specified under Division 31 “Earthwork” of these Specifications.

F. Backfilling material shall be free from rock, trash, and debris.

3.3 PIPE LAYING

A. Pipes shall be of the dimensions and laid to the line and grade as illustrated on the Drawings.

B. Maximum distance between manholes for sewer lines under twenty four (24) inches is five hundred (500) feet.

C. Within a paved area minimum cover from finished grade is seven (7) feet. Cover less than seven (7) feet within paved area requires DIP and will only be approved when site conditions dictate.

D. In non-paved area minimum cover from finished grade is four (4) feet. Cover less than four (4) feet in non-paved area requires DIP and will only be approved when site conditions dictate.

E. Pipe shall be laid with joints close and even, butting all around, special care being taken that there is no sagging at the hub, and that a true surface is given to the invert throughout the entire length of the sewer.

F. Wyes and/or service connections and stubs shall be placed where illustrated on the Drawings and as directed by the Landscape Architect/Engineer. All such connections shall be blanked off with a suitable stopper and made watertight with cement mortar.

G. Bell holes must be dug so that the barrel of the pipe shall carry the load. After the pipe is laid, backfilling up to six inches (6") above the top of the pipe shall be made of three inch (3") layers of clean, dry earth, thoroughly rammed between each layer.

H. Water in Trenches: Sewers with fresh joints shall not be used for draining water from ditches. Contractor will be required to provide and operate pumps, if necessary, to remove water from trenches while pipe is being laid and joints made.

I. Bedding: Bedding of Sanitary Sewer pipes shall be in accordance with the details show on the Drawings.

3.4 JOINTING PIPE

A. In jointing gasket pipe, both the bell and spigot shall be thoroughly cleaned before the gasket is applied.

B. Proper size gasket shall be used for each size of pipe and shall be lubricated only with a lubricant recommended by the manufacturer of the pipe.

C. Spigot end shall be inserted in the bell for the proper distance and care shall be taken to see that the pipe remains in this position.

D. Joint material that may be left on the inside shall be thoroughly cleaned out and the pipe left clean and smooth throughout.

E. Every third pipe shall be filled around immediately after being properly placed and jointed to

prevent the moving of joints.

F. Interior of the pipe shall be carefully freed of all dirt and superfluous material of every description, as the work proceeds.

G. Defective joints discovered after laying shall be repaired and made tight.

H. Defective pipes shall be removed and the proper replacement made.

I. Openings shall be closed with an approved type vitrified clay plug held in place with material such as specified for fillings joints.

J. Dead ends of sewer lines shall be similarly stoppered.

3.5 MANHOLES

A. Manholes shall have a minimum of four (4) feet of clearance from storm water sewers and other underground utilities.

B. Manholes shall be located along center line of Sanitary Sewer at locations illustrated on the Drawings.

C. Pipe entry into a manhole shall be at no more than a 90 degree angle from the direction of flow through the manhole.

D. Pipes entering a manhole shall be sealed by a rubber boot such as A-Lok, Z-Lok or Kor-n-Seal, or other approved equal.

E. Barrel joints shall be tongue and groove with Kent-Seal type gaskets or approved equivalent. Joints shall be grouted smooth with cement grout on inside.

F. Lift holes shall be fully sealed with grout and troweled smooth inside and out.

G. Manholes shall have a minimum of six inches (6") of compacted #57 stone bedding (95% Proctor Density).

H. Eccentric manholes are required.

3.6 MANHOLE CORINGS

A. Contractor shall be responsible for performing manhole corings.

B. The coring must not be backfilled until approved by the Jackson County and City of Jefferson Inspector. Failure, for any reason, to have the Jackson County and City of Jefferson Inspector approve the coring will cause all work on the Sanitary Sewer system to be halted until the cored manhole is excavated and the rubber boot exposed.

C. Cores for connections are only allowed when installed with a rubber boot, three (3) feet of DIP and a mechanical joint plug.

3.7 MANHOLE INVERTS

A. Solid precast inverts or Rowlock (Brick) are required. Crushed stone filler may be utilized under the table.

B. Invert shall be constructed with the same radius as the outflow pipe.

C. Invert walls shall be constructed to a height corresponding to the springline of the influent and effluent pipes with smooth rounded walls.

D. Inverts shall be appropriately channeled for all stub connections to the manholes.

E. Flow channel through manholes shall be made to conform in shape and slope to that of the Sanitary Sewer. Minimum drop across manhole invert shall be 0.20 feet to prevent solids deposition.

F. Tables are to be gently sloped and troweled smooth form manhole wall to invert wall height and constructed of aggregate-mix cement with smooth, veneer finish.

G. Inverts must be grouted 360 degrees around rubber boots.

3.8 MANHOLE STEPS

A. Manhole steps shall be equal to M.A. Industries, Inc. (#PS-1 or #PS-1-PF).

B. The uppermost step shall be built into the masonry not over twelve (12) inches below the top of manhole dome/cone and these steps shall be continued in alignment downward along the interior vertical side of the manhole to a point no lower than the crown of the largest sewer.

C. Spacing of steps shall not exceed twelve (12) vertical inches.

D. Steps shall not descend over any pipe connection into the manhole.

3.9 MANHOLE FRAMES AND COVERS

A. The cast iron frame for the manhole cover shall be set at the required elevation and properly anchored to the masonry.

B. For manholes constructed in paved areas, frames and covers shall be Vulcan #VM-1357, U.S. Foundry #USF-229 or approved equal. The top surface of the frame and cover shall conform to the crown and grade of the existing or proposed pavement. Adjustment to final grade in paved areas shall be provided by means of brick coursing not to exceed four (4) common brick or twelve (12) inches maximum, in height with Portland-type cement joints.

C. For manholes constructed in non-pavement areas, frames and covers shall be Vulcan #VM-2358, U.S. Foundry #USF-152 or approved equal. The top surface of the frame and cover shall have bolt-down lids with a watertight gasket. Manholes in wooded or unmaintained area shall be a minimum of eighteen (18) inches above adjacent ground level. The cast iron frame shall be factory cast into the concrete cone. Manholes in maintained grass areas may be flush with the ground. Manholes on sloped ground in unmaintained areas shall be a minimum of eighteen (18) inches above ground level on the uphill side of the manhole.

3.10 TESTING

A. Contractor shall call for all pressure testing and television inspections required by Jackson County and City of Jefferson Department of Water Resources.

B. Contractor shall provide the Owner with complete set of data and Certificates of Approval of all testing and inspection.

C. Infiltration limits shall be as specified in ASTM C425 and shall not exceed 0.40 gal. /inch diameter/hour/100 linear feet of pipe for the entire system or for any one run of sewer between manholes.

D. Contractor shall provide means for measuring infiltration as directed by the Landscape Architect/Engineer.

E. If infiltration exceeds the prescribed limit, the Contractor shall locate the sources and make repairs as directed by the Landscape Architect/Engineer.

3.11 CONNECTION TO PROPOSED BUILDING

A. Connection to any proposed building shall be made by the plumbing contractor.

3.12 CLEAN UP AND INSPECTION

A. Total Sanitary Sewer system shall be left clean and clear of materials of all kind.

B. When lamped, each run of total Sanitary Sewer pipe shall present a full circle of light.

C. Connection to the public system will be made only when there is no reasonable possibility of accidents to the public system due to reconstruction.

3.13 "AS-BUILT" RECORD DRAWINGS

A. Submit to Jackson County and City of Jefferson Department of Water Resources and the Owner, two (2) sets of certified record documents of all portions of the new constructed Sanitary Sewer system (As- Built) prepared by a Georgia Registered Land Surveyor for review and approval.

B. As a minimum, the following information shall be included in all record documents:
   1. Horizontal location of all manholes, pipes, laterals, cleanouts, easements, patching or paving, etc. as built in plan view.
   2. Vertical information shall be illustrated in profile regarding the Sanitary Sewer As-Built such as tops of all structures, invert elevations, location and differential vertical location at crossings with storm sewer, water, gas and all other utility lines in profile.
   3. Seal and certification of a Georgia Registered Land Surveyor.

C. Record “As-Built” Drawings shall be considered a certifiable accurate representation of the constructed Sanitary Sewer System and shall be in compliance with Jackson County and City of Jefferson Standards and shall be consistent with the engineering design concept in construction and function of the Sanitary Sewer system as completed.

D. Record documents information required by the Jackson County and City of Jefferson shall be included in the Contract Sum with no additional cost to the Owner.

3.14 CONSTRUCTION INSPECTION

A. Expose and notify Architect of when all Sanitary Sewer trenches will be open for observation of depth, bedding conditions etc.

B. Architect has the right to have any backfilled trench opened to observe any portion of the Sanitary Sewer system that he was not notified of, all at the contractor's expense.

C. Elements of the Sanitary Sewer system are subject to observation, review, rejection or acceptance as so deemed by the Architect at no additional cost to the Owner.

D. Piping and structures shall be opened for inspection upon request by the Architect.

3.15 CLEANING AND INSPECTION

A. In addition to the "As-Built" survey (Section 3.15) and Clean Up and Inspection (Section 3.14) defined above the Contractor shall conduct certain post construction activities to ensure that the total Sanitary Sewer system is functioning as intended, all costs for which shall be included in the Contract Sum. Post construction activities to include , but shall not be strictly limited to:
   1. Video Inspection of the total Sanitary Sewer System: The Contractor shall view and video tape the condition of the interior of the total Sanitary Sewer system using video camera equipment of type suitable for the pipes to be viewed.
   2. Preparation: Prior to conducting the viewing and video taping of the total Sanitary Sewer system the Contractor shall thoroughly clean the lines with clean water and let the water drain from the total Sanitary Sewer system.

   3. Record of Video: The Contractor shall provide four (4) identical copies of the video tape of each of the pipe lines of the Sanitary Sewer system. Each video tape to include the following information:
      a. Name of Firm conducting the video inspection.
      b. Date and time of video inspection.
      c. Location of video inspection; identify each line by manholes and pipe number.

B. Cleaning of Sanitary Sewer System: It is the, intent, that upon the completion of all construction activities and prior to the occupancy of the Facility that the Contractor thoroughly clean out all pipe lines comprising of the total Sanitary Sewer system to ensure that the lines are clean and free from all construction and soil type materials at no additional cost to the Owner.

END OF SECTION 33 3000

SECTION 33 4000 - STORM DRAINAGE UTILITIES

PART 1 - GENERAL

1.1 SCOPE

A. Storm water runoff shall be collected in area drains, catch basins, curb inlets etc. and piped underground through primary and secondary storm water drainage systems to sub-surface detention facilities located within property boundaries of the project site.

B. Roof water runoff shall be collected by a gutter and down spout system on the building and then transferred through a secondary storm water drainage system to the primary storm drainage system.

C. Fine grading to direct surface storm water runoff to the primary and secondary storm water drainage systems described below.

D. By submittal of his bid, the Contractor certifies that all means, methods, labor equipment and materials to complete the satisfactory construction of the project is included within the contract sum of his bid.

1.2 DESCRIPTION OF WORK

A. Work described in this section includes, but is not limited to, construction of primary and secondary storm sewers, drainage structures, and drainage appurtenances.

B. Contractor is responsible to complete, submit and secure any Certificate of Development Compliance or equivalent documentation required in connection with all the storm drainage systems as may be required by Jackson County Stormwater Department.

C. Related Work Specified Elsewhere
   1. Reference Division 31 0000, Earthwork.
   2. Reference Division 32 0000, Exterior Improvements.
      a. Section 32 1216 Asphalt Paving.
      b. Section 32 1313 Concrete Paving.
      c. Section 32 1723 Pavement Markings.
      d. Section 32 9219 Seeding and Sodding.

1.3 SUBMITTALS

A. Product data: Submit for each type of piping material, prefabricated structure, castings and trench drain. Indicate product descriptions and installation procedures.

B. In the event that storm water drainage systems and structures are not maintained during the construction process to the satisfaction of the Architect, an interim “as built” may be required to establish the extent of deficiencies. All costs associated with an interim “as built” will be borne by the Contractor.

C. For each type of Cast-In-Place Concrete Structure the Contractor will furnish a detailed Shop

Drawing illustrating the structure. Shop Drawing will also illustrate the reinforcement proposed in the structure sized to accommodate the structure and any load bearing on it. This information is required regardless of the Details and information provided on the Drawings.

D. During the Bid Phase of the Project, the Contractor is responsible to carefully examine the Storm Water Management System and relay questionable and/or conflicting information illustrated on the Engineer's Drawings to the Architect in the format of a Request for Information (RFI). Examples of such issue might include conflicting pipe to structure dimensional information, vertical conflicts, the ability to construct structures, systems or devices or the overall Design Concept of the Storm Water Management System. The Engineer (through the Architect) will clarify such issues by Addenda during the Bid Phase of the Project.

E. Copies of the approved Record "As-Built" Hydrology Report and the Record "As-Built" Survey. Provide copies of Jackson County 's release of any holds on C.O. or CDC for the Project.

F. Furnish detailed Shop Drawing(s) illustrating precast Storm Sewer Manholes that require a larger diameter to accommodate larger or multiple pipes.

1.4 QUALITY ASSURANCE

A. Industry standards: Standards for the following, as referenced hereinafter.
   1. American Society for Testing and Materials (ASTM).
   2. American Concrete Institute (ACI).
   3. Georgia Department of Transportation, "Standard Specifications for the Construction of Transportation Systems", 2013, or latest edition, hereinafter referred to as Georgia DOT Specifications and any Supplemental Specifications thereto.
   4. Jackson County Storm Water Systems and Facilities Installation Standards and Specifications - Latest Edition.

B. Work implied here shall be performed by a Contractor and/or his sub-contractor qualified to perform such work in Jackson County and licensed by the State of Georgia. Provide Certificate of Qualification to Architect.

1.5 GUARANTEE

A. Contractor shall guarantee the construction of all primary and secondary storm drainage systems for a period on one (1) year from the date of Substantial Completion.

1.6 PROJECT CONDITIONS

A. In no instance will the Contractor be compensated for "lost revenue" resulting from his inability to perform work for third parties because he did not finish his work on this Project within the specified Contract Time.

B. Final payment will not be paid until the Owner receives copies of approved "As-Built(s)" and the approved Jackson County CDC.

PART 2 - PRODUCTS

2.1 PIPES

A. Contractor will use for the primary storm water drainage system either Reinforced Concrete Pipe (RCP), Aluminized Steel, Type 2 (AST2), Smooth Interior Corrugated Polyethylene Pipe (HDPE), Polyvinyl Chloride Pipe (PVC) or a combination of them.

B. Primary storm water sewer pipes are those pipes that are greater than (18”) inches diameter, regardless of material. The type, size, class or gauge, and material is illustrated on the Drawings in plan and profile and as specified on the Pipe Chart.

C. Contractor will only use (PVC) Pipe & Fittings and HDPE Pipe and Fittings for the secondary storm water drainage system as illustrated on the Drawings. To be used to connect area drains to the primary drainage system as illustrated on the Drawings. Cleanouts to the secondary system will be provided where illustrated on Drawings.

D. Secondary Storm pipes are those pipes that are (18”) inches or less in diameter, regardless of material.

2.2 PIPE MATERIALS

A. Reinforced Concrete Pipe (RCP) and Flared End Sections (FES) shall conform to Georgia DOT Standard Specifications Section 843.01, Min. Class III pipe for pipes up to fifteen (15') feet of cover, Min. Class V for pipes over fifteen (15') feet of cover, and shall meet the requirements of AASHTO: M 170 and/or ASTM C-76. Class and wall thickness shall be in accordance with Standard Detail 1030D Georgia DOT Specification Table 1. All pipe joints shall be bell & spigot with a rubber gasket conforming to ASTM C-443.

B. Aluminized Steel, Type 2 (AST2) pipe shall conform to Georgia DOT Standard Specifications Section 844.08, and shall meet the fabrication requirements of AASHTO: M 36 or ASTM A760. The steel sheet used in the fabrication shall conform to the requirements AASHTO: M 274 or ASTM A 929. The outside and inside surfaces of the corrugated metal pipe shall be aluminized. Coupling bands shall be corrugated, galvanized, and aluminized hugger type with a two bolt or more connector. Bolts shall be ½" diameter and galvanized. Coupling bands shall be the same thickness as used for the pipe.

C. Smooth Lined Corrugated Polyethylene Pipe (HDPE) shall conform to Georgia DOT Standard Specifications Section 845.00, and shall meet the requirements of AASHTO: M 294 Type S or AASHTO MP7. The coupling bands shall engage two full corrugations on each pipe section and rubber gaskets conforming to ASTM F-477 will be required for all joints.

D. Polyvinyl Chloride Pipe Schedule 40 Pipe & Fitting, shall conform to Georgia DOT Standard Specifications Section 847.08, and shall meet the requirements of AASHTO: D 3034 (SDR 35). Joints shall have elastomeric seals which conform to the requirements of ASTM F 477.

2.3 CONCRETE, MASONRY AND ACCESSORY MATERIALS

A. Concrete
   1. 3,000 psi compressive strength, in accord with Division 3, Concrete, including form work, reinforcement and finish.
   2. Concrete must meet Georgia DOT Specifications, Section 500.00.

B. Manhole Brick
   1. Meeting ASTM C32-73, Grade MM.
   2. Bricks must meet Georgia DOT Specifications, Section 834.00.

C. Mortar and Grout
   1. Meeting ASTM C270-80, Type M.
   2. Mortar must meet Georgia DOT Specifications, Section 834.03.

D. Construction Castings
   1. Meeting ASTM A48-76, grey cast iron.
   2. Castings must meet Georgia DOT Specifications, Section 854.00.

E. Manhole Steps
   1. Meeting ASTM A48-76, Class 30B, integrally cast into manhole sidewalls.

F. Gravel Fill
   1. Shall consist of sound, durable rock, free from injurious amounts of coatings of any kind and shall be graded so 100% passes the 1-½" sieve, 95-100% passes the (1") inch sieve, 25-60% passes the (½") sieve, 0-10% passes the No.4 sieve and 0-5% passes the No.8 sieve.
   2. All stone for Gravel Fill shall meet the quality requirements of Section 800 of the State of Georgia Department of Transportation Standard Specifications for Construction of Roads and Bridges, 1993 or latest Edition.

G. Granular Bedding and Backfill Material
   1. Shall consist of a granular soil, sand, chert, crushed stone or mixture of these, all of which passes a 3/4 inch sieve, 80% passing a 3/8 inch sieve, 40% passing a No.4 sieve, 10% passing a No. 8 sieve, and not more than 5% passing a No. 16 sieve.
   2. Material shall be free of organic matter and debris. All stone for Granular Bedding shall meet the quality requirements of Section 800 of the State of Georgia Department of Transportation Standard Specifications for Construction of Roads and Bridges, 1993 or latest Edition.

H. Plain Rip Rap
   1. Shall meet the quality requirements of Section 805 of the State of Georgia Department of Transportation Standard Specifications for Construction of Roads and Bridges, 1993 or latest Edition.
   2. Material shall be processed such that the largest pieces have a volume of not more than two (2) cubic feet and not more than ten (10%) percent of the total weight of rip rap shall consist of spalls passing a five (5") inch sieve.
   3. Stone for Rip Rap shall be sound, durable pieces and shall be resistant to the action of air and water.
   4. Flat, slabby and shaley pieces are not acceptable.

5. Stone shall be clean and essentially free of rock dust and fines.

I. Precast Concrete Manholes
   1. Meeting ASTM C478-79, concentric cone type and Georgia DOT Specifications Section 866.00.

J. All structures whether pre-cast or brick shall meet or exceed the requirements of the Georgia Department of Transportation Standards and Specifications.

PART 3 - EXECUTION

3.1 CONSTRUCTION OF DRAINAGE SYSTEM

A. Excavation, bedding, filling and compaction for construction of drainage system shall be in accordance with Section 31 0000, Earthwork.

B. Laying of pipe on top of soil and then backfilling around the pipe is inconsistent with the Design Concept and will not be permitted. Any such "construction" will be disassembled and redone. No payment will be made to the Contractor for such inconsistent work.

C. Inspect piping prior to placing in trenches. Do not install defective or damaged piping.

D. Lay piping beginning at low point of the drainage system with joints lapped upgrade. Lay in proper alignment and to slopes indicated, fully supported on firm subgrade.

E. Clean interior of piping of dirt and debris as work progresses. Place plugs in the ends of uncompleted piping at the end of each work period. Continue to flush lines between manholes and drainage structures as required to remove collected debris until permanent vegetative cover has been established.

F. Lengths of storm drain pipe illustrated on the Drawings are approximate distances center to center of structures. The Contractor is responsible for all pipe quantities to convey storm drainage to points indicated in accordance with the design concept illustrated.

G. All drainage piping shall have watertight joints and all structures shall be watertight joints.

H. Smooth Lined Corrugated Polyethylene Pipe (HDPE) shall be installed in accordance with ASTM recommended practice D-2321, AASHTO Section 30, or with Section 550 of the Georgia DOT Standard Specifications.

I. Reinforced Concrete Pipe (RCP) shall be installed in accordance with Section 550 of the Georgia DOT Standard Specifications.

J. Aluminized Steel, Type 2 (AST2) pipe shall be installed in accordance with Section 550 of the Georgia DOT Standard Specifications, and in accordance with AASHTO Standard Specifications for Highway Bridges, Section 26, Division II or ASTM A 798.

K. Polyvinyl Chloride Pipe Schedule 40 Pipes & fittings shall be installed in accordance with ASTM recommended practice D2321.

3.2 CONSTRUCTION OF DRAINAGE STRUCTURES

A. Construct catch basins, drop inlets, headwalls and similar structures of reinforced concrete unless otherwise indicated; manholes of masonry, concrete or precast units at Contractor's option.

B. Provide concrete foundations for manholes and other structures as indicated on Drawings.

C. All drainage structures shall have paved (mortar) inverts.

D. Concrete structures shall be reinforced whether indicated on the Drawings or not.

E. Concrete construction shall receive a smooth formed finish in accord with ACI-301-72 on all surfaces exposed to exterior or interior of structure; rough formed for all unexposed construction.

F. Moist cure concrete for a minimum of seven (7) days after placing.

G. Mix mortar with only enough water for workability. Re-tempering of mortar will not be permitted.

H. Keep mortar mixing and conveying equipment clean. Do not deposit mortar upon or permit contact with ground.

I. Lay masonry in full mortar bed with ends and with full vertical joints, not more than 5/8" wide. Protect fresh masonry from freezing and from too rapid drying.

J. Apply a ½" thickness mortar parge coating on interior and exterior or of masonry walls surfaces.

K. Set tops of frames and covers of manholes flush with finished surface.

L. Set drainage gratings to elevations indicated on the Drawings.

M. Remove any lifting rings after structure installation.

N. Grout all structured inverts.

O. Take notice of, coordinate and clarify “top” elevations versus “flow line” elevations prior to construction of all catch basins, drop inlets, yard inlets, etc.

P. For any final grade adjustment up to one (1') foot use precast concrete grade rings or brick courses.

3.3 “AS-BUILT” RECORD DRAWINGS

A. Contractor shall employ the services of an independent Registered Land Surveyor (R.L.S.) for the “As-Built” Record Drawings. The R.L.S. will hold active licensure and registration in the State of Georgia. Contractor shall establish a relationship with this R.L.S. so that he may assist the Contractor with the entire process of preparing the required “As-Built” Record Drawing(s)

in such a manner that it will be consistent with the requirements of Jackson County Stormwater Division. The R.L.S. and the Contractor will together assess and correct inconsistent construction of the “Primary” and “Secondary” Storm Water Systems and Detention Facility; rendering the built construction consistent with the Design Concept, Drawings, Specifications and the original Design Hydrology Report prepared by the Design Landscape Architect/Engineer (McFarland-Dyer & Associates, Inc.).

B. “As-Built”
   1. At his expense, Contractor shall provide the Owner with two (2) hard copies and one (1) digital copy in Autocad Release (Format to be approved by Jackson County Stormwater Division) of an "As-Built" record drawing plan of all primary and secondary storm sewers, detention facility and all underground utilities, constructed under this Contract “As-Built” shall show:
      a. All contours and elevations.
      b. Bottom of detention facility in front of outlet device and opposite end of basin to verify positive drainage.
      c. Maximum ponding elevations and limits of ponding.
      d. Vertical and horizontal location (i.e. in plan and profile) of each pipe, structure or other utility line with dimensions illustrated to the buildings, curb lines, walls, walks, and other above ground built appurtenances after construction is complete.
      e. Detail of outlet device illustrating all elevations and dimensions.
      f. Date of record survey.
      g. Any and all easements related to the detention facility.
      h. Georgia Registered Land Surveyors seal and signature.

C. Said “As-Built” and any corrections or amendments to them are a part of the Contractor’s responsibility in meeting the requirements for securing any Jackson County Stormwater Division Certification of Development Compliance.

D. All the record documents information, corrections and/or amendments required by Jackson County Stormwater Division shall be included in the Contract with no additional cost to Owner.

3.4 “AS-BUILT” HYDROLOGY ANALYSIS/REPORT

A. Contractor shall employ the services of an independent Professional Engineer (P.E.) for the “As-Built” Hydrology Report. The P.E. will hold active licensure and registration in the State of Georgia. The Contractor shall establish a relationship with this P.E. so that he may assist in entire process of preparing the required “As-Built” Hydrology Report in such a manner that it will be consistent with the requirements of Jackson County Stormwater Division (i.e. the “As-Built” Hydrology Report will prove that the built “Primary and “Secondary” Storm Water Drainage System and the Detention Facility functions in conformity with the approved Design Hydrology Report). The P.E. and the Contractor will together assess and correct inconsistent construction of the “Primary” and “Secondary” Storm Water Systems and Detention Facility rendering the built construction consistent with the Design Concept, Drawings, Specifications and the original Design Hydrology Report prepared by the Design Landscape Architect/Engineer (McFarland-Dyer & Associates, Inc).

B. “As-Built”: Contractor shall provide, at his cost, the Owner with two (2) hard copies and one (1) digital copy in AutoCAD Release (Format to be approved by Jackson County Stormwater Division) of an "As-Built" record drawing plan of the constructed detention facility as prepared

by the above described Land Surveyor and an "As-Built: Hydrology Study prepared by the above described Professional Engineer. "As-Built" shall contain:

1. Allowable release rates as indicated in the original design for all storms.
2. Design volumes as indicated in the original design for all storms.
3. Calculations which verify the actual 2, 5, 10, 25, 50 and 100-year release rates, ponding elevations and volumes.
4. Details of outlet device illustrating all elevations and dimensions.
5. Drainage Area Map (if applicable).
6. Date of study.
7. Registered Professional Engineer's seal and signature.

C. It is the Contractor's responsibility to obtain a copy of the Design Hydrology Report from Jackson County Stormwater Division - for use in preparation of the "As-Built" Hydrology Study.

D. Said "As-Built" are a part of the Contractor's responsibility in meeting the requirements for securing any Jackson County Certification of Development Compliance.

E. All the record documents information required by Jackson County Stormwater Division shall be included in the Contract with no additional cost to Owner.

3.5 CONSTRUCTION INSPECTION

A. Expose and notify Architect of when all drainage trenches will be open for observation of depth, bedding conditions etc.

B. Architect has the right to have any backfilled trench opened to observe any portion of the storm drainage system that he was not notified of, all at the contractor's expense.

C. All elements of the storm drainage system are subject to observation, review, rejection or acceptance as so deemed by the Architect.

D. All piping, structures and cleanouts shall be opened for inspection upon request by the Architect.

3.6 CLEANING AND INSPECTION

A. In addition to the "As-Built" survey defined above the Contractor shall conduct certain post construction activities to ensure that the total storm water sewer system is functioning as intended, all costs to be included in the Contract sum.

B. Post construction activities to include , but shall not be strictly limited to:
   1. Video Inspection of the Storm Water Sewer System: Contractor shall view and video tape the condition of the interior of the total storm water sewer system using video camera equipment of type suitable for the pipes to be viewed.
   2. Preparation: Prior to conducting the viewing and video taping of the total storm water sewer system the Contractor shall thoroughly clean the lines with clean water and let the water drain from the storm water sewer system.
   3. Record of Video: The Contractor shall provide four (4) identical copies of the video DVD

of each of the pipe lines of the storm water sewer system. Each video DVD to include the following information:

a. Name of Firm conducting the video inspection.
b. Date and time of video inspection.
c. Location of video inspection; identify each line by manholes and pipe number.

A. Cleaning of Storm Water Sewer System: It is the intent that upon the completion of all construction activities and prior to the occupancy of the Facility, the Contractor thoroughly clean out all pipe lines comprising of the total storm water sewer system to ensure that the lines are clean and free from all construction and soil type materials.

END OF SECTION 33 4000

SECTION 33 4925 - STORM DRAINAGE PONDS AND RESERVOIRS

PART 1 - GENERAL

1.1 SCOPE

A. Storm water runoff shall be collected in a storm water sewer system and piped underground to the Stormwater detention facility and outlet control structure located within property boundaries of the Project site.

1.2 DESCRIPTION

A. Work described in this section includes the construction of the sub-surface detention facility, outlet control structure and required inlet and outlet connectors to the external primary storm water drainage system.

B. Contractor is responsible to complete, submit and secure any Certificate of Development Compliance or equivalent documentation required in connection with the Stormwater detention facility and outlet control structure as required by Jackson County .

C. Related Work Specified Elsewhere
   1. Reference Division 31 Earthwork.
   2. Reference Section 31 2500 Erosion and Sediment Pollution Control.

1.3 SUBMITTAL

A. Product data: Submit for each type of piping material, manifold, gasket, banding, prefabricated structure and castings. Indicate product descriptions, installation procedures, and specifications.

B. Submit design mix certified by independent testing laboratory employed by the Contractor for the mix design based on cylinder check tests verifying the design mix at least fifteen days (15) prior to start of concrete work.

C. Submit mill certification certifying that cement, sand, aggregate, reinforcing steel and jointing materials comply with the requirements of this specification.

D. For the Outlet Control Structure submit Shop Drawings for review prior to placement showing bending and placing details for steel reinforcing including bar sizes, spacings, bending and tagging identification. Shop Drawings submitted after material is installed shall not be reviewed by the Architect. Covering of steel for which Shop Drawings have not been reviewed is prohibited. Contractor shall assume total responsibility for steel reinforcing covered with concrete for which Shop Drawings have not been reviewed. These instructions shall be strictly enforced.

E. For the Reinforced Concrete Manhole Caps and base collars submit Shop Drawings for review prior to placement showing bending and placing details for steel reinforcing including bar sizes, spacings, bending and tagging identification. Shop Drawings submitted after manhole caps have been installed shall not be reviewed by the Landscape Architect/Engineer.

F. Submit delivery tickets for each load of ready-mix concrete delivered to site showing the class and strength of concrete, pounds of cement per cubic yard, maximum size of coarse aggregate, the slump ordered, amount of admixtures and time of batching.

G. In the event that the Stormwater detention facility is not maintained during the construction process to the satisfaction of the Architect, an interim “As Built” may be required to establish the extent of deficiencies. All costs associated with an interim “As Built” will be borne by the Contractor.

1.4 QUALITY ASSURANCE

A. Industry standards: Standards for the following, as referenced hereinafter.

B. American Society for Testing and Materials (ASTM).

C. American Concrete Institute (ACI).

D. Georgia Department of Transportation, "Standard Specifications or the Construction of Roads and Bridges", 1993 edition, hereinafter referred to as Georgia DOT Specifications.

E. Jackson County Storm Water Systems and Facilities Installation Standards and Specifications - Latest Edition.

F. National Corrugated Steel Pipe Association (NCSPA).

1.5 GUARANTEE

A. Contractor to provide the Architect a written guarantee that all work is of good quality, free from faults and defects and in conformance with these Specifications; and that if, within one (1) year after completion and acceptance of the work, any work or materials are found to be defective, for the sub-surface detention facility and outlet control structure, the Contractor will promptly, without cost to the Owner, correct such defective Work or materials.

PART 2 - PRODUCTS

2.1 PIPES

A. Contractor will use either: Reinforced Concrete Pipe (RCP), Aluminized Steel, Type 2 (AST2) Corrugated Steel Pipe or Smooth Lined Corrugated Polyethylene Pipe (HDPE) for the stormwater piping system.
B. Pipes will be of the type, size, class or gauge, and material illustrated on the Drawings in plan and profile and as specified. All pipes are subject to manufacturers tolerances.

2.2 PIPE MATERIAL

A. Reinforced Concrete Pipe (RCP) shall conform to Georgia DOT Standard Specifications Section 843.01, Minimum Class III pipe, and shall meet the requirements of AASHTO: M 170 and/or ASTM C-76. Rubber type gaskets, including o-rings shall conform to the requirements

of AASHTO M198, Type A. Gaskets will be provided for all joints. All pipe joints shall be bell and spigot.

B. Aluminized Steel, Type 2 (AST2) Pipe shall conform to Georgia DOT Standard Specifications, Section 844.08 and shall meet the fabrication requirements of AASHTO: M 36.The steel sheet used in the fabrication shall conform to the coating requirements AASHTO: M 274. The minimum gauge for underground detention pipe shall be 14 with 5 x 1corrugation, as determined by ASTM A998 for any prefabricated fitting or as determined by GADOT Standard Detail (# 1030D). Pipe bands shall be a minimum 12" width for underground detention pipes and shall meet the minimum band gauge requirements as per AASHTO M —196, Section 19, and AASHTO M —36, Section 9 or as determined by GADOT Standard Detail (# 1030D). Gaskets shall be provided for all joints and shall meet the requirements of AASHTO M —36, Section 9.3. All welds shall be watertight and painted with a zinc rich paint.

C. Smooth Lined Corrugated Polyethylene Pipe (HDPE) shall conform to Georgia DOT Standard Specifications Section 845.00 and shall meet the requirements of AASHTO: M 294 Type S or AASHTO MP7. The coupling bands shall engage two full corrugations on each pipe section and rubber gaskets conforming to ASTM F-477 will be required for all joints.

D. Filling the gaps between band and pipes shall be expedited with a thick mastic material, such as “Conseal” or other approved material. The mastic material must meet or exceed the requirements of AASHTO M-198B and ASTM C-990-91.

E. Underground pipe joints shall be wrapped with a filter fabric consisting of Georgia Dot approved (Section 171.00) pervious sheet of synthetic polymer filaments non-woven from continuous filaments. A separate non-woven geotextile fabric is to be placed above and below differing layers of fill material. The filter fabric shall meet the following requirements:
   1. Minimum Average Thickness: 30 mil (by ASTM D1777).
   2. Air permeability: 250 to 550C.F.M. /Sq. Foot.
   3. Minimum grab strength: 110 lbs (by ASTM D1682).

2.3 CONCRETE

A. Cement shall comply with ASTM C150 normal Type I specifications.

B. Aggregate shall comply with ASTM C33.

C. Water shall be potable.

D. Form materials shall comply with the requirements of ACI 301.Plywood shall be five eighths (5/8") inch thick, edge sealed exterior form type, grade BB-DFPA, concrete commercial standard 45-60 not previously used on any other job.

2.4 REINFORCING STEEL

A. Reinforcing bars and dowels shall conform to ASTM A615, Grade 60, deformed bars with an uncoated finish.

B. Welded wire fabric shall consist of deformed bars, furnished in flat sheets or coiled rolls with

an uncoated finish, and shall conform to ASTM A-185.

C. Tie wire shall be 16 gauge annealed steel.

2.5 MASONRY AND ACCESSORY MATERIALS

A. Manhole brick: Meeting ASTM C32-73, Grade MM.

B. Mortar: Meeting ASTM C270-80, Type M.

C. Construction castings: Meeting ASTM A48-76, grey cast iron.

D. Manhole steps: Meeting ASTM A48-76, Class 30B, integrally cast into manhole sidewalls.

E. Precast concrete manholes: Meeting ASTM C478-79, concentric cone type.

F. All structures whether pre-cast or brick shall meet or exceed the requirements of the Georgia Department of Transportation Standards and Specifications.

2.6 BEDDING AND BACKFILL MATERIAL ETC.

A. Stone for Granular Bedding shall meet the requirements of Section 800.00 of the State of Georgia Department of Transportation Standard Specifications for Construction of Roads and Bridges, 1993 or latest edition. Material shall consist of a granular soil, sand, chert, crushed stone or mixture of these, all of which passes a ¾" sieve, 80% passing a d" sieve, 40% passing a No. 4 sieve, 10% passing a No. 8 sieve, and not more than 5% passing a No.16 sieve. Material shall be free of organic matter and debris.

B. Stone for Gravel Fill shall meet the requirements of Section 800.00 of the State of Georgia Department of Transportation Standard Specifications for Construction of Roads and Bridges, 1993 or latest edition. Material shall consist of sound, durable rock, free from injurious amounts of coatings of any kind and shall be graded so 100% passes a 1½" sieve, 95-100% passes the 1" sieve, 25-60% passes the ½" sieve, 0-10% passes the No. 4 sieve and 0-5% passes the No. 8 sieve.

C. Stone for Granular Fill shall meet the requirements of Section 800.00 of the State of Georgia Department of Transportation Standard Specifications for Construction of Roads and Bridges, 1993 or latest edition. Material shall consist of sound, durable particles of rock and shall be graded so 100% passes a (2") inch sieve, 97-100% passes the (1½") inch sieve, 60-95% passes the (¾") sieve, 25-50% passes the No. 10 sieve, 10-35% passing a No. 60 sieve and not more than 7-15% passes the No. 200 sieve.

PART 3 - EXECUTION

3.1 PREPARATION AND EXCAVATION

A. Comply with all state and local requirements for execution of the work, including local building codes and current OSHA excavation regulations. Contractor is responsible for stability of the area during excavation and outlet control structure construction. Any excavation support

required to maintain/protect existing structures, utilities, landscape features or property shall be the responsibility of the Contractor and should be included in the contract Sum.

B. Coordinate installation of any underground utilities with the Stormwater piping system installation.

C. Control any surface water drainage and prevent inundation of the Stormwater detention facility area during construction.

3.2 OUTLET CONTROL STRUCTURE

A. Construct the outlet control structure of reinforced concrete or precast concrete units unless otherwise indicated.

B. Provide reinforced concrete foundations for the outlet control structures whether indicated on the Drawings or not. Foundations to be a minimum of 12" thick. Reinforcing shall be a minimum of #4 bars @ 12" O.C. longitudinally and #4 @ 9" O.C. laterally for the foundations.

C. The design, engineering, construction, and removal of concrete formwork shall be the Contractor's responsibility. Formwork shall be constructed and reinforced to ensure that poured concrete is accurately placed to a tolerance of one eighth inch (c") in ten feet (10'). Earth may be used as form for the footing provided the earth is clean-cut and true with bottom level and sound. Construct forms to lines and dimensions indicated on the drawings, plumb straight and sufficiently tight to prevent leakage. Securely brace and shore forms to prevent displacement. Provide for the installation of inserts and conduits etc.

D. Steel reinforcement shall be protected by concrete cover. Where not otherwise illustrated on the Drawings the thickness of concrete over the reinforcement shall be as follows:
   1. Concrete cast against earth three inches (3").
   2. Concrete in walls two inches (2").

E. Install any welded wire mesh reinforcing, size as indicated on the Drawings, at two inches (2") from nearest indicated surface. All joints shall be lapped eight inches (8") and extend mesh to within one inch (1") of sides.

F. Concrete outlet control structure shall be reinforced whether indicated on the drawings or not. Walls shall be a minimum of 6" thick. Reinforcing shall be a minimum of #4 bars @ 8"O.C. each way.

G. All concrete construction shall receive a smooth formed finish in accordance with ACI-301-72 on all surfaces exposed to exterior or interior of structure; rough formed for all unexposed construction.

H. Moist cure concrete for a minimum of seven days after placing.

I. Mix mortar with only enough water for workability. Re-tempering of mortar will not be permitted. Keep mortar mixing and conveying equipment clean. Do not deposit mortar upon or permit contact with ground.

J. Lay masonry in full mortar bed with ends and with full vertical joints, not more than 5/8" wide. Protect fresh masonry from freezing and from too rapid drying.

K. Apply a ½" thickness mortar parge coating on interior and exterior or of masonry walls surfaces.

L. Set tops of frames and covers of manhole caps flush with finished surface.

M. Set drainage gratings to elevations indicated on the drawings.

N. Grout all structured inverts.

3.3 INSPECTION

A. Architect has the right to have any backfilled areas to the Stormwater piping system opened to observe any portion of the detention system that he was not notified of, all at the contractor's expense.

B. All elements of the Stormwater piping system are subject to observation, review, rejection or acceptance as so deemed by the Architect.

C. All piping and structure(s) shall be opened for inspection upon request by the Architect.

3.4 "AS-BUILT" RECORD DRAWINGS/HYDROLOGY ANALYSIS
(Refer to Section 33 4000 Storm Drainage Utilities Section 3.3 and 3.4 for requirements.)

3.5 DETENTION POND SYSTEM CLEANING AND INSPECTION

A. In addition to the "As-Built" survey defined above the Contractor shall conduct certain post construction activities to ensure that the sub-surface detention facility is functioning as intended. Post construction activities to include, but shall not be strictly limited to:
   1. Video Inspection of Sub-surface Detention Facility: The Contractor shall view and video tape the condition of the interior of the facility using video camera equipment of type suitable for the pipes to be viewed.
   2. Preparation: Prior to conducting the viewing and video taping of the sub-surface detention facility the Contractor shall thoroughly clean the lines with clean water and let the water drain from the detention facility.
   3. Record of Video: The Contractor shall provide four (4) identical copies of the video tape of each of the pipe lines of the sub-surface detention facility. Each video tape to include the following information:
      a. Name of Firm conducting the video inspection.
      b. Date and time of video inspection.
      c. Location of video inspection; identify each line by manifolds and manholes.

B. Cleaning of Stormwater Detention Facility: It is the, intent, that upon the completion of all construction activities and prior to the occupancy of the School Building(s) that the Contractor thoroughly clean out all pipe lines comprising of the Stormwater piping system to ensure that the lines are clean and free from all construction and soil type materials.

END OF SECTION 33 4925